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The Impact of Cloud Accounting on MENA Boards

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Abstract

Purpose:

This study aims to explore how using cloud accounting systems impacts the governance and performance of boards of directors in MENA countries. It seeks to uncover both the benefits and challenges of cloud accounting, while also examining its role in enhancing board efficiency and oversight.

Design/Methodology/Approach:

This research uses a mixed-method approach, blending quantitative surveys with qualitative interviews involving board members and financial officers from various companies across the MENA region. The quantitative data helps identify patterns and correlations, while the qualitative insights offer a deeper understanding of the factors shaping cloud accounting adoption and its effects.

Findings:

The findings show that cloud accounting greatly improves boards' decision-making by offering real-time financial data and fostering better communication among members. Companies that use cloud accounting report enhanced financial oversight, with more timely and accurate financial reporting. However, challenges like cybersecurity risks, resistance to change, and the need for continuous training and support were also highlighted in the research.

Practical Implications:

The study recommends that MENA companies invest in cloud accounting technologies to strengthen board governance and enhance strategic decision-making. It emphasizes the need to address cybersecurity concerns and ensure proper training for board members to fully capitalize on the benefits of cloud accounting.

Originality/Value:

This research adds to the limited literature on cloud accounting in the MENA region, providing valuable insights for policymakers, business leaders, and academics. It highlights the transformative potential of cloud accounting in improving board performance and corporate governance in emerging markets.

Keywords:

Cloud Accounting, Board of Directors, MENA Region, Corporate Governance, Financial Transparency, Real-Time Data, Decision-Making, Cybersecurity, Technology Adoption.

1.0 INTRODUCTION

1.1 Background

1.1.1 Overview of Cloud Accounting Technology

In today's technological era, cloud accounting represents a significant leap forward in financial management for organizations. This digital solution is transforming how companies manage their accounting processes and handle finances. Opposed to conventional accounting systems, cloud accounting technology relies on remote servers that are accessible to physical infrastructure via the internet (Asikpo, 2024). The adoption of these technological solutions allows companies to store their financial records remotely and process the data in real-time in a manner that provides instant access to up-to-date financial information from any location across the globe. Due to the increased scalability of cloud accounting systems, organizations are empowered to adjust their financial management requirements based on their growth trend (Tawfik, Durrah, Hussainey, & Elmaasrawy, 2022). Also, they benefit from the heightened security and disaster recovery possibilities granted by cloud service providers. Additionally, Rittinghouse and Ransome (2017) noted that there is seamless integration offered by cloud accounting technology with other business applications that increases automation of routine tasks like payroll, invoicing, and tax filing in way that enhances overall efficiency and diminishes the risk of human error.

1.1.2 Importance of Financial Technological Tools in Corporate Governance

Tawfik et al. (2022) asserted that with rapid technology growth, it is critical for organizations to maintain integrity and accountability for financial transparency, real-time data access, and corporate governance. Achieving financial transparency ensures that stakeholders, including regulators, investors, and employees, have an accurate and clear understanding of a company's financial health. Transparency in financial reporting is crucial for building trust and ensuring that business operations align with stakeholders' best interests (Markova et al., 2019). Additionally, real-time access to financial data enhances transparency by providing decision-makers with up-to-date information, supporting informed and timely decisions (Rittinghouse & Ransome, 2017). In today's fast-paced business environment, the ability to quickly access and analyze financial data is essential for responding to risks, market shifts, and new opportunities. Cloud accounting technology meets these needs by offering a dynamic platform for continuous storage and processing of financial data, ensuring that corporate governance remains strong and effective (Lloyd, Ramesh, Chinthalapati, Ly, & Pallickara, 2018).

1.1.3 The Role of Boards of Directors in Strategic Decision-Making

Chang, Yen, Chang, and Jan (2014) alleged that the role played by board of directors is essential since they facilitate in strategic decision-making process in a business environment. They form the highest governing body in an organization and are responsible for the company's direction because they approve major policies and oversee management for the achievement of the set organizational goals and objectives. Strategic decision-making process by the board mostly entail risk management, long-term planning, and effective allocation of resources, these require availability of comprehensive and accurate financial information (Grove, Clouse, & Schaffner, 2018). Lloyd et al., (2018) highlighted that decisions regarding the organization's future necessitates the board to heavily rely on timely and precise data for the accurate evaluation of the company's performance and examination of potential investments for informed decisions to be made. Within this context, integration of cloud accounting systems into business systems in a way that facilitates more agile governance. Leveraging the benefits of cloud accounting allows the boards of directors to enhance their oversight functions, warrant better alignment with corporate goals, and eventually drive sustainable growth (Guetterman, Fetters, & Creswell, 2015).

1.1.4 Growing Adoption of Cloud Accounting in MENA Countries

Recent research highlights a growing shift toward the adoption of cloud accounting technology in the Middle East and North Africa (MENA) region. Businesses in these countries, seeking to improve their competitive edge in an increasingly globalized market, have embraced cloud-based solutions to modernize their financial management practices (Al-Okaily, Alkhwaldi, Abdulmuhsin, Alqudah, & Al-Okaily, 2023). Several factors have driven this trend, including the region's rapid economic growth, the increased availability of reliable internet infrastructure, and ongoing digital transformation initiatives. Additionally, the cost-effectiveness, scalability, and accessibility of cloud accounting make it appealing to businesses of all sizes (Ahmad et al., 2023; Lutfi, 2022).

This trend is particularly evident in MENA countries, where organizations have recognized the importance of aligning their financial practices with international standards. Doing so not only attracts foreign investment but also

ensures compliance with evolving regulatory requirements. As a result, the adoption of cloud accounting in these organizations serves as both a technological advancement and a strategic move toward better financial transparency and health in the region (AlBar & Hoque, 2019; Alsharari, Al-Shboul, & Alteneiji, 2020).

1.1.5 Need to Understand Its Impact on Board Effectiveness and Governance Practices

Al-Okaily et al. (2023) emphasized that while cloud accounting technology is gaining traction in the MENA region, it is crucial to understand how this technology influences the effectiveness of boards of directors and corporate governance practices. Since boards play a key role in overseeing financial performance and shaping an organization's strategic direction, the technological tools that enhance decision-making are vital for their effectiveness. Ahmad et al. (2023) noted that although cloud accounting offers numerous benefits, such as improved financial reporting, real-time data access, and increased transparency, its impact on board governance remains underexplored.

Understanding this influence is important for several reasons. First, cloud accounting systems can transform how directors interact with financial data, enabling more timely and informed decision-making (Hussainey & Dalwai, 2024). Additionally, these systems could improve governance by providing better oversight capabilities, helping boards enhance their monitoring of management and ensure regulatory compliance. Finally, identifying the challenges and limitations of cloud accounting implementation can help boards mitigate risks and optimize the technology for developing effective governance frameworks (Lukonga, 2021).

This study aims to address this knowledge gap by thoroughly assessing how cloud accounting technology affects board effectiveness and governance practices in MENA countries, providing valuable insights for both policymakers and business leaders.

1.2 Research Objectives of the study

- 1. To analyze how the adoption of cloud accounting systems influences the governance practices and performance of boards of directors in MENA countries.
- 2. To identify the benefits and challenges associated with adoption of cloud accounting and its role in improving board efficiency and oversight.

1.3 Research Questions

- 1. How does the adoption of cloud accounting technology influence the governance practices and performance of boards of directors in MENA countries?
- 2. What are the benefits and challenges associated with adoption of cloud accounting and its role in improving board efficiency and oversight?

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Relevant Governance Theories to Board Decision-Making

The theoretical foundation of this study is rooted in governance theories that underscore the critical role of boards of directors in overseeing and guiding organizational decision-making. One of the most relevant theories in this context is Agency Theory, which suggests that boards act as agents for shareholders and are responsible for ensuring that management's actions align with the interests of the business owners (Panda & Leepsa, 2017). This theory argues that effective governance requires strong oversight mechanisms to mitigate potential conflicts of interest between shareholders and senior management. Cloud accounting can strengthen these oversight functions by providing boards with accurate, timely, and transparent financial data, enabling them to monitor management's actions effectively and make decisions that serve shareholders' best interests (Mio, Fasan, Marcon, & Panfilo, 2020).

Another relevant framework is Resource Dependency Theory, which posits that boards are crucial in securing essential resources for the organization, such as expertise, information, and strategic partnerships. Cloud accounting technology can be seen as a valuable resource that enhances board decision-making capabilities. By offering real-time access to financial data, the technology enables boards to make more accurate forecasts and respond more swiftly to external challenges and opportunities. This theory underscores the importance of equipping boards with the right technological tools to fulfill their governance responsibilities effectively (Petcu, Sobolevschi-David & Curea, 2024).

2.1.2 Theories on Technological Adoption and Its Impact on Performance

This research study is based in the Technology Acceptance Model (TAM) and the Diffusion of Innovation Theory. It aims to understand why adopting cloud accounting is important and how it impacts organizational performance. The Technology Acceptance Model (TAM) is linked to Fred Davis and provides a perspective on technological adoption since it focuses on the users' alleged ease of usage and supposed practicality of the technological tools (Min, So, & Jeong, 2021). In this context, there is a higher inclination to adopt the cloud accounting technology if board members and financial officers are made to believe how significantly it enhances their ability to execute their functions. TAM alleges that increased user-friendliness and perceived benefits of a technology increases the likelihood of the technology being adopted and incorporated into organizational processes (Al-Rahmi et al., 2019). Hence, the model aids in explaining the behavioral characteristics of cloud accounting technology and how its adoption will impact the attitudes of board members toward technology, setting a foundation and willingness to implement technological tools for enhanced governance outcomes.

On the other hand, the Diffusion of Innovation Theory is accredited to Everett Rogers, it expounds on modalities of adopting new technologies in organizations and societies. Based on this theory, the adoption of cloud accounting system can be perceived as an innovation that can be traced across different stages, from early adopters to the mainstream. There are factors that determine the rate and success of adoption, they include perceived benefits, compatibility with existing systems, and technological complexity (Al-Rahmi et al., 2021). In the context of MENA countries, understanding how cloud accounting spreads among organizations can provide valuable insights into the varying levels of adoption. It can also reveal the factors that facilitate or hinder its integration into governance practices (Petcu, Sobolevschi-David, & Curea, 2024).

By combining the Technology Acceptance Model and the Diffusion of Innovation Theory, we create a comprehensive framework for assessing how cloud accounting affects board decision-making and overall organizational performance. These theories emphasize the significance of both structural factors—such as resource dependencies and governance mechanisms—and behavioral factors, including user perceptions and the process of innovation diffusion. Together, these elements shape the adoption and impact of cloud accounting technology in the MENA region.

2.2 Cloud Accounting: An Overview

2.2.1 Evolution of Cloud Accounting Technology

Over the past two decades, cloud accounting technology has significantly evolved, transforming how organizations manage their financial processes. Initially, accounting software was primarily desktop-based and required installation on individual computers or company servers (Senyo, Addae, & Boateng, 2018). This setup was costly and complex to maintain, with limitations in scalability and accessibility. However, with the rise of internet connectivity and enhanced security, organizations began to transition to cloud-based solutions. Cloud accounting emerged as a vital option, allowing businesses to manage their financial data online, eliminating the need for physical infrastructure and providing real-time access to data from anywhere in the world (Ali, Matarneh, Almalkawi & Mohamed, 2020).

The rapid evolution of cloud accounting can be attributed to advancements in cloud computing, software integration, and data encryption. Small and medium-sized enterprises (SMEs) were the early adopters of cloud accounting, drawn by its affordability and ease of use. As the technology matured, larger organizations began to recognize its potential, leading to widespread adoption across various industries (Lukonga, 2021). Today, cloud accounting platforms have become highly sophisticated tools that offer a wide range of features tailored to businesses of all sizes. These platforms are designed to be scalable, intuitive, and easy to integrate with other business tools, making them essential components of modern financial management systems (Al-Rahmi et al., 2021).

2.2.2 Key Features and Benefits of Cloud Accounting

Cloud accounting is an elaborate technological tool that provides a wide array of features that enhance accuracy, accessibility, and efficiency of organizational financial data. A prominent feature of this technology is realtime access to data, this capability enables users to view, update, and retrieve financial information instantly. This is a valuable feature that can be explored by boards of directors in collaboration with financial officers to obtain up-todate data that is paramount in making informed decisions. Another feature of cloud accounting technology is automation of routine tasks since it supports execution of tasks like payroll processing, tax calculations, and invoicing in a manner that reduces the likelihood of human error and spares time to be used in more strategic activities (Prasad & Green, 2015). Moreover, another crucial feature is the scalability of cloud accounting system. As opposed to conventional accounting systems that needs substantial investment in hardware maintenance and software upgrades to accommodate growing business operation, cloud accounting technology can be easily scaled to effectively serve mounting volumes of transactions and increased users (Tawfik, Al Tahat, Jasim, & Abd Almonem, 2021). The flexibility offered by the innovation makes the cloud accounting approach a preferrable option that can be considered for businesses at different stages of development. In addition, cloud accounting technology offers advanced security measures encryption and multi-factor authentication and encryption that guarantee financial data is secure and protected from cyber threats and unauthorized access (Gupta & Gaur, 2018).

Sikhosana (2015) asserted that the benefits associated with cloud accounting spread beyond improved efficiency and enhanced security. Provision of real-time financial insights empowers cloud accounting to become a better financial forecasting too that can play a vital role in budgeting, aiding businesses to plan better for the future. The ease of integration with other business tools like enterprise resource planning (ERP) software and customer relationship management (CRM) systems further expands the functionality of cloud accounting technology. This allows for a more robust approach to business operations since consistency of financial information is maintained. Also, the cloud-based characteristic of these accounting platforms promotes working remotely, this has become progressively essential within the context of globalized business operations. More recently, the COVID-19 pandemic triggered a shift towards remote work that was popularized by the lockdowns (Ahmad, Hannoon, Al-Daoud, Abu-Alsondos, & Al-Qaisieh, 2023).

Summarily, evolution of cloud accounting technology has resulted into a powerful tool consisting of numerous features and benefits, this makes it requisite for modern businesses. Its capability to offer real-time data access, scalability based on business growth, automating tasks, and increased integration with other systems lays a concrete foundation of efficient financial management and empowers board of director to execute governance responsibilities. With the continued adoption of digital transformation, the acceptance of cloud accounting keeps increasing in a way that further solidifies its position in the future of financial management (Hussainey & Dalwai, 2024).

2.3 Corporate Governance in MENA Countries

2.3.1 Characteristics of Governance Structures in MENA Countries

In Middle East and North African (MENA) countries, corporate governance shows unique characteristics impacted by the region's cultural, economic, and regulatory environments. Governance structures in this region are mostly depicted by concentrated ownership, businesses are either family-owned or state-controlled enterprises across various sectors in the economy. In family-owned entities, the board of directors mostly comprise of family members, this ha the possibility of attaining a strong alignment between business ownership and regulation but tends to limit the diversity of viewpoints in making decisions (Ashok & Pragya, 2018). On the other hand, state-owned enterprises frequently incorporate boards that government-appointed, this leads to adopting governance structures that replicate political considerations and national priorities. However, in both cases a close association between the board of directors and business management can occasionally affect accountability and independence (AlHares, Dominic, & Al Abed, 2019).

Moreover, the embraced governance structures among the MENA countries are profoundly influenced by existing domestic legal frameworks, mostly reinforced by cultural and religious norms. However, in the past few decades, several countries in the region have implemented governance codes founded on international standards like those endorsed by the OECD. It's important to recognize that the implementation and adherence to corporate governance codes vary across MENA economies (Schomaker & Bauer, 2020). Research shows that boards of directors in MENA countries are generally smaller and less independent compared to those in Western economies. There's a reduced emphasis on external accountability and shareholder activism; however, there have been recent efforts to transform corporate governance practices. Increasingly, MENA economies are eager to attract foreign investment, enhance their operational effectiveness, and better integrate with global markets (Hussainey & Dalwai, 2024).

2.3.2 Challenges and Opportunities in MENA Corporate Governance

MENA countries are faced with numerous corporate governance challenges, they often emanate from the region's distinct socio-economic and regulatory atmosphere. One main challenge is the deficiency of board independence and transparency, especially in state-controlled enterprises and family-owned businesses. Given that family-controlled boards are exhibit a close-knit characteristic, they have a high probability of hindering objectivity and limiting oversight in a way that leads to likely conflicts of interest (Farah, Elias, Aguilera, & Abi Saad, 2021).

Equally, the impact of the state in state-owned enterprises might lead to having boards whose emphasis is attainment of political objectives rather than prioritizing corporate efficiency and profitability. The lack of autonomy challenges the efficacy of governance structures in a manner that makes it hard for boards to make crucial decisions in the best interests of every stakeholder or holding management accountable (Schomaker & Bauer, 2020).

Another challenge in MENA corporate governance is the irregular implementation of governance reforms within the region. Although significant progress has been made in some MENA countries in incorporating corporate governance frameworks and aligning them with international standards, there are some that lag behind because of weak regulatory enforcement, resistance to change, and lack of awareness. Furthermore, disclosure practices and transparency remain erratic where most organizations fail to offer satisfactory financial information to shareholders. This has the potential to erect barriers to foreign investment and hinder the capacity of businesses competing in global markets (Farah, Elias, Aguilera, & Abi Saad, 2021).

Although these challenges exist, momentous opportunities exist that can be exploited for improved corporate governance in the MENA region. The rapidly growing incorporation of MENA economies into the global financial system has resulted to an upsurge in demand for attainment of stronger governance practices, especially among international investors seeking heightened transparency and accountability (AlHares, Dominic, & Al Abed, 2019). It is in the implementation of modern governance technologies like cloud accounting systems that present a notable opportunity to advance financial reporting, improve board oversight, and boost the efficiency of decision-making processes. Leveraging the cloud technologies can strengthen boards in MENA countries and their governance structures for close alignment with international best practices. Furthermore, the push for economic diversification in many MENA countries, particularly in the Gulf Cooperation Council (GCC) region, is fostering the development of more professionalized corporate governance as non-oil industries become more prominent (Buallay, 2019).

These transformative changes create a conducive environment for governance reforms that can enhance investor confidence and corporate performance. In summary, while corporate governance in MENA countries faces challenges related to regulatory enforcement, board independence, and transparency, there are also promising opportunities for modernization within organizations. Significant improvements in governance in the region could spur economic diversification and facilitate the adoption of new governance technologies, benefiting both companies and the broader economy (Buallay, 2019; Schomaker & Bauer, 2020).

2.4 Impact of Technology on Corporate Governance

2.4.1 Previous Studies on the Impact of Technological Advancements on Governance

Technological advancements are significantly transforming corporate governance, reshaping how boards of directors manage organizations and make strategic decisions. Research highlights the increasing impact of digital tools, such as data analytics, artificial intelligence (AI), and enterprise resource planning (ERP) systems, in enhancing governance practices (Grove, Clouse, & Schaffner, 2018). These tools improve transparency, accountability, and the speed of decision-making.

For instance, digital reporting and automated data management facilitate more accurate and timely financial reports, allowing boards to better monitor performance and assess risks. Studies indicate that technology enhances internal controls by reducing human error, improving audit processes, and identifying fraud or compliance issues (Chang, Yen & Jan, 2014). ERP systems streamline communication across departments, providing boards with a clearer view of operations and enhancing oversight.

Additionally, AI and machine learning have introduced predictive analytics into governance, helping boards anticipate risks and opportunities, which leads to more informed decision-making. As global organizations become increasingly complex, these technologies are becoming essential for ensuring timely, data-driven governance (Li, Chang, & Yen, 2017).

2.4.2 How Cloud Accounting Fits into This Broader Technological Context

Cloud accounting plays a pivotal role in the wave of technological advancements reshaping corporate governance by providing real-time financial insights, enhancing transparency, and automating critical financial processes. This technology aligns with the broader shift toward cloud computing, increasing organizational flexibility and efficiency (Asikpo, 2024). With cloud-based accounting platforms, boards of directors can access up-to-date financial data from anywhere, enabling faster and more informed decision-making—a necessity in today's fast-paced business environment, where delays in financial reporting can heighten risks (Li, Chang, & Yen, 2017).

One of the key strengths of cloud accounting is its ability to improve financial transparency, a cornerstone of good governance. Automated, real-time reporting minimizes errors and reduces the potential for data manipulation, resulting in more accurate and reliable financial oversight (Petcu & Curea, 2019). Cloud accounting also supports stronger internal controls and better financial reporting standards. Furthermore, it seamlessly integrates with other systems, such as customer relationship management (CRM) and enterprise resource planning (ERP) tools, giving boards a comprehensive view of a company's financial health. This interconnectedness enables boards to monitor not only finances but also broader operational metrics, leading to more informed and holistic governance decisions (Singhal, Kothuru, Sethibathini, & Bammidi, 2024).

In regions like MENA, where traditional governance structures often struggle with transparency and efficiency, cloud accounting offers a path toward modernization. It helps boards address issues related to limited financial oversight and slow reporting by providing real-time, data-driven insights (Lukonga, 2021). Its scalability also makes it accessible to organizations of all sizes, allowing even smaller companies to benefit from improved governance practices. In summary, cloud accounting is a crucial part of the technological advancements revolutionizing corporate governance, equipping boards with the tools needed to navigate complex regulatory and business environments with greater accuracy and agility (Buallay, 2019).

2.5 Gaps in Existing Literature

2.5.1 Lack of Focus on the MENA Region in Existing Studies

While there is substantial research on corporate governance and the adoption of technological tools like cloud accounting, much of it focuses on developed economies in North America, Europe, and parts of Asia. This creates a gap in understanding the unique governance challenges and opportunities in emerging markets, particularly in the Middle East and North Africa (MENA) region (Senyo, Addae & Boateng, 2018). Governance in MENA countries operates under distinct socio-economic and regulatory frameworks, shaped by factors such as concentrated ownership, family-run businesses, and state-owned enterprises. These characteristics set the region apart, making it crucial to examine how governance reforms and technological innovations, like cloud accounting, are being implemented within this context.

Current research on cloud accounting's influence on governance often neglects these regional differences, leaving a gap in understanding how technology is specifically transforming governance practices in MENA (Hussainey & Dalwai, 2024). Furthermore, studies on corporate governance in MENA tend to focus on broader themes such as transparency, regulatory reform, and the role of boards in economic diversification. While these are important topics, they often overlook how emerging technologies could directly address governance challenges unique to the region.

As MENA countries deepen their integration with the global economy and accelerate digital transformation, it becomes increasingly important to understand how technologies like cloud accounting are reshaping governance structures (Ali, Matarneh, Almalkawi, & Mohamed, 2020). The scarcity of region-specific studies makes it difficult to generate actionable insights for MENA companies seeking to leverage technology to enhance board effectiveness and governance practices. Addressing this gap would offer valuable guidance for organizations in the region aiming to modernize their governance through technological innovation (Lukonga, 2021).

2.5.2 Need for Specific Analysis on the Impact of Cloud Accounting on Boards of Directors

The impact of cloud accounting on board governance practices remains a largely underexplored topic, especially within the context of the MENA region (Senyo, Addae & Boateng, 2018). While the benefits of cloud accounting—such as real-time data access, automation, and improved transparency—are well-documented, little attention has been given to how these tools are leveraged by boards of directors to enhance decision-making and oversight. Most research has focused on the operational advantages for finance departments rather than exploring the strategic influence on governance. As boards increasingly depend on financial data to inform corporate strategy, it is essential to examine how cloud accounting affects key aspects of governance, including decision-making speed, the quality of financial oversight, and the agility of responses to market shifts (Valentine & Stewart, 2013).

In MENA countries, where governance challenges such as limited board independence and concentrated ownership structures are prevalent, understanding how cloud accounting can improve board effectiveness is especially crucial. There is a lack of empirical evidence on whether the adoption of cloud accounting by boards in the region helps

address persistent issues like poor financial transparency and slow decision-making processes (Hussainey & Dalwai, 2024). Without a focused analysis, boards may underutilize cloud accounting, missing out on opportunities to strengthen governance and enhance corporate performance (AlHares, Dominic, & Al Abed, 2019).

This study seeks to fill that gap by providing a comprehensive analysis of how cloud accounting influences governance practices and board effectiveness in MENA countries. The findings will offer valuable insights for academic research, practitioners, and policymakers aiming to improve corporate governance through technological innovation in the region.

3.0 Research Methodology

3.1 Research Design

This study employs a mixed-method approach, integrating both quantitative and qualitative research techniques to comprehensively analyze the impact of cloud accounting on boards of directors in the MENA region. This method is particularly effective as it captures both measurable outcomes (quantitative) and more nuanced insights (qualitative) related to cloud accounting adoption and its effect on governance practices. Quantitative methods will identify patterns, trends, and correlations such as the relationship between cloud accounting use and board effectiveness while qualitative methods will offer deeper insights into the reasons behind these patterns. By combining both approaches, the research provides a holistic understanding of how cloud accounting influences corporate governance (Guetterman, Fetters & Creswell, 2015).

The quantitative aspect involves distributing surveys to board members and financial officers from a range of companies across the MENA region. These surveys will measure key variables like the degree of cloud accounting adoption, improvements in decision-making, and overall governance efficiency. The qualitative component will include semi-structured interviews with board members and financial officers. These interviews will provide detailed insights into the challenges, benefits, and strategic considerations they face when adopting cloud accounting. This combination ensures a broad and deep understanding of how cloud accounting affects governance (Awotomilusi, Dagunduro, & Osaloni, 2022).

3.2 Data Collection

The study will use purposive sampling to select companies from various industries across MENA countries. The focus will be on businesses that have adopted cloud accounting systems, ensuring representation across small, medium, and large enterprises, as well as balancing family-owned and state-owned organizations. Board members and financial officers, who play critical roles in decision-making and governance, will be the primary respondents (Ali, Shrestha, Soar, & Wamba, 2018). The survey will feature closed-ended and Likert-scale questions to gather quantitative data on cloud accounting adoption, perceived benefits, and its impact on governance practices. Topics will include financial transparency, real-time data access, decision-making efficiency, and challenges faced during the implementation of cloud accounting. Demographic and company-specific questions will help segment and compare results across industries, company sizes, and governance structures (Kumar, Sharma, Goel, & Singh, 2019).

Semi-structured interviews will be conducted with a subset of survey participants, focusing on key themes such as the strategic influence of cloud accounting on decision-making, challenges in integrating cloud systems within traditional governance frameworks, and the impact of cloud accounting on boardroom dynamics. The interview protocol will be flexible, allowing participants to elaborate on their experiences and ensuring that qualitative data captures a diverse range of perspectives (Pandey & Pandey, 2021).

3.3 Data Analysis Procedures

To analyze the survey data, statistical techniques such as descriptive statistics, correlation analysis, and regression analysis will be employed. Descriptive statistics will offer an overview of cloud accounting adoption rates, perceived benefits, and its overall impact on governance practices. Correlation analysis will be used to assess relationships between variables like cloud accounting use and governance improvements, focusing on areas such as decisionmaking efficiency and financial transparency. Regression analysis will dig deeper, identifying predictors of successful cloud accounting implementation. Factors like company size, industry sector, and governance structures will be analyzed to determine which variables most strongly drive effective adoption (Patel & Patel, 2019). A thematic analysis will be used to interpret the interview transcripts. This process involves coding the data to uncover recurring themes such as "challenges in adopting cloud accounting," "improved decision-making," and "strategic advantages of real-time data access." These codes will help categorize the qualitative insights into meaningful patterns, providing a deeper understanding of how cloud accounting influences governance at the board level. This qualitative analysis will complement the quantitative findings, adding context to the statistical results and offering more detailed explanations of how and why cloud accounting is reshaping governance practices (Langmead & Nellore, 2018).

3.4 Ethical Considerations

Maintaining confidentiality and anonymity is crucial given the sensitive nature of financial and governance practices (Lancaster, 2017). To address this, participants will be assured that their responses will remain completely anonymous, with no identifying information included in the analysis. Pseudonyms will be used to safeguard the identities of both individuals and their organizations. Informed consent will be obtained from all participants, clearly explaining the study's objectives, methodology, and any potential risks. Furthermore, participants will be notified of their right to withdraw from the study at any point, without facing any repercussions or obligations (Langmead & Nellore, 2018).

3.5 Limitations of the Study

One limitation of this study is the potential for bias in data collection, particularly in qualitative interviews, where participants might give socially desirable responses or downplay the challenges they encounter. Additionally, relying on self-reported survey data could introduce response biases, as participants may exaggerate the benefits of cloud accounting or underreport difficulties (Theofanidis & Fountouki, 2018). Another concern is the generalizability of the findings. While the study covers a diverse range of industries and companies in the MENA region, the unique socio-economic and regulatory contexts of these countries may limit the applicability of the results to other regions (Ross & Bibler Zaidi, 2019). Furthermore, since the study excludes companies that have not adopted cloud accounting, it will miss insights into the barriers to adoption. Despite these limitations, the mixed-method approach ensures a comprehensive view of how cloud accounting influences governance in MENA, providing valuable insights for both academic theory and practical application (Cooper, Hedges, & Valentine, 2019).



4.0 Data Analysis

4.1 Descriptive Statistics

Figure 1: Participant's Gender

As shown in Figure 1, the gender distribution in the study reveals that out of the total respondents, 55% are female (88 respondents), while 45% are male (72 respondents). This near-equal representation suggests that the perspectives of both genders are adequately captured, contributing to a well-rounded understanding of the impact of cloud accounting on governance. The inclusion of both male and female respondents is vital for exploring potential gender dynamics that may influence the adoption and perceived benefits of cloud accounting within organizations. This balanced representation strengthens the study by ensuring that insights are reflective of diverse viewpoints, enriching the analysis of how cloud accounting affects governance practices across different organizational settings.



Figure 2: Participant's Organizational Position

The respondents in the study held various organizational roles, with 37% serving as Chief Financial Officers (CFOs), 32% as Financial Officers or Accountants, and 31% as Board Members, as shown in Figure 2 above. The largest group, CFOs, reflects their central role in financial reporting and governance, making their insights particularly valuable for understanding the operational benefits of cloud accounting. The inclusion of board members ensures that the strategic decision-making perspective is represented, while financial officers and accountants provide a more granular view of day-to-day financial processes. This diverse representation ensures a comprehensive analysis of how cloud accounting impacts governance, blending both high-level strategic insights and practical financial considerations.

Table 1

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Industry Representation
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Industry	Frequency
Government/State-Owned Enterprise	23
Technology	32
Retail	33
Manufacturing	35

Financial Services	37	
	0,	

The respondents in the study represented a diverse range of industries, as shown in table 1 above. Financial Services leads the way with 23.12%, followed closely by Manufacturing at 21.88%. Retail makes up 20.62%, and Technology stands at 20.00%. Government/State-Owned Enterprises are the least represented, contributing 14.38% of the total. This industry distribution reflects varying levels of cloud accounting adoption across sectors, with Financial Services being the most engaged—unsurprising given its strong reliance on real-time financial data for governance. Meanwhile, the smaller representation from Government and State-Owned Enterprises may point to unique challenges in adopting cloud technology in more regulated or traditional sectors. This data shows how cloud accounting is making strides across private sector industries while highlighting potential barriers in public enterprises.



Figure 3: Participant's Company Size

Figure 3 above shows that the sample included companies of various sizes: 37% large organizations (251+ employees), 35% medium-sized organizations (51-250 employees), and 28% small companies (1-50 employees). This diversity in company size allows the study to explore how cloud accounting affects businesses of different scales. Larger organizations may have more complex financial reporting needs, while smaller businesses could be seeking cost-effective solutions, providing varied insights into the challenges and benefits of cloud accounting across the spectrum.



Figure 4: Adoption of Cloud Accounting

A significant portion of the respondents, 53%, have adopted cloud accounting systems, while 47% have not yet implemented these technologies as illustrated in Figure 4 above. This demonstrates a strong but still growing trend toward cloud accounting in the MENA region. The nearly even split between adopters and non-adopters offers the opportunity to explore not only the advantages experienced by those using cloud accounting but also the barriers preventing others from making the transition.

Table 2

Cloud Platform Used in Organizations

Cloud Platform	Frequency	Percentage
Sage Intacct	12	8%
Xero	13	8%
Other	18	11%
Zoho Books	20	13%
QuickBooks Online	23	14%
None	74	46%

Among the respondents who use cloud accounting, QuickBooks Online is the most popular platform (14%), followed by Zoho Books (13%). Other platforms like Sage Intacct and Xero have smaller shares, while 46% of respondents do not use any cloud platform. The diversity of platforms indicates that companies are exploring a range of solutions to meet their accounting needs. The large proportion of non-users reflects the opportunity for further cloud accounting adoption in the region, particularly in companies still relying on traditional methods.



Figure 5: Years Using Cloud Accounting

As shown in Figure 5 above, majority of the respondents, totaling 74, indicated that cloud accounting is "Not applicable" to them, suggesting that a large portion of companies have not yet adopted these systems. However, among the adopters, the distribution shows a steady but varied level of experience. A small group of 19 respondents has been using cloud accounting for more than 5 years, reflecting early adoption. Meanwhile, 21 respondents are recent adopters, having used the technology for less than a year, indicating that interest is growing. Additionally, 22 respondents have been using cloud accounting for 3-5 years, and 24 respondents for 1-2 years. This distribution highlights a gradual uptake of cloud accounting, with adopters spread across different stages of experience. This varied adoption timeline offers a valuable opportunity to analyze both the long-term benefits realized by early adopters and the motivations or challenges faced by more recent users.

4.2 Correlation

A correlation test was executed to determine the relationship between the variables considered in this research study, the output is shown in Table 3 below. The correlation between Cloud Platforms and Decision-Making Speed (.5) as well as Board Uses Data Frequency (.5) revealed that the use of cloud accounting technology led to increased speed in the decision-making process and increased use of data in making decisions. Moreover, a high correlation (.48) was noted between Years Using Cloud Accounting and Decision-Making Speed, this can be explained to mean that an increase in the duration of using cloud computing technology resulted to higher speed in making organizational decisions. Similarly, it was observed that Years Using Cloud Accounting and Risk Management Improvement was moderately strong (0.41), this means that an increase in the duration of using cloud correlation between Performance Monitoring Improvement and Cloud Platform was notably high (0.42), this can be explained to mean that adoption of cloud accounting technology resulted in better performance monitoring. Lastly, the correlation between Risk Management Improvement and Decision-Making Speed was considerably high (0.42), which mean that heightened speed in making decisions resulted in better risk management practices.

Table 3	;
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Correlation

	Company Size	Industry	Gender	Position	Years of Experience	Uses Cloud Accounting	Years Using Cloud Accounting	Cloud Platform	Transparency Improvement	Decision- Making Speed	Board Uses Data Frequency	Perfo Moni Impro
	1											
	0.09	1.00										
	0.04	0.15	1.00									
	-0.06	-0.11	-0.09	1.00								
	0.06	-0.02	0.09	-0.06	1.00							
g	-0.01	-0.08	0.04	0.10	0.04	1.00						
oud												
	-0.04	0.02	0.04	0.10	-0.06	-0.04	1.00					
	0.08	0.04	0.11	0.08	0.00	-0.05	0.63	1.00				
	0.01	-0.18	0.04	0.09	-0.04	0.05	0.32	0.35	1.00			
d	0.06	0.03	0.01	0.01	-0.02	-0.04	0.48	0.50	0.17	1.00		
Data												
	0.04	0.08	0.13	0.08	-0.08	-0.04	0.38	0.50	0.15	0.33	1.00	
ing	0.16	0.08	0.10	0.07	0.02	-0.05	0.33	0.42	0.15	0.30	0.37	1.00
lent	-0.11	-0.09	-0.01	0.12	-0.19	-0.10	0.41	0.42	0.12	0.42	0.31	0.25

4.3 Qualitative Data Analysis

Exploration of the qualitative data collected from interviews from the selected 12 members revealed dominant themes relating to cloud accounting technology in MENA corporate governance. The qualitative data was gathered through interviews with board members and financial officers, the analysis sought to explore notable themes regarding the impact of cloud accounting on governance practices. Thematic analysis was executed to determine emerging key themes that offered insights into both the benefits and challenges linked with the adoption of cloud accounting by boards of directors. The findings were categorized into four dominant themes namely financial transparency, decision-making speed, resistance to change, data security concerns, and integration and infrastructure challenges.

I. Financial Transparency

A key theme that emerged from multiple interviews was the enhanced financial transparency provided by cloud accounting technology. Respondents emphasized that real-time access to financial data significantly improved their ability to monitor financial performance and maintain governance accountability within their organizations.

In Interview 2 (Board Member, UAE), one participant remarked, "Cloud accounting increased the board's confidence in the accuracy of financial reports, reducing errors and providing clearer financial visibility." Similarly, Interview 9 (Financial Officer, Bahrain) explained, "The board's approach to governance has become more datadriven, relying heavily on real-time access to monitor budgets and operational performance." Interview 10 (Board Member, Saudi Arabia) echoed this sentiment, noting, "Cloud accounting technology has enhanced trust and accountability within the board by providing up-to-date financial reports, eliminating the need to rely solely on management for quarterly summaries."

II. Decision-Making Speed

Another notable theme was the improvement in decision-making speed that was facilitated by cloud accounting systems. Respondents consistently outlined the ability to act swiftly on financial insights because of the availability of real-time data, this permitted boards of directors the capability to respond more effectively to internal performance metrics and changing market conditions. Interview 1 (CFO, Saudi Arabia) observed that "cloud accounting technology permitted the board members to respond faster when making investment decisions that are focused on the enhancement of overall agility in business operations". Also, Interview 5 (Board Member, Egypt) highlighted that "the availability of real-time data can meaningfully speed up the process of decision making, this empowers them to develop strategic plans based on available financial information". Interview 4 (CFO, Jordan) emphasized that "strategic decisions in organizations may be made with more confidence because there is faster access to accurate financial information unlike previously when accessing data was an uphill task".

III. Resistance to Change

Numerous respondents discussed resistance to change, which emerged to be the dominant theme that depicted how organizations can be slow to accommodate disruptive technological innovations. It was heightened as a challenge in cloud accounting adoption, especially among older board members who esteemed traditional accounting approaches and were unfamiliar with new technologies. The resistance necessitated significant effort to be put into training and convincing stakeholders of the value associated with the innovative cloud accounting technology. Interview 2 (Board Member, UAE) noted that "older board members in our organization were initially resistant to the idea of cloud accounting adoption because they were unfamiliar with the technology, this was overcome through additional training". Similarly, Interview 6 (CFO, Oman) explained that "directors who for a long time relied on conventional accounting systems were hesitant to trust the modern technology, this required the young employees in the accounting department to consistently demonstrate the system's value". Also, Interview 8 (Financial Officer, Kuwait) stated that "board members showed concern on the complexity of features and training for cloud accounting, with consistent training sessions the concern eventually diminished".

IV. Data Security Concerns

Another dominant theme in the collected data was data security concerns linked with the cloud accounting technology. Data security was alluded to as a recurrent concern during the implementation of cloud accounting systems, especially due to the delicate nature of financial data and the necessity to guarantee compliance with domestic and international regulations. With rapid technology growth, the rate of data breaches has increased which is a critical

factor among organizations in sectors with strict privacy and security requirements, like state-owned enterprises and financial services. Interview 5 (Board Member, Egypt) cited that " there are concerns about data privacy because of the strict regulatory environment in the financial sector. It was important for the extensive due diligence to be done before the board members agreed to the transition in our organizational accounting systems". In addition, Interview 3 (Financial Officer, Morocco) noted that " initially in our organization there were concerns on moving sensitive financial data to a cloud platform, but these concerns were addressed after certifying that the cloud service provider was compliant with international standards. Lastly, Interview 10 (Board Member, Saudi Arabia) emphasized that "there is a need to adhere to local regulations in financial and government-owned enterprises, this requires extensive assessments of security protocols of the cloud provider.

4.4 Discussion

Analysis on this shows that the enhanced transparency provided by cloud accounting authorizes board members to be more proactive in their governance responsibilities. Adoption of this innovative technology guarantees financial oversight that is more instant and comprehensive, this empowers board members in making informed decisions since they heavily rely on accurate and up-to-date data. The findings on financial transparency are in alignment with existing literature which notes that transparency is a pillar of good governance, particularly in regions like MENA where conventional governance practices mostly lack adequate transparency. Hence, the possibility of accessing real-time data diminishes the risk of financial misreporting and augments the board's oversight functions.

The analysis of this theme underscores that faster decision-making is a crucial advantage for boards, giving organizations a competitive edge in a dynamic business environment. Real-time access to financial data, enabled by cloud accounting, significantly reduces the time boards take to address financial issues, allocate resources, and seize opportunities. This is particularly relevant in the fast-paced MENA markets, where speed is vital for staying agile and competitive. The findings highlight how cloud accounting helps boards move beyond slower, conventional reporting cycles, which can hinder timely decision-making.

Regarding resistance to change among senior board members, the analysis reveals that it is a common challenge, as many traditional governance structures did not account for the integration of new technologies. In the MENA region, some companies still adhere to conservative governance practices, limiting their adoption of cloud accounting, which can introduce significant shifts. Overcoming this resistance may require time, effort, and comprehensive training to ensure alignment among all stakeholders. The findings align with the Technology Acceptance Model (TAM), which suggests that perceived ease of use and perceived usefulness are key factors in the acceptance of new technologies. Therefore, effective training programs and regular demonstrations of cloud accounting's benefits are critical in overcoming resistance.

Lastly, data security emerged as a major concern, particularly for boards overseeing sectors with stringent regulations or handling sensitive financial data. While cloud providers generally offer robust security measures, boards in many organizations remain cautious about potential risks associated with storing sensitive information on external servers. This concern is especially pronounced in the MENA region, where financial services and state-owned enterprises operate under strict regulatory frameworks. Although data security concerns may slow the adoption of cloud accounting, due diligence and strong assurances from service providers can help alleviate these issues.

4.5 Conclusion

The correlation test results align closely with the dominant themes identified in the qualitative analysis, providing a deeper comprehension of how cloud accounting technology influences governance practices in MENA countries. The strong correlation between cloud platforms and decision-making speed (0.5) strengthens the theme that cloud accounting enhances board agility by providing real-time financial data in a manner that promotes faster decision-making processes. Sequentially, this leads to more frequent use of data in board meetings, as demonstrated by the moderately strong correlation between cloud platforms and data frequency (0.5). The relationship between years of using cloud accounting and decision-making speed (0.48) proposes that prolonged exposure to the technology improves the operational efficiency of board members, which is consistent with interview responses on increased confidence in decision-making. Furthermore, the correlation between years of using cloud accounting and risk management (0.41) supports the theme that cloud accounting boosts governance by improving financial oversight in a manner that permits the board of directors to anticipate and manage risks effectively. Finally, the notable correlations between performance monitoring and cloud platforms (0.42) as well as risk management and decision-making speed (0.42) outline how cloud accounting technology aids in executing more effective governance by aiding

better monitoring of financial performance and in making better decisions on risk management, emphasizing the transformative potential of cloud technology in corporate governance. Therefore, the findings of this study indicate that cloud accounting technology impacts the effectiveness of the board of directors and governance practices in MENA countries, delivering valuable insights for both policymakers and practitioners.

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Organizational Structure within MHS in Rural America Effect on Financial Performance: A National Study

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Abstract

Considering the increasing challenge to providing access to affordable healthcare in the United States and its effect on the economy, it is critical for patients, healthcare organizations, financial institutions, and federal and state agencies to understand the impact of different organizational structures within affiliated hospitals. The objective of this study was to investigate the impact of different organizational structures within rural multi-hospital systems (MHS) on the hospitals' financial performance. The data for this study were drawn from the 2020 American Hospital Association (AHA) Annual Survey. The AHA survey provided information on rural hospitals' organizational structure and financial information. The three financial measures used were 1) operating margin, 2) return on equity (ROE), and 3) days cash on hand. There were 757 hospitals in the financial indicators pool. The financial indicators showed that there are significant variations within days cash on hand and the types of MHS organizational structures. It was concluded that there was a significant relationship related to centralized and decentralized days cash on hand, with decentralized MHS having the lowest days cash on hand (32.63 days).

Keywords: Multi-Hospital Systems, Rural Health, Healthcare Finance, Financial Vulnerability, Hospital Closures

Introduction

Healthcare represents nearly 18% of the entire U.S. economy and currently is one of the few bright spots in terms of job growth. Hospitals are an integral part of our healthcare system. Over the years, hospitals have undergone a significant transition with respect to organizational structure. In 2010, there were 5,724 registered hospitals in the United States, 4,972 (86%) of which were community hospitals. Of all community hospitals, 3007 (60%) belonged to a system and 1,535 (30%) were part of a network (Association, 2012c). Considering the increasing challenge to providing access to affordable healthcare in the US and its effect on the economy, it is critical for patients, healthcare organizational institutions, and federal and state agencies to understand the impact of different organizational structures within affiliated hospitals.

By exploring whether and how hospital organizational structure impacts financial performance and selected quality care measures on a national level, this research seeks to help major stakeholders—government, investors, suppliers, administrators, and patients—to make informed management and care-delivery decisions. Rural hospitals are closing at a faster rate than their urban counterparts and in a recent controversial study found that the quality of care provided to rural populations is generally lower than in urban areas with counties classified as remote rural as experiencing 19.8%, the highest percentage of individuals reporting fair or poor health (Monnat & Beeler Pickett,

2011). Rural populations also suffer from higher uninsured rates than their urban counterparts—18.7% uninsured rate versus 16.3% (Proctor, & Smith, 2012).

Economic Research Service (ERS) researchers refer to non-metropolitan areas as "rural areas". In this research, we follow this definition of rural hospitals. This has resulted in the current trend where roughly 20% (or 60 million) residents live in rural areas (Lipsky & Glasser, 2011). However, only 11 percent of US physicians practice in rural areas (Arcury, et al., 2005). The rural community in general is unique with respect to their decreased access to healthcare, which is believed to result in decreases in the utilization of health services. Further, rural populations are forecasted to incur more difficulty within their communities, most importantly related to sustainability of their healthcare system soon. Rural populations tend to be more vulnerable; the residents tend to be older, of a lower socio-economic status, and have lesser access to healthcare providers than urban populations.

The growth of rural hospitals in the US can be traced to the passage of the Hill-Burton Act of 1945, which helped provide financial means for the construction of rural community hospitals. The Hill-Burton Act provided more than \$6.1 billion in loans and grants that helped construct or update 6,800 healthcare facilities, serving 4,000 communities. When the Act was originally passed, the focus was to assist healthcare facilities that served rural populations (Simmons, et al., 2012). Organizational theory suggests that the relationship between organizational characteristics and profitability could vary greatly based on the organizational level and structure under consideration (Hearld, Alexander, Fraser, & Jiang, 2008). Although many studies have considered hospitals as the unit of analysis, these studies have examined the outcome of quality based on a hospital's internal organization and structure.

Literature Review

The American rural hospital system experiences multiple interconnected challenges that combine financial trouble with decreasing patient numbers and staff deficits. Hospital closures have become widespread because of various challenges that severely diminish healthcare availability in rural areas. The sustainable future of rural healthcare facilities and population health depends on resolving present problems. The combination of economic pressures together with policy changes and population changes requires immediate healthcare service improvement strategies to protect and advance medical care in rural parts of America.

Rural hospital financial struggles substantially derive from Medicare and Medicaid paying lower reimbursement rates than actual costs of care. The majority of rural residents depend on Medicare and Medicaid to get their healthcare benefits (Center for Children & Families (CCF) of the Georgetown University McCourt School of Public Policy Center for Children and Families, 2025). The reimbursement payments Medicare and Medicaid provide to hospitals fail to match the real expenses of medical treatment, thus causing major financial troubles for healthcare facilities (Healthcare Value Hub, 2020). The economic performance of rural hospitals suffers greatly in states that did not adopt the Medicaid expansion since they maintain more uninsured patients while receiving less funding (Keesee et al., 2023). The financial instability of rural hospitals becomes worse because they operate continuously at a loss, while some hospitals face negative operating margins that endanger their financial survival.

Rural hospital closures create major negative effects on both local healthcare and the economic stability of communities. A hospital closure requires patients to journey longer distances for emergency care and specialized medical assistance, which generates delayed care and possibly poorer health results (UNC Gillings School of Global Public Health, 2020). Hospital closures create economic impacts that cost jobs, lower employment prospects, and decrease economic activity within the affected area. According to the Center for Healthcare Quality and Payment

Reform (McGrath, 2025), 768 rural hospitals in the U.S. face closure risks, and 315 hospitals will definitely close down within three years because of financial problems.

Rural hospitals face two major difficulties alongside workforce shortages that particularly affect healthcare professionals. The high socioeconomic appeal of city living creates challenges for rural hospitals to retain medical personnel in their facilities (Mohammadiaghdam et al., 2020). The lack of healthcare professionals creates problems for both the quality of treatment and hospital service range (Rural Health Information Hub, 2024). Rural hospitals continue facing severe challenges because their outdated infrastructure needs extensive investments to maintain modern facilities and do necessary repairs, which drain their already minimal financial resources (ShiftMed, 2024). The solution to maintain high-quality healthcare in rural areas requires immediate attention to current workforce problems.

Rural hospital financial health relies heavily on the decisions made by policymakers. Rural hospital financial performance improves in states that expanded Medicaid because more residents gain coverage access while hospitals get better reimbursement payments (Rural Health Information Hub, 2022). States without Medicaid expansion experience reduced hospital revenue alongside growing costs for treating patients without insurance coverage. The alternating health status of rural healthcare facilities depends directly on which policies states adopt for their healthcare systems. Analysis from the Kaiser Family Foundation (Godwin, 2023) shows that rural hospitals with negative operating margins exist only in states that did not expand Medicaid coverage, but expansion states demonstrate positive margins.

The solution requires multiple methods to overcome these problems. Repayment rates for Medicaid services should receive increased funding, especially in states that have not adopted expansion, thus reducing financial burdens. The establishment of telemedicine infrastructure along with mobile health units operates as a potential solution to remedy healthcare accessibility deficiencies by permitting virtual patient-provider contacts (Anawade et al., 2024). The recruitment of healthcare workers to rural areas will be supported by incentive programs that provide loan forgiveness and attractive compensation packages. Rural community needs require strategic approaches, which must be developed through joint efforts between federal, state, and local governments and private stakeholders (Dr. Mohammad Tarikul Islam, 2025). Rural healthcare systems will experience revitalization through these implemented measures, which provide residents with quality and affordable medical care.

The financial stability of United States rural hospitals develops from multiple economic pol, economic, and demographic elements. The solution requires complete policy changes along with investments in medical infrastructure combined with programs to hold rural healthcare providers in practice. Rural healthcare systems will experience revitalization through these implemented measures that provide residents with high-quality, affordable medical care. Rural hospital financial health improves when non-expansion states expand Medicaid coverage, demonstrating how healthcare policies affect hospital stability. The deployment of telemedicine technology combined with mobile health units helps close healthcare gaps by allowing remote patient-provider connections, which resolves workforce problems while enhancing medical service quality. Rural healthcare sustainability depends on unified efforts between public agencies such as federal, state, and local governments and private stakeholders who should devise adapted strategies for rural populations.

Data Analysis

The study involves multi-variable regression analysis of survey data (conducted by AHA) of administrators of rural hospitals that are members of a multi-hospital system. The study will utilize a cross level study design incorporating 2020 American Hospital Association (AHA). The AHA Annual Survey of Hospitals has gathered individual hospital level data since 1946 and response rates have historically been above 70% each year. This dataset

is the single source for American Hospital Association data that are associated with other state and industry organizations.

Data from the AHA Annual Survey contained a total sample size of 2,220 rural hospitals. 1,398 hospitals with missing organizational structure information and independent or unassigned organizational structure were omitted from the analysis. The remaining 822 rural hospitals were used in the data linking process and analysis.

Currently, the AHA dataset tracks hospital demographics and characteristics. This includes information pertaining to hospital leadership, strategic planning, service-line offering, beds, utilization, finance human resource management, information management, process management, patient-centered focus satisfaction, and staffing. An added level of analysis is implemented to ensure the highest data quality. Hospital data are compared to information obtained in previous years with regard to hospital type, size, and geographic location. System membership was not provided although it was used to generate the dataset. It was labeled as the variable "MHSMEMB". AHA region code was coded as the variable "REGION" within the dataset. This variable was generated using hospitals' state locations and coded as "STATE." Financial information for each hospital used in this study was obtained through the Online Medicare cost report worksheets and datasets from the Cost Report data through the AHD. This data, taken directly from The Healthcare Cost Report Information System (HCRIS) dataset, contains the most recent information from each cost report filed with CMS.

Financial indicators are an integral part of a business's overall decision-making and benchmarking. One of the main indicators financial organizations and stakeholders use to gauge a business model's viability is the business's return on equity (ROE). ROE allows firms to increase profitability from alternatives to their normal method of business. A company can become a market leader if it provides higher return on equity than its counterparts in the same sector or industry (Younis & Forgione, 2005).

FINANCIAL FPERFORMANCE= $\beta_0 + \beta_1$ Organizational Structure = β_2 Agency Characteristics + β_3 Region + ϵ_i .

Variables	Root Data	RQ1	RQ2
Operating Margin		D1	-
Return on Equity		D2	-
Day's Cash on Hand		D3	-

Table 1 Variables from the AHD Dataset

Table 2 Selected Financial Performance Indicators from AHD Dataset

Variable	Variable/Format		Calculated as:	Source
Total Operating	Continuous	/	[(Total operating Revenue – Total operating expenses) /	AHD
Margin	Percentage		(Total operating Revenue)] * 100	
Return on	Continuous	/	Net income/(total assets - total liabilities) *100	AHD
Equity	Percentage			
Day's Cash on	Continuous	/	(Cash on hand + market securities) / [Total operating	AHD
Hand	Percentage		expenses – depreciation) / 365]	

Financial Variable	Generic Definition
Total Operating Margin	The operating margin is the most commonly used ratio to measure a hospital's financial performance. If total operating revenue is less than total operating expenses, the organization is operating at a loss and will have a negative operating margin.
Return on Equity	Profitability ratio of a company is sometimes gauged using Return on Equity. This is a tool investors can use to measure how effectually the company is utilizing their money. Source: (Commerce, 2012)
Day's Cash on Hand	A commonly used liquidity measurement that indicates the amount of cash that is readily available for an organization's day-to-day monetary requirements (Bazzoli, et al., 1999; Ricketts & Heaphy, 2000)

Tabl	e 3	Det	finition	of F	inancial	Per	formance	Indicators
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Figure1: American hospital association regions



Results

Out of the 822 rural hospitals included in the study, 17 rural hospitals were located in region I, 23 in region II, 110 in region III, 115 in region IV, 121 in region V, 203 in region VI, 101 in region VII, 89 in region VII, and 43 in region IX. Region VI has the highest rural hospital representation and region I has the lowest. Among all rural hospitals, 54.26% identified themselves as critical access hospital, while 45.74% did not. The average number of total facility beds was 71.50 with a minimum of two and maximum of 757 beds. Approximately 56% of rural hospitals have a decentralized organizational structure, 29% have a moderately centralized structure, and 15% have a centralized organizational structure. (Table 6)

A total of 462 rural hospitals identified a decentralized organizational structure. 236 identified a moderately centralized structure, and only 124 hospitals identified a centralized organization structure. The average MHS rural hospital operating margin was between -15 and 12 with returns on equity ranging from -27 to 48.92 and days cash on hand ranging from -21 to 101 days. The widest variation is in days cash on hand among MHS rural hospitals. The

American Hospital Association's data was linked with the ADA data to obtain three financial elements: operating margin, return on equity (ROE), and days cash on hand. A total of 784 hospitals were matched.

Further examination of the data revealed the presence of outlier observations within the three financial indicators, which resulted in 27 rural hospitals being omitted from the analysis. Table 4.5 reports the mean and standard error of the financial indicators across all three organizational structures. The mean operating margins were -0.22, -1.63, and -1.94 for centralized, moderately centralized, and decentralized rural hospitals, respectively. The mean returns on equity were 15.76, 9.51, and 9.83 for centralized, moderately centralized, and decentralized rural hospital, respectively. The mean days cash on hand was 52.67, 40.43, and 36.26 days for centralized, moderately centralized, and decentralized, moderately centralized, and decentralized, moderately centralized, moderately centra

Hypothesis

H1: Rural hospitals affiliated with other multi-hospital systems and with a centralized organizational structure will have higher operating margins than multi-hospital-affiliated hospitals with decentralized organizational structures, and multi-hospital-affiliated hospitals with moderately centralized organizational structures.

H2: Rural hospitals affiliated with other multi-hospital systems and with a centralized organizational structure will have higher returns on equity than multi-hospital-affiliated hospitals with decentralized organizational structures, and multi-hospital-affiliated hospitals with moderately centralized organizational structures.

H3: Rural hospitals affiliated with other multi-hospital systems and with a centralized organizational structure will have more days cash on hand than multi-hospital-affiliated hospitals with decentralized organizational structures, and multi-hospital-affiliated hospitals with moderately centralized organizational structures.

Table 4: Descriptive Statistics of Study Population in AHA Dataset (n=822)

Characteristics	Frequency	Unweighted	Percent (%)	
Region				
Region I	17	2.07		
Region II	23	2.80		
Region III	110	13.38		
Region IV	115	13.99		
Region V	121	14.72		
Region VI	203	24.70		
Region VII	101	12.29		
Region VIII	89	10.83		
Region IX	43	5.23		
Cluster Code				
Centralized	124	15.09		
Moderately Centralized	236	28.71		
Decentralized	462	56.20		
Critical Access Hospital				
Yes	446	54.26		
No	376	45.74		
	Mean	SE	Min	Max
Total Facility Beds	71.50	69.56	2	757
Total Hospital Beds	60.71	62.10	2	650

 Table5: Bivariate Analysis of Organizational Structures across Regions (n=822)

Regions	Centralized	Moderately Centralized	Decentralized
Region I	7	8	2
Region II	7	6	10
Region III	16	45	49
Region IV	18	26	71
Region V	33	29	59
Region VI	12	37	154
Region VII	20	35	46
Region VIII	5	35	49
Region IX	6	15	22
Total	124	236	462

Table6: Descriptive Statistics of AHA + AHD Financial Data (n=757)

Characteristics	Frequency	Unweighted Percent (%)				
U.S. Region						
Region I	16	2.11				
Region II	23	3.04				
Region III	103	13.61				
Region IV	105	13.87				
Region V	114	15.06				
Region VI	194	25.63				
Region VII	90	11.89				
Region VIII	72	9.51				
Region IX	40	5.23				
MHS Structure						
Centralized	121	15.98				
Moderately Centralized	196	25.89				
Decentralized	440	58.12				
Critical Access Hospital						
Yes	358	47.29				
No	399	52.71				
	Mean	SE	Min	Max		
Total Facility Beds	73.32	71.08	2	757		
Operating Margin	-1.58	13.80	-73.21	51.19		
Return on Equity	10.70	38.22	-182.79	329.52		
Days Cash on Hand	39.96	61.21	-63.03	370.41		

Table7: MHS Hospitals' Organizational Structures and Financial Strengths

Organizational S (n=757)	Structure	Operating Margin		Return on Equity		Day's Cash on Hand	
		Mean	SE	Mean	SE	Mean	SE
Centralized		-0.22	10.38	15.76	52.23	52.67	69.03
Moderately Centraliz	zed	-1.63	12.89	9.51	30.67	40.43	59.54
Decentralized		-1.94	14.97	9.83	36.66	36.26	59.31

Discussion

Healthcare represents nearly 18% of the entire U.S. economy and currently is one of the few bright spots in terms of job growth. Hospitals are an integral part of our healthcare system. Rural populations tend to be; older, of a lower socio-economic status, and have lesser access to healthcare providers than urban populations (Bennett, et al., 2010). Rural communities tend to have weaker economies, higher poverty, and higher unemployment than their urban counterparts. Residents in these areas visit their medical home less frequently and suffer from decreased access to care, lack of insurance, and travel restrictions associated with obtaining their needed medical care (Harrison, et al., 2009).

Over the years, legislative changes have had significant implications on the organization and operation of hospitals, especially rural hospitals. One particular development has been the emergence of multi-hospital systems (MHS). Rural hospitals also view joining a MHS as an optimal alternative to the necessary financial support and strength required for survival and can help avoid mergers from investor-owned systems. Historically, rural hospitals have found it hard to stay solvent while having to retain an optimal position with respect to staffing and other overhead expenditures (McSwain, et al., 2012).

Conclusion

The significant findings within the data obtained was in connection with days cash on hand. There was a significant relationship between centralized and decentralized days cash on hand. Decentralized MHS was found to have the lowest days cash on hand of 32.63 days. This was significant as the p-value was .0130. This indicates that out of the three types of hospital structures (centralized, moderately centralize, and decentralized), the decentralized hospitals had the lowest days cash on hand and can be seen as a sign that these MHS are less liquid and have lower available funds to cover upcoming expenses. It is very important to note that in many cases the number of days cash on hand is seen as a direct link to an organizations' abilities to pay their short- and long-term debt obligations.

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Green marketing practices and consumer purchasing intention within the cosmetic industry of a developing country: The mediation effects of green awareness and

green loyalty

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Abstract:

The study examines the effects of green marketing practices (eco-products, sustainable packaging, and green image) on consumers' purchasing intention. The paper also examines the mediating roles of green awareness and green loyalty in the relationship. This quantitative-based explanatory study, underpinned by the theory of planned behaviour, employed a structured questionnaire to collect primary data from 408 consumers of green cosmetic products in Ghana. Using the structural equation modelling technique to test the proposed hypotheses, it was found that green marketing practices positively affect Ghanaian consumers' purchasing intentions toward green cosmetics, with green awareness and green loyalty having partial mediating effects. The study concludes that green marketing practices positively predict changes in the purchasing intentions of consumers toward cosmetic products. Also, it concludes that green marketing practices can positively influence consumers' purchasing intention through green loyalty and green awareness.

Keywords: Green marketing, eco-products, green image, green awareness, green loyalty.

Unfolding Leadership Styles for Disaster Response

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Abstract

Purpose- This paper aims to: (1) review the existing literature related to leadership styles; (2) investigate the value of leadership during the disaster response phase; and (3) discuss whether the adoption of any of the different leadership styles can produce different outcomes during this critical stage of the disaster lifecycle.

Design/ Methodology/Approach- An extensive review of the existing literature has been made in order to identify leadership styles and their key characteristics. Twelve leadership styles have been identified and introduced in this study. A conceptual model is developed in order to provide a mechanism by which leadership styles can be examined and applied. A trial and error approach was proposed to examine the appropriate leadership style(s).

Findings- This paper argues that the adoption of different leadership styles during the disaster response phase can produce different outcomes. Subsequently, this reflects on the effectiveness of the entire disaster management process. **Practical implications-** The current literature does not comprehensively discuss the consequences of adopting different leadership styles during the disaster response phase. The insights garnered from this research hold significant implications for business executives, decision makers and the individuals assigned to run the scene of the incident as it reflects on the ways people are being guided, inspired and finally enabled during the occurrence of a disaster.

Originality/value – Leadership styles are still largely underexplored in the context of disaster management. Assuming that disaster response can be steered differently using different leadership styles, the outcomes of the overall disaster management process are expected to vary accordingly. This can be of a great value not only for organizations but also for societies in coping with disasters and other major incidents.

Keywords- Disaster, leadership, response, human behavior, decision making, group dynamics. **Paper type-** Research paper.

1. Introduction

In recent times, disasters pose more threats to societies, the environment, and infrastructure than before. Consequently, the requirements for successful and effective disaster management should differ than those of the past. This call has been endorsed by many researchers (e.g. Witt and Lill, 2018; Hofmann *et al.*, 2015; McGowan, 2014). Today, disaster management requires new insight, open thinking, and a combination of knowledge and expertise at the scene of the incident, especially during the disaster response phase.

Disaster response is a critical phase in the disaster management cycle. Only very few studies have highlighted the role and significance of leadership in disaster response. In this regard, a number of questions can be raised; first, which leadership style(s) can be adopted or is recommended during the disaster response phase? Second, what are the expected outcomes of adopting any of the various leadership styles during the disaster response phase? And third, is there any universally accepted/adopted leadership style that is used during the disaster response phase?

This research therefore aims to: (1) review the existing literature related to the different leadership styles; (2) investigate the value of leadership during the disaster response phase; and (3) discuss whether the adoption of the different leadership styles can produce different outcomes during this critical stage of the disaster lifecycle.

2. Literature review

2.1 The concept of leadership

The concept of leadership has received increasing attention in contemporary literature, within almost all areas of management. Examples include; leadership in the public sector (Tizard, 2012; Gill, 2009; Tripathi and Dixon, 2008); leadership in tourism (Zmyslony, 2014; Pröbstl-Haider *et al.*, 2014; Zehrer *et al.*, 2014); and organizational leadership

(Anning-Dorson *et al.*, 2017; Megheirkouni, 2017). Li *et al.* (2012) argued that leadership research is important as it enables us to understand how leaders can make actual change and provide guidance to the rest of group members.

In their query into leadership styles, Stone *et al.* (2004) identified two types of leadership; transformational and servant. Rao (2013) investigated two other leadership styles; soft and hard leadership. Jennison (2015) discussed three different styles; front, side, and back leadership. Megheirkouni (2017) and Jogulu (2010) studied two other styles namely; transformational and transactional. Saeed *et al.*'s (2014) research focused on three types of leadership; transformational, transactional and laissez-faire (delegative leadership). Mauri (2017) studied two other styles; operationally-driven and opportunity-driven leadership and Yuan *et al.* (2019) described the features of coaching leadership.

Various definitions have also been introduced in the literature for leadership. For instance, Hassan *et al.* (2013) defined leadership as: "*the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication, reinforcement, and decision-making*". For the purpose of this research, leadership is defined as: "*the ability to guide and motivate individuals, groups or communities to achieve a specified goal, by guiding them and providing focus and inspiration*" (DuBrin, 2010).

Yang (2015) argued that the effectiveness of any style of leadership depends primarily on how leaders' behaviors are perceived by the followers and the extent to which these behaviors are influential. Amit *et al.* (2009) mentioned that leaders should have unique personal characteristics over non-leaders or average managers so that they can influence others. The question why leadership styles matter continues to be a core question in management research (Mauri, 2017; Washbush, 2005). Haddon *et al.* (2015) argued that there is no specific style of leadership that fits all contexts or enterprises because business environments are different and each has its own distinct characteristics.

2.2 The disaster response phase: an overview

Disaster response represents the immediate human reactions produced in reply to an incident. Response, as a stage, starts when it becomes clear that an incident is imminent and lasts until next stages are declared (Kapucu, 2007). Organized response determines the success of all subsequent stages of the disaster management cycle and helps to curb expenditures needed for recovery (Coppola, 2011; Donnelley, 2007; Son *et al.*, 2007).

Moore (2008) highlighted that no one should be criticized for treating an incident as serious in the first instance, even if this incident later proved not to be. Some researchers argue that what makes incidents extreme are people themselves; by the ways they respond to them and that the outcomes of an emergency are determined primarily by the behaviors of the people involved (Cutter, 2014; McEntire, 2002; Pauchant and Mitroff, 1988).

During a disaster, panic is the first wide-spread observable reaction within the workplace or within a society. According to Mawson (2005), panic represents an inappropriate/excessive pattern of human response. It considers the movement of people in public spaces as uncoordinated objects that behave irrationally, selfishly and competitively in an attempt to ensure their own safety and security. A typical consequence of panic is crowd crushing. Panic therefore affects disaster response negatively (Moore and Lakha, 2006). Shaw (2001) argued that if there is no guidance and support information, people will continue to behave irrationally as long as the incident poses threat.

During the disaster response phase, even the first responders are often confronted with unfamiliar and hostile conditions (Weisaeth, 1989). Many asserted that behavioural response patterns under such adverse conditions have often been inadequate and ineffective and several limitations of response operations have been observed (Son *et al.*, 2007). Also during the response phase, people interactions are typically inconsistent and incompatible even within the

best prepared organizations due to a number of factors; such as cultural differences and personal characteristics (Sawalha, 2018a). Normal decision making is also disrupted during the disaster response phase and very often wrong decisions are made due to the rapid escalation of the events (FairWork, 2019; Rodríguez-Espíndola *et al.*, 2018; Cosgrave, 1996).

In general, the disaster response phase is critical and complex and requires extra attention, organization, and control over the scene of the incident, as well as all sorts of cross-functional synergy and expertise. If people, even the most well-educated and well-prepared ones, are left with no prompt and adequate guidance, they are expected to prioritize one's interest/self-interest over the public's interest at the onset of a major incident.

2.3 The value of effective leadership during the response phase

Group dynamics is a key aspect in disaster management (Cuny, 2012). This comprises the mobility, guidance, and removal of people from the affected area(s). This also includes the personnel who run/manage the scene of the incident. Group dynamics can be controlled, or at least, guided or influenced by effective leadership.

Typically, the focus on the implementation of procedures at the onset of a disaster/major incident prevails over the focus on how these procedures are applied to achieve tangible and successful change at the scene of the incident. Following the procedures thoughtlessly without having a clear vision is unlikely to add real value (Sawalha *et al.*, 2018). At the onset of a major incident, people should be guided carefully and provided with the necessary information so that they can better respond and cope with the aftermath of the incident.

A review of the existing literature shows a number of studies that discuss the role of leadership during the recovery phase (Yiwen *et al.*, 2017) and during the planning and mitigation (Canton, 2013). Leadership has been given less attention in contemporary disaster management literature during the response phase in specific taking into consideration the criticality of this phase. There is an increasing need for having leaders who can lead the efforts at the scene of the incident the moment it occurs (McCarthy, 2014; Hahm *et al.*, 2013; Wheeler *et al.*, 2013; Demiroz and Kapucu, 2012). Figure 1 illustrates visually the expected role of leadership at the onset of a disaster (i.e. during the response phase) and how this might affect the success of subsequent stages.
Figure 1: The role of leadership in disaster response.



Figure 1.a: people without a leader.

Figure 1.b: people with a leader.

Source: Author's own.

The figure suggests that if people have common vision and goals at the onset of a disaster, then the more organized they are likely to be at the scene of the incident. The style of leadership the leader adopts while dealing with subordinates becomes a determinant of peoples' behaviors (Saeed *et al.*, 2014). Consequently, the adoption of different leadership styles is expected to reflect differently on the type of decisions being made and the expected outcomes of the disaster management process. In some cases, a combination of different leadership styles may be required due to the rapidly evolving nature of the situation (Dierendonck *et al.*, 2014).

3. Methodology

The disaster response phase is typically a short period of time during which quick and critical decisions have to be made. Nonetheless, the issue of which leadership style(s) is more effective during this phase is still largely underexplored.

Therefore, this paper provides a review of the existing literature related to leadership styles; investigates the value of leadership during the disaster response phase; and discusses whether the adoption of any of the different leadership styles can produce different outcomes during this critical stage of the disaster lifecycle.

Haddon *et al.* (2015) and Washbush (2005) argued that the effectiveness of leadership varies according to the context in which it is applied, and that there is no single prototype for a "good leader" that fits all organizational situations. Therefore, an extensive review of literature is made to investigate the characteristics of the different leadership styles.

A trial and error approach is then proposed to be applied in order to examine the leadership style(s) that is more practical and useful to adopt at the onset of a disaster (i.e. during the disaster response phase). A conceptual model has therefore been developed for this purpose. Overall, the approach taken in this research is based on theoretical reasoning informed by the literature (Figure 2).

Figure 2: Research methodology.



4. Findings and Discussion

4.1 Leadership styles

Twelve leadership styles were identified based on an extensive review of the literature. The discussion in this section aims to clarify the appropriateness (i.e. pros and cons) of each leadership style to workplace conditions at the onset of a disaster (i.e. during the disaster response phase). These styles are soft leadership, hard leadership, transformational leadership, servant leadership, front leadership, side leadership, back leadership, transactional leadership, Laissezfaire leadership, operationally-driven leadership, opportunity-driven leadership and coaching leadership. Before discussing the key characteristics of each of these styles of leadership, it is important to summarize the typical workplace conditions at the onset of a disaster (table 1). Table 1: Typical workplace conditions at the onset of a disaster (during disaster response phase).

	Workplace conditions at the onset of a disaster				
	Abnormal people dynamics				
Lack of organization					
	Fear, anxiety, panic and stress				
	Unfamiliar and hostile conditions confronting first responders				
	Extremely demanding environment				
	Rapid decision making				
_	Lack of information				

Source: Sawalha (2018b).

Table 2 shows the key characteristics of soft leadership derived from the literature. In workplace settings and at the onset of a major incident/disaster, the skills and emotional intelligence of people are considered critical elements at the scene of the incident. While the mixture of skills and knowledge could have some positive outcomes, a potential drawback of soft leadership is that people may have different/varying backgrounds, especially in multinational corporations, and since Soft leadership is typically based on persuasion and dialogue, this could be time consuming during an emergency. Soft leadership eliminates boarders between leaders and followers which subsequently creates a space for extended arguments, as well as inconsistent decisions to be made. Despite the tendency towards a collective approach of response, overall outcomes may incline towards heterogeneous types of reactions where the sense of leadership weakens under the complex and demanding workplace conditions.

Leadership style	Key characteristics	Reference(s)
Soft	 People-orientated. Centers on the emotional intelligence of people. Handling people with persuasive and negotiation skills. It is the art of leading politely to get the tasks executed. Based in partnership between the leaders and the followers. Very often, leaders listen to their followers. 	 Rao (2013). Rao (2016a). Rao (2016b).
	Apparent overall direction: persuasion and negotiation to get tasks executed.	

Table 2: Soft leadership.

Table 3 shows the key characteristics of hard leadership. This style of leadership tends to be more objective than soft leadership because it is mainly data-driven. The leader relies on the available data to control the scene of the incident

and the aftermath of a disaster. Data availability enables the leader to identify the direction and disclose it to people. However, in workplace settings and at the onset of a major incident/disaster, people are already overwhelmed by the immensity of the surrounding conditions. Additional pressure imposed by leaders could have negative impacts on the ways they react to the incident and interact. A superior and directive style of leadership is more appropriate when the circumstances are less significant/problematic than disaster situations and since pressure prevails over persuasion in hard leadership, this usually triggers difficult conversations which might further escalate the situation. Overall, the influence of the leader is highly observed in hard leadership.

Table 3: 1	Hard lead	lership.
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Leadership style	Key characteristics		Reference(s)
Hard	 Pressure prevails over persuasion. Task-oriented. Leaders are data-driven. Leaders take people where they (i.e. leaders) decide to go. Suits better when problems are simple and clearly defined. Fosters competition which in turn triggers difficult conversations. Often referred to as "directive" leadership which subsequently weakens the element of collaboration. 	•	Rao (2016b). Lombardo (2019).
	Apparent overall direction: Directive, task-centric and data- driven.		

Table 4 shows the key characteristics of transformational leadership. In workplace settings, transformational leadership aims mainly at building a foundation for long-term survival and success. Future goals and position of the organization are therefore treated as priorities. The focus of the leader is to instill commitment and motivation among employees in order to facilitate the achievement of the vision of the organization. A number of positive attributes of this type of leadership can prove to be useful during an incident, such as teamwork and collective involvement. Typically however, this future-centric orientation pays less attention to events that have a sudden onset nature, such as disasters and emergencies, commonly resulting in a less effective response capability as the focus is on the long-term aspect of the organization. In their basic nature, disasters are usually unexpected, and therefore need preparation and other day-to-day arrangements to be taken into consideration not only for future purposes but also as daily requirements.

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	Leadership style	Key characteristics	Reference(s)
	Transformational	 The leader focuses primarily on the organization as a whole and how to achieve its vision on the long run. The leader builds followers' commitment toward fulfilling the organizational objectives. Leaders tend to lead in a way that is motivating. Consistent with communal features, such as teamwork. Leaders focus on future trends and long-term issues, such as change. Focuses on performance optimization especially for the operations that have potential future impacts. 	 Stone <i>et al.</i> (2004). Jogulu (2010). Saeed <i>et al.</i> (2014). Judge and Piccolo (2004).
		Apparent overall direction: charge all efforts towards achieving the organizational objectives (primarily the long-term ones).	

Table	4:	Transformational	leadership.
	Table	Table 4:	Table 4: Transformational

Table 5 shows the key characteristics of servant leadership. Servant leadership exhibits some of the features of soft leadership, such as promoting people-centric organizational cultures. Both styles of leadership focus on investing in people and on entrusting them to run the scene of the incident at the onset of an emergency. Servant leaders are not only soft in their communication with people but also act as "servants" (i.e. as ultimate facilitators in the exact meaning of the word) to their followers. This attitude encourages others to behave similarly and serve the rest of the team and group members. This attitude therefore, creates positive organizational behavior. At the onset of a disaster, people following this style, tend to be collaborative, share and exchange resources. The role of the leader is to coordinate mainly. However, this style is highly questionable as it allows each single individual to take part in decision making during the disaster response phase replacing the fundamental role of the leader whose main responsibility is to draw direction and lead the operations.

Leadership style	Key characteristics	Reference(s)
Servant	 A servant leader focuses on modest use of power. A servant leader nurtures trust. Focuses on the well-being of the employees. A servant leader empowers followers. A servant leader shifts attention from processes to people. A servant leader encourages positive organizational behaviour. Some argue that positive organizational behaviour reflects positively on the ability to manage risk and major incidents. 	 Stone et al. (2004). Rao (2016a). Rao (2013). Turner & Baker (2018). Dutta & Khatri (2017).
	Apparent overall direction: people-centric with modest use of power.	

Table 5: Servant leadership.

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Table 6 shows the key characteristics of front leadership. Front leadership helps to develop a defensive capability for the group where the leader is the first responder to the entire range of unforeseen incidents that are likely to occur and who is then responsible of communicating the information/details to the rest of the team members. This enables the followers to cope with fast-paced and sudden-onset incidents in a more organized manner. Therefore, the attributes associated with this style of leadership help to build organizational and social resilience overtime if practiced correctly and fosters compliance; however, a significant shortfall of this style is that the leader remains the primary control figure and the only one who sets the pace, direction and goals. The team is supposed to follow the steps and the directions mandated by the leader. Often, the role of the leader extends further to get more involved operationally with the team members. This however overburdens the leader by time. A front position also prevents the leader from carefully observing the reactions and behaviors of the team members.

Table	6:	Front	leadership.
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Leadership style	Key characteristics	Reference(s)
	 The leader sets the direction for the followers. 	 Jennison (2015).
	 The leader decides how fast people should go. 	 Gibbings (2018).
Front Leadership	 Since the leader is at the front, he/she is capable 	
	of conserving the energy of people when it is most needed.	
	 Focuses on preventing burn-out and work- related stress. 	
	 The leader sets the goals quickly so that everyone has clear expectations. 	
	 The leader very often gets engaged operationally 	
	with the rest of the team members.	
	Apparent overall direction: defensive and fast-	
	paced style in which the leader is the main	
	controller.	

Table 7 shows the key characteristics of side leadership. This style assists the leader to observe the behaviors and responses of the team members more closely. Subsequently, this enables the leader to support and adjust the behaviors of the followers more strategically and prudently according to the requirements of the situation and the needs of the scene of the incident. Unlike front leadership, this style enables the team members to take the lead in varying moments and situations which, in many cases, reduces the extra burden on the leader and gives him extra time to regain control over the other areas of management. By adopting side leadership, the leader can be assured that all group members are active and are contributing positively. It has to be noted though that vision, goals and objectives should be set clear from the beginning; otherwise, a front leader will then be needed to assist the side leader. In general, side leadership helps to make group dynamics more organized; a significant aspect during the disaster response phase.

Leadership style	Key characteristics	Reference(s)
Side Leadership	 A coaching style of leadership. Promotes cohesiveness in actions. Promotes complementary roles between team members. Stresses on sharing of skills and knowledge. Enables the leader to "see and observe" what is not working and figure out what people need at the scene of the incident. The side position helps the leader to support more than to control. Allows team members to steer the team at varying moments alongside with the leader. 	• Jennison (2015).
	Apparent overall direction: increased homogeneity between team members and closer coordination and communication with the leader. The supportive role of the leader prevails over the controlling role.	

Tabl	e 7:	Side	lead	lersi	hip.
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Table 8 shows the key characteristics of back leadership. This style fits more in long-established organizations where employees have a level of experience and skills that enables them to draw their own directions. The leader in this context can be best viewed/described as "adjuster". The role of the leader is to push the group forward in case their pace or potential slows down or in case they lose track. This style allows the leader to monitor the dynamics of the group and group members so that he/she adjusts their actions and responses according to the requirements of the scene of the incident or according to a set of pre-defined guidelines, goals or objectives. Back leadership also enables the leader to monitor the actions of the group remotely which can have some additional advantages at the onset of an organizational or environmental disaster. Yet, this style could be doubtful to adopt especially in newly established organizations where employees are still in the early stages of learning and gaining experience.

Leadership style	Key characteristics	Reference(s)
Back Leadership	 This style can only be adopted if the leader has much confidence in the capabilities of the team members. The leader applies as little or as much control as necessary from the back according to the requirements of the situation. The leader sometimes applies force to push the group forward in case they slow down or in case they lose track. This style enables the followers to draw their own direction. Is more useful to apply when everyone knows where they are heading. It fits more within long-established businesses with extensive experiences. 	• Jennison (2015).
	Apparent overall direction: Team-led but with continuous monitoring and supervision from the	
	leader.	

Table 8: Back leadership.

Table 9 presents the key characteristics of transactional leadership. This style of leadership is based on exchange process whereby the followers/members of groups are rewarded for fulfilling their duties successfully and effectively as requested/instructed by the leader. Incentives include both; financial and non-financial rewards. This style of leadership can be configured to fit to the context of disaster management when disaster awareness and best practices are being promoted and when those who have core responsibilities during the response phase fulfil their duties successfully in loss mitigation, the safeguarding of lives of others, and adherence to best response practices. This style of leadership however requires an expert leader who is well-oriented and fully acquainted with the knowledge about disaster response and how to leverage this knowledge and experience at the scene of the incident. Incentivizing disaster awareness and effective response has rarely been discussed in the literature, and is found to be confined to environmental disaster management where climate change best practices are being rewarded/incentivized.

Leadership style	Key characteristics	Reference(s)
Transactional	 The relationship between the leaders and followers is defined in terms of specifying expectations, clarifying responsibilities and receiving rewards in order to achieve the expected outcomes. Followers accept or comply with the leader in exchange for incentives and in order to avoid disciplinary action(s). Leadership is mainly based on an exchange process whereby followers are rewarded for fulfilling their duties as requested. As such, employees are not expected to exceed the initial expectations of the leader, nor they are motivated to try out creative solutions to change the status quo. The followers often take popular strategies for approaching risk rather than attempting novel mechanisms for fear of reproach. 	 Jogulu (2010). Saeed <i>et al.</i> (2014). Bass (1990). Liu <i>et al.</i> (2011).
	Apparent overall direction: Reward-based style confined to predefined roles and responsibilities assigned by the leader.	

Table 9: Transactional leadership.

Table 10 shows the key characteristics of Laissez-faire leadership. This type of leadership assumes that people can excel in managing their own affairs (e.g. challenges or problems) and in drawing their own future directions even without a direct guidance or input from a leader. A very close example that demonstrates this style is what is known as "self-conducted" orchestra (i.e. a group of musicians who are not led by a conductor). Despite the fact that a typical orchestra does not always need a conductor as long as the music is not too difficult or complicated to conduct, advanced pieces of music need to be directed in order to avoid possible inaccuracies. Accordingly, this style raises several questions about issues of organization, consistency and decision making. In workplace settings and at the onset of a disaster, this type of leadership is therefore questionable in terms of its outcomes/deliverables. The lack of direct influence or input from a leader is likely to create "loose points" or gaps in group performance, responses, and communication and subsequently might not help to achieve the desired outcomes. Despite these shortcomings, some positive aspects can still be attributed to this style of leadership, especially during the disaster response phase, such as fostering self-learning, building self-confidence in one's actions and decisions, and allowing group members to improvise in case standard procedures proved to be deficient.

Leadership style	Key characteristics	Reference(s)
Laissez-faire	 Also known as "absent" leadership or non-involvement leadership. Leaders provide the least possible guidance. Leaders are hands-off and allow subordinates to manage their own affairs. Leaders typically avoid making decisions. Team members draw their own direction(s). People have the freedom to select and set their own objectives and monitor their own work. Leaders usually intervene using less noticeable measures. 	 Yang (2015). Saeed <i>et al.</i> (2014).
	Apparent overall direction: Non-involvement leadership; believing that people can excel when they are left alone to manage their own affairs.	

Table 10: Laissez-faire leadership.

Table 11 shows the key characteristics of operationally-driven leadership. This style centers on business continuity management. The primary focus of the leader is to secure the normal running of critical business functions and daily operations in order to avoid disruption and subsequently organizational disasters and crises. According to this style of leadership, leaders usually do not trigger or seek fundamental change as long as the daily business operations and critical functions are secured and maintained. This generally promotes stability at the workplace. On the other hand, full complacency with the status quo is likely to produce stagnation among employees; where the leader and followers remain relatively inactive while the environment surrounds them heats up unaware of the incremental and dangerous change occurring in their environment. Finally, when the disaster is unavoidable, the leader and the followers do not know where to start from which subsequently reflects negatively on the quality of their responses at the onset of an organizational disaster or a major incident.

Leadership style	Key characteristics	Reference(s)
Deader ship style	itey characteristics	Reference(s)
Operationally-driven	 The focus of the leader is on sustaining a smooth running of operations (business continuity). Leaders are usually complacent with the status quo as long as critical business functions are 	 Mauri (2017).
	 Maintained. Only advising incremental change. This style of leadership rarely seeks change as long as daily operations are undisrupted. Change is not implemented unless mandated from senior management. Leaders do not expect further value adding from the followers nor do the followers expect further advice from their leaders as long as the daily business operations are maintained. 	
	Apparent overall direction: Securing the normal running of business operations while seeking minimal	
	level of change.	

 Table 11: Operationally-driven leadership.

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Table 12 shows the key characteristics of opportunity-driven leadership. In contrast to operationally-driven leadership, this style emphasizes change more extensively. Supporters of this style argue that change is embedded in the fabric of every day's life and business activity and that the role of the leader is to promote this type of organizational culture among group members. Maintaining the status quo is not the goal, rather seeking opportunities in every business activity. Because of that, continuous information enquiry and research and development become parts of the daily routine of all group members which enables the organization to stay ahead in terms of the changes in the business environment. Accordingly, this style of leadership underpins the element of preparedness which in turn reflects positively on the ways people respond to disasters and other major incidents. However, a potential drawback of this style of leadership lies in the scope of activity which is channeled on how to make advantage of external factors rather than paying equal attention to securing internal operations and preventing disruption to critical business functions. The orientation of activity is therefore biased towards the external aspect of the organization which renders the time given to internal issues shortened.

Leadership style	Key characteristics	Reference(s)
Opportunity-driven	 Change is promoted across the organization. Leaders always seek to find original solutions for complex situations. Seeks to adapt with new organizational settings as long as these settings bring new opportunities. Leaders do expect further value adding from the followers in every activity which evolves into value-adding culture by time. Continuous information enquiry, which underpins the element of disaster preparedness. 	 Mauri (2017). Taylor (2016).
	Apparent overall direction: Continuous positive change and value-adding operations are encouraged within an organizational of societal contexts.	

Table 12: Opportunity-driven leadership.

Table 13 shows the key characteristics of coaching leadership. This style has some common features with side leadership where the leader is perceived as a supporter. This style aims to empower and enable group members to perform their duties to the fullest and successfully. Performance optimization is a main goal of the leader who seeks to provide the necessary information, updates, and resources. In addition, this type of leadership focuses on problem-solving and innovation. All these attributes are significant during the disaster response phase where cooperation and information availability are key elements for success. Coaching leadership goes even further by addressing the needs of each individual/member in the group. Therefore, in workplace settings and at the onset of an organizational disaster or major incident, this style of leadership fosters psychological safety and a sense of security as each and every member of the group is equipped with the necessary skills and the know-how to run the scene of the incident supported by a leader whose utmost attention is to promote common interest and tranquility, and where everybody works together more consistently and with higher levels of coherence.

Leadership style	Key characteristics	Reference(s)
Coaching	 Leadership by motivation and guidance. Provides resources and support whenever needed for the people in order to fulfill their tasks. Focuses on performance optimization. Underpins continual improvement. Cares for the psychological quality of the employees and motivates extra-role behaviours. Focuses on problem-solving skills and innovation capabilities. 	• Yuan <i>et al.</i> (2019).
	Apparent overall direction: Problem-solving and people empowerment.	

Table	13:	Coaching	leadership.
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4.2 A trial and error approach

A review of the extant literature does not provide conclusive evidence on a prevailing style of leadership that is adopted during the response phase for all types of organizational disasters; meaning that there is no universally accepted one.

The questions remain on whether a universal style(s) can be proposed/adopted and how can we validate the appropriateness of this style(s). Turner and Baker (2018) asserted that there is a need to revisit the existing leadership theories more frequently in the light of the dynamics and rapid developments of the different business environments.

Jones *et al.* (2010) and Williams (2007) argued that the concept of trial and error is commonly used in business and management to examine the usefulness of various management practices. Peters and Waterman (1982) asserted that there is evidence that a "trial and error" approach in business improves organizational performance. For the purpose of this research, it is proposed that multiple rounds of trial and error can be conducted in order to test the appropriateness of the different leadership styles to the context of disaster response. Trial and error is advised to be conducted before the actual event and during scenario tests, scenario exercises, or mock drills.

It is also imperative to point out that there are several types of disasters. Subsequently, trial and error can be useful in finding out the most applicable style of leadership that fits to these different categories of disasters especially within the context of business organizations. Figure 3 shows the different types of disasters.

Figure 3: Types of Disasters.



Source: Moore and Lakha (2006).

4.3 Development of the conceptual model

Figure 4 shows the proposed conceptual model. It sheds light on the trial and error approach and the order of the steps included. A full understanding of the organization and its context should mark the starting point. A mock drill or exercise is then initiated prior to the actual event. A trial and error approach is then applied during the mock drill or the exercise in order to examine the appropriateness of the selected leadership style(s). Next, the deliverables (outcomes) of the selected style(s) and their practical implications on the organization should be assessed. The assessment is expected to determine if the deliverables match the workplace conditions in order to know which aspects of the selected leadership style are useful and which are not. If the outcomes were positive, then the leadership style can be adopted. An enterprise-wide recognition of the adopted style should then be shared especially with the relevant parties and with those who are directly involved in the scene of the incident.

Figure 4: proposed conceptual model.



5. Conclusion

The disaster response phase is a critical one during which people are typically characterized as being disorganized and lacking of specific direction due to the hostile conditions they are exposed to and surrounded by. The ways people respond to major incidents determine the success of all subsequent stages of the disaster management cycle. Leadership is therefore a significant element as it defines the patterns of behaviors of the people involved/exposed. Unfortunately however, leadership has been rarely discussed in the literature of disaster management, specifically in the context of the disaster response phase.

This research did not aim at proposing a universal style of leadership that fits all organizations within all sectors but rather discussing the pros and cons and raising questions about the patterns of leadership that are likely to yield better outcomes to the workplace settings, people and systems during the disaster response phase. A number of key leadership styles have been investigated. The proposed conceptual model provides a theoretical mechanism for comparing the features of these leadership styles and their effectiveness during the disaster response phase. If the outcomes meet the expectations, then the selected leadership style can be adopted.

This study has been conducted to fit within an organizational context mainly. Yet, it can also be applied to societal contexts by endorsing concepts of public leadership and matching them with the concepts of business leadership. Typically, the concept of leadership applies wherever group work is needed. Twelve leadership styles have been investigated in this research which represent the key styles that dominate the extant literature. The tables provided describe the main features of these styles that match workplace settings during the occurrence of disasters.

Future research can apply the methods used in this research quantitatively in order to provide quantitative reasoning, evidence or rating of the effectiveness of the various styles of leadership to disaster response. Future research can set quantitative measures for the outcomes and the deliverables of these different styles. Future research can also investigate other types of leadership. Bass (1990) stated that "there are almost as many different definitions of leadership as there are persons who have attempted to define the concept". The ultimate goal is to enrich the disaster management literature with contemporary concepts that are likely to produce more positive outcomes which in turn are likely to reduce the adverse consequences of disasters on people, organizations and communities.

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Effects Of Economic Discomfort And Environmental Air Pollution On Maternal And Child Health In West Africa.

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Abstract

This study explored the impact of economic discomfort and environmental air pollution on maternal and child health in West Africa. The analysis focused on how these factors influence maternal and child health outcomes in response to different economic and environmental shocks. The Socio-ecological model provided the theoretical basis for the study. Key variables included maternal mortality rate, under-five mortality rate, economic discomfort, particulate matter (PM2.5), air pollution exposure, GDP per capita, health expenditure, prevalence of undernourishment, and immunization. Data were obtained from the World Development Indicators (WDI). To determine the magnitude and direction of the relationships, the study employed Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS). The Dynamic Autoregressive Distributed Lag (DYNARDL) approach was used to examine the response among the variables, with results analyzed at a significance level of $\rho < 0.05$. The study revealed that both economic discomfort and air pollution had significant positive effects on maternal mortality rates in West African countries ($\beta = 0.333$; $\rho < 0.05$; $\beta = 0.527$; $\rho < 0.05$), and similarly significant effects on infant mortality rates $(\beta = 0.314; \rho < 0.05; \beta = 0.579; \rho < 0.01)$. Country-specific results showed varying significance levels, with effects being significant in Benin and Cote d'Ivoire ($\beta = 0.321$; $\rho < 0.05$; $\beta = 0.489$; $\rho < 0.05$; $\beta = 0.245$; $\rho < 0.05$; $\beta = 0.293$; $\rho < 0.05$), and insignificant in Burkina Faso and Senegal ($\beta = 0.204$; $\rho > 0.05$; $\beta = 0.131$; $\rho > 0.05$; $\beta = 0.152$; $\rho > 0.05$; $\beta = 0.120$; $\rho > 0.05$). DYNARDL analysis indicated that increases in economic discomfort and air pollution positively correlated with higher maternal and child mortality rates. Based on the findings, the study recommends that West African governments should implement measures to mitigate environmental air pollution in the region while prioritizing investments in health infrastructure and social support systems to improve access to quality maternal and child healthcare services in the region.

Keywords: Economic discomfort, Environmental air pollution, Maternal health, Child health, Particulate matter

Introduction

Maternal and child health is a critical global concern, particularly in West Africa, where socio-economic and environmental challenges lead to high mortality rates. Despite advancements in healthcare, this region faces significant maternal and child mortality due to poverty, income inequality, and limited access to essential services (George et al., 2024; Bai et al., 2024). Environmental pollution, such as poor air quality and contaminated water, further exacerbates health risks (Shetty et al., 2023; Yu et al., 2023). The UN Sustainable Development Goals (SDG 3) aim to reduce the maternal mortality ratio to under 70 per 100,000 live births by 2030 (Bello & Joseph, 2014). Factors like economic discomfort and inadequate healthcare access complicate progress (Joseph, 2020; Santos et al., 2023). Major causes of maternal morbidity include postpartum hemorrhage, infection, and unsafe abortion (Wilson et al., 2024). Economic hardship, linked to unemployment and limited resources, intensifies healthcare access issues (Cakici & Zaremba, 2023; Stirling et al., 2023). Projections suggest that sub-Saharan Africa may face 390 maternal deaths per 100,000 live births by 2030, far exceeding SDG targets (World Bank, 2023). Moreover, rising food prices and food insecurity threaten nutrition for vulnerable groups (Fitzpatrick et al., 2021; Ma et al., 2021). While governments have enacted policies to promote child health (Mardani et al., 2022), barriers like inadequate resources hinder achieving SDG targets (Babawarun et al., 2024). This study investigates the relationship between economic discomfort, environmental pollution, and health outcomes in West Africa, aiming to inform effective health strategies in the region.

Literature Review Mental Health

Maternal health is vital for public health and sustainable development, significantly influencing family and community well-being. It encompasses women's health during pregnancy, childbirth, and postpartum, focusing on physical, mental, and social aspects to ensure safe experiences for mothers and infants (Anglim & Radke, 2022; Firoz et al., 2022; Hernandez et al., 2023). Key components include quality prenatal care, nutrition, skilled attendance during childbirth, and emotional support (Young & Ramakrishnan, 2020; Marshall et al., 2022). Promoting reproductive rights and gender equality empowers women to make informed health choices, aiming to reduce maternal mortality and enhance newborn well-being (Olonade et al., 2019).

Child Health

The WHO defines child health as the physical, mental, and social well-being of children from birth to adolescence, focusing on healthy development and disease prevention (Vesoulis et al., 2023; Enelamah et al., 2023). Access to

healthcare, immunizations, nutrition, and safe living conditions are crucial (Thakur & Pathak, 2022). Collaborative efforts among healthcare providers, parents, and policymakers create supportive environments for child development (Dyakova, 2017; Garcia et al., 2020), enabling children to thrive and live healthy lives (Jourdan et al., 2021).

Economic Discomfort

Economic discomfort refers to dissatisfaction due to adverse economic conditions, manifesting as financial instability and insufficient income (Ibikunle & Oyerinola, 2022). This leads to stress and restricts access to healthcare, education, and quality of life, exacerbated by poverty and unemployment (Rencz & Janssen, 2022). Economic discomfort refers to dissatisfaction due to adverse economic conditions, manifesting as financial instability and insufficient income (Ibikunle & Oyerinola, 2022). This leads to stress and restricts access to healthcare, education, elibikunle & Oyerinola, 2022). This leads to stress and restricts access to healthcare, education, and quality of life, exacerbated by poverty and unemployment (Rencz & Janssen, 2022).

Environmental Air Pollution

Environmental air pollution threatens ecosystems and human health, stemming from industrial emissions, vehicular exhaust, and fossil fuels (Manoev & Azzamov, 2023; Krammer et al., 2023). It contributes to respiratory diseases and climate change, making it essential to address these issues for improved health outcomes and sustainability (Ren et al., 2022; Yuan et al., 2022).

Theoretical Framework

This study employs the Socio-Ecological Model (SEM) Framework, developed by the World Health Organization (WHO), which asserts that health outcomes are shaped by individual behaviors and genetics, alongside broader social, economic, and environmental contexts. The SEM framework is crucial for understanding health factors affecting vulnerable populations, particularly mothers and children in West Africa.

Key Areas of Influence:

Economic Conditions: Economic discomfort, including poverty, unemployment, and income inequality, significantly impacts maternal and child health. Such conditions restrict access to healthcare services, nutritious food, and clean water, leading to malnutrition and increased disease susceptibility (Rencz & Janssen, 2022).

Environmental Pollution: Pollution (air, water, soil) exposes mothers and children to harmful toxins, causing respiratory and gastrointestinal diseases. In West Africa, lax industrial regulations exacerbate health risks from pollution (Manoev & Azzamov, 2023).

Interconnectedness of Factors: The SEM framework highlights the link between economic discomfort and environmental pollution. Economic constraints can worsen pollution effects by limiting resources for prevention. Conversely, polluted environments increase healthcare costs and reduce productivity, perpetuating cycles of poverty and poor health. This underscores the need for comprehensive interventions addressing both economic and environmental determinants to enhance health outcomes in West Africa.

Methodology

Data Requirement and Source

The study focuses on 16 West African countries: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Key variables include maternal mortality rate, under-five mortality rate, economic discomfort (measured by the sum of inflation and unemployment rates), particulate matter (PM2.5), air pollution levels, GDP per capita, health expenditure, prevalence of undernourishment, and immunization rates. All data are sourced from the World Development Indicators (WDI).

Model Specification and Analysis of Results

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The study employs several models to analyze the impact of economic discomfort and environmental air pollution on maternal and child health.

Model I: Investigates the aggregate impact on maternal health using the following equation:

 $\label{eq:MMRit=} MMRit=\beta0+\beta1ECDFit+\beta2EPOit+\beta3GHEit+\beta4PKYit+\beta5PUNit+\varepsilonit\text{MMR}_{it} = \beta_0 + \beta_1 \text{ECDF}_{it} + \beta_2 \text{EPO}_{it} + \beta_3 \text{GHE}_{it} + \beta_4 \text{PKY}_{it} + \beta_5 \text{PUN}_{it} + \beta_6 \text{PUN}_{it} \text{PUN}_{it} + \beta_6 \text{PUN}_{it} \text{PUN}_{it} + \beta_6 \text{PUN}_{it} \text{PUN}_{it} \text{PUN}_{it} + \beta_6 \text{PUN}_{it} \t$

where MMR is the maternal mortality rate, ECDF is economic discomfort, EPO is environmental pollution, GHE is government health expenditure, PKY is GDP per capita, and PUN is the prevalence of undernourishment.

Model II: Examines the impact on child health, specifically infant mortality rate (IMR):

 $\label{eq:IMRit=} IMRit=\beta0+\beta1ECDFit+\beta2EPOit+\beta3GHEit+\beta4PKYit+\beta5IMUit+\epsilon it text \{IMR\}_{it} = \beta_0 + \beta_1 \text \{ECDF\}_{it} + \beta_2 \text \{EPO\}_{it} + \beta_3 \text \{GHE\}_{it} + \beta_4 \text \{PKY\}_{it} + \beta_5 \text \{IMU\}_{it} + \beta_6 \text \{IMR\}_{it} + \beta_6 \text \{IMU\}_{it} + \beta_6 \text \{IMR\}_{it} + \beta_6 \text \{IMI\}_{it} + \beta_6 \text \{IMI\}_{it}$

Model III: Assesses variations in the impact across countries, using a similar structure as Model I but focusing on differences in responses to economic and environmental factors.

Model IV: Further explores the variability in maternal health impacts across West African countries, maintaining the same variables as in previous models.

Method of Estimation

To account for cross-sectional dependence among countries, the study employs a cross-section dependence test. The Panel Fully Modified OLS (PFMOLS) and Panel Dynamic OLS (PDOLS) methodologies are used to address the first two objectives, capturing interdependencies and dynamic relationships. Fully Modified OLS is applied for the third and fourth objectives, while the dynamic Autoregressive Distributed Lag (ARDL) approach is utilized for the fifth objective, allowing for the examination of responses to economic and environmental shocks.

Results and Discussion

	Mean	Std. Dev.	Minimum	Maximum			
Maternal Mortality Rate per 100,000 live births							
Benin	552.837	50.754	469	625			
Burkina Faso	348.696	88.974	205.813	506			
Cape Verde	58.014	25.851	18.689	125			
Cote d'Ivoire	545.259	41.069	473	619			
The Gambia	600.238	121.692	403.827	778			
Ghana	325.755	83.306	193.176	499			
Guinea	709.741	152.821	463.148	971			
Guinea Bissau	818.477	207.889	500.868	1300			
Liberia	677.307	54.631	624.168	805			
Mali	528.074	86.501	395.749	742			
Mauritania	556.33	95.197	404.067	684			
Niger	592.301	185.716	292.689	878			
Nigeria	1104.171	25	1047	1148			

Table 1: Descriptive Statistics

Senegal	400.399	140.29	173.461	639
Sierra Leone	832.769	477.906	66.526	1682
Togo	472.163	38.672	399	530
Panel	570.158	279.767	18.689	1682
Mortality rate, un	nder -5 (per 100)0 live births)		
Benin	106.173	17.541	77.679	136.800
Burkina Faso	119.616	35.109	62.822	178.900
Cape Verde	23.179	7.365	11.378	38.100
Cote d'Ivoire	103.507	23.759	64.934	143.300
The Gambia	71.740	22.679	35.067	113.400
Ghana	65.426	19.642	33.532	99.700
Guinea	117.495	22.647	81.274	164.200
Guinea Bissau	111.618	35.699	53.857	173.800
Liberia	105.474	37.084	48.069	189.700
Mali	126.258	34.195	70.863	187.400
Mauritania	91.138	16.184	64.959	112.500
Niger	123.208	54.049	36.673	224.900
Nigeria	136.604	23.124	99.691	182.900
Senegal	66.005	32.333	14.314	129.500
Sierra Leone	154.811	42.860	85.239	224.900
Togo	85.846	19.521	54.141	119.900
Panel	100.508	43.053	11.378	224.900
Benin	3.544	2.213	0.667	9.137
Burkina Faso	6.565	3.895	1.475	19.355
Cape Verde	14.529	2.695	10.512	20.371
Cote d'Ivoire	6.985	2.978	1.293	12.744
The Gambia	14.969	3.938	10.364	26.909
Ghana	22.778	11.896	10.314	51.142
Guinea	18.199	8.291	4.983	39.766
Guinea Bissau	6.281	3.867	-0.139	15.623
Liberia	20.297	15.559	8.975	61.216
Mali	4.481	4.651	-1.698	19.159
Mauritania	15.559	3.336	11.776	25.736
Niger	3.515	3.191	-1.942	12.864
Nigeria	17.092	4.234	9.179	25.056
Senegal	9.113	3.817	4.031	17.584
Sierra Leone	16.412	7.914	9.319	45.418
Togo	6.313	3.25	2.327	15.043
Panel	11.665	8.896	-1.942	61.216
PM2.5 air pollution	on, mean annu	al exposure		
Benin	42.670	8.211	18.385	50.602
Burkina Faso	54.041	2.432	47.342	60.272
Cape Verde	47.262	4.897	34.111	53.840

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Cote d'Ivoire	56.689	3.569	48.053	63.411
The Gambia	56.810	3.151	50.819	62.127
Ghana	54.515	4.259	46.953	60.482
Guinea	52.754	1.974	45.973	56.214
Guinea Bissau	53.333	3.169	46.632	57.509
Liberia	50.641	3.048	44.146	55.997
Mali	60.125	2.406	52.780	65.829
Mauritania	66.652	3.836	60.593	71.879
Niger	79.181	4.032	69.291	87.522
Nigeria	69.416	4.526	59.484	76.053
Senegal	59.212	3.835	53.042	65.394
Sierra Leone	50.345	2.355	44.139	55.086
Togo	46.135	3.363	40.292	51.064
Panel	56.174	9.829	18.385	87.522
Government Hea	lth Expenditure			
Benin	2.808	0.292	2.321	3.414
Burkina Faso	4.931	1.158	2.888	6.719
Cape Verde	4.797	0.568	3.583	6.019
Cote d'Ivoire	4.208	1.085	2.494	6.127
The Gambia	4.149	1.297	2.089	6.654
Ghana	3.748	0.595	2.764	4.693
Guinea	4.183	0.711	3.266	5.809
Guinea Bissau	7.362	1.015	5.823	9.969
Liberia	8.669	2.495	2.904	11.648
Mali	4.439	0.682	3.503	5.466
Mauritania	3.219	0.414	2.474	4.033
Niger	5.151	0.511	4.307	6.201
Nigeria	3.562	0.565	2.491	5.054
Senegal	4.183	0.438	3.415	5.151
Sierra Leone	11.832	3.046	8.289	20.413
Togo	4.694	1.389	2.794	6.891
Panel	5.121	2.558	2.089	20.413
GDP Per Capita				
Benin	1049.124	277.182	512.674	1468.616
Burkina Faso	644.389	215.499	255.719	978.513
Cape Verde	3030.252	921.881	1259.353	4287.296
Cote d'Ivoire	1788.872	494.723	997.479	2583.168
The Gambia	699.451	138.225	335.906	924.509
Ghana	1496.477	848.857	258.471	2841.337
Guinea	714.615	274.673	322.416	1194.038
Guinea Bissau	591.395	171.961	308.91	862.029
Liberia	560.228	207.631	243.089	876.533
Mali	701.143	231.108	270.542	1061.944

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Mauritania	1455.036	474.086	639.668	2140
Niger	458.209	144.605	197.833	681.359
Nigeria	2019.736	819.665	567.931	3112.409
Senegal	1229.8	307.265	613.732	1686.599
Sierra Leone	456.543	168.888	138.699	716.836
Togo	615.78	224.528	292.823	971.997
Panel	1094.441	820.716	138.699	4287.296
Immunization, DPT	(% of children			
ages 12-23 months)	75 570	0.595	70	02
Benin	/5.5/2	2.585	/0	82
Burkina Faso	85.616	11.86	45	99.775
Cape Verde	94.487	2.868	90	99
Cote d'Ivoire	74.994	7.424	61	87
The Gambia	91.372	5.904	79	98
Ghana	91.017	6.926	78	100.403
Guinea	52.623	6.555	44	64
Guinea Bissau	74.745	11.458	49	87
Liberia	65.185	15.741	31	83.435
Mali	69.845	9.148	43	79.289
Mauritania	73.56	7.338	51	89
Niger	67.061	18.822	34	99.455
Nigeria	47.329	13.243	25	66
Senegal	85.158	12.821	52	99.783
Sierra Leone	78.887	17.018	38	103.296
Togo	78.802	9.219	50	89.245
Panel	75.391	16.687	25	103.296
Prevalent of Underno	ourishment (% of j	population)		
Benin	10.688	2.751	8.100	17.3
Burkina Faso	15.723	2.939	11.968	22.9
Cape Verde	17.093	3.544	11.200	21.928
Cote d'Ivoire	13.673	4.266	6.950	18.9
The Gambia	17.613	2.726	12.90	21.5
Ghana	8.376	3.279	3.709	14.9
Guinea	14.173	1.938	11.609	18
Guinea Bissau	26.651	9.434	15.000	40.567
Liberia	35.254	2.326	29.500	38.4
Mali	8.676	4.804	2.866	16.6
Mauritania	7.696	1.195	6.200	11.1
Niger	16.613	3.939	10.900	24.2
Nigeria	10.096	3.420	6.400	19.3
Senegal	12.454	6.509	4.700	25.8
Sierra Leone	33.683	10.886	21.100	51.3
Togo	23.063	5.203	17.200	31.6

Panel	16.970	9.654	2.866	51.3	
Source: Deseau	ahar (2021)				

The descriptive statistics reveal significant disparities in maternal and child health outcomes across West African countries. The mean maternal mortality ratio for the region is 570.16 per 100,000 live births, with Nigeria having the highest ratio at 1,104.17, followed by Sierra Leone (832.77) and Guinea Bissau (818.48). In contrast, Cape Verde exhibits the lowest ratio at 58.01, indicating better maternal health outcomes. The mean under-5 mortality rate is 100.51 deaths per 1,000 live births, with Sierra Leone again recording the highest rate at 154.81, while Cape Verde has the lowest at 23.18, highlighting significant health service disparities. Economic discomfort varies widely, with Ghana at the highest mean (22.78) and Niger at the lowest (3.51). The mean PM2.5 air pollution exposure is 56.17, with Niger experiencing the highest levels (79.18) and Cape Verde the lowest (47.26). Government health expenditure averages \$5.12 billion, with Sierra Leone leading at \$11.83 billion. The mean GDP per capita is \$1,094.44, with Cape Verde at the highest (\$3,030.25) and Niger at the lowest (\$458.21). Lastly, immunization coverage for DPT averages 75.39%, with Cape Verde showing the highest coverage (94.49%) and Nigeria the lowest (47.33%). The prevalence of undernourishment averages 16.97%, with Sierra Leone at the highest (33.68%) and Ghana at the lowest (8.38%). These statistics underscore the need for targeted health interventions across the region.

	Test Statistics			
	Breusch-Pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
MMR	1562.874***	92.104***	91.756***	25.844***
	(0.000)	(0.000)	(0.000)	(0.000)
IFR	2811.102***	172.677***	172.329***	53.015***
	(0.000)	(0.000)	(0.000)	(0.000)
ECDF	528.163***	25.314***	24.967***	17.807***
	(0.000)	(0.000)	(0.000)	(0.000)
EPO	1192.894***	68.222***	67.874***	31.704***
	(0.000)	(0.000)	(0.000)	(0.000)
GHE	695.395***	36.109***	35.761***	-0.722
	(0.000)	(0.000)	(0.000)	(0.470)
IMU	921.489***	50.703***	50.355***	24.219***
	(0.000)	(0.000)	(0.000)	(0.000)
РКҮ	2316.237***	140.734***	140.386***	47.773***
	(0.000)	(0.000)	(0.000)	(0.000)
PUN	1203.462***	68.904***	68.557***	11.440***
\	(0.000)	(0.000)	(0.000)	(0.000)

Note: The probabilities values are in the parentheses ii. *** denotes significance of the variable at 5%. *Source: Researcher (2024)*

In investigating the effects of economic discomfort and environmental air pollution on maternal and child health in West Africa, it is essential to recognize the diverse socio-economic and environmental characteristics across the region. A cross-section dependence test was conducted to assess whether data from different countries were independently distributed. The results, detailed in Table 2, indicated significant cross-section dependence among all variables, leading to the rejection of the null hypothesis of independence. This confirms interdependencies among observations from various West African regions, underscoring the need for a robust analysis that considers these relationships.

Table 3: Correlation

		MMR	IFR	EPO	ENVP	GHE	РКҮ	IMU	PUN
	Pearson								
MMR	Correlation	1.000							
	Sig. (2-tailed)								
	Pearson								
IFR	Correlation	.839**	1.000						
	Sig. (2-tailed)	(0.000)							
	Pearson								
ECDF	Correlation	0.069**	.183**	1.000					
	Sig. (2-tailed)	(0.000)	(0.000)						
	Pearson								
EPO	Correlation	.140**	0.044**	0.091	1.000				
	Sig. (2-tailed)	(0.006)	(0.004)	(0.076)					
	Pearson								
GHE	Correlation	-0.043	104*	0.091	445**	1.000			
	Sig. (2-tailed)	(0.404)	(0.043)	(0.076)	(0.000)				
	Pearson								
РКҮ	Correlation	514**	653**	.143**	.483**	335**	1.000		
	Sig. (2-tailed)	(0.000)	(0.000)	(0.005)	(0.000)	(0.000)			
	Pearson								
IMU	Correlation	552**	590**	-0.008	215**	0.086	.312**	1.000	
	Sig. (2-tailed)	(0.000)	(0.000)	(0.876)	(0.000)	(0.093)	(0.000)		
	Pearson								
PUN	Correlation	.116*	.175**	0.069	583**	.594**	503**	-0.067	1.000
	Sig. (2-tailed)	(0.023)	(0.001)	(0.175)	(0.000)	(0.000)	(0.000)	(0.189)	
	Ν	384	384	384	384	384	384	384	384

Table 3 presents a correlation analysis of key variables, revealing significant interrelationships. A positive correlation exists between maternal mortality ratios and economic discomfort (r = 0.069, p < 0.05), indicating that higher economic instability correlates with increased maternal mortality. Similarly, infant mortality rates also show a robust positive correlation with economic discomfort (r = 0.183, p < 0.05), suggesting that financial strain impacts child health outcomes. Environmental air pollution is positively correlated with both maternal mortality (r = 0.140, p < 0.05) and child mortality (r = 0.044, p < 0.05), highlighting the detrimental health effects of pollution. Government health expenditure shows a weak inverse relationship with maternal mortality (r = -0.043), but a significant negative correlation with infant mortality (r = -0.104, p < 0.05), indicating that increased spending may reduce child mortality more effectively. A strong inverse relationship exists between per capita GDP and both maternal (r = -0.514) and infant mortality rates (r = -0.613), emphasizing the role of economic prosperity in improving health outcomes. Additionally, immunization coverage negatively correlates with infant mortality (r = -0.590, p < 0.05), while undernourishment positively correlates with maternal mortality (r = -0.590, p < 0.05), while undernourishment positively correlates with maternal mortality (r = -0.590, p < 0.05), while undernourishment positively correlates with maternal mortality (r = 0.116, p < 0.05), underscoring the need for targeted interventions to combat malnutrition and improve health outcomes in West Africa.

	Level	First Difference
	I(0)	I(1)
MMR	6.274	-7.654***
	(1.000)	(0.000)
IFR	13.195	-2.493***
	(1.000)	(0.008)

Table 4: Im, Pesaran and Shin CIPS Unit Root Test

ECDF	-2.600***	
	(0.005)	
EPO	1.288	-9.546***
	(0.901)	(0.000)
GHE	-0.498	-9.962***
	(0.308)	(0.000)
РКҮ	-2.357***	
	(0.009)	
IMU	-5.932***	
	(0.000)	
PUN	-0.453	-3.357***
	(0.325)	(0.000)

Conventional unit root tests may struggle with cross-section dependence in panel data analysis. This study utilizes the Im, Pesaran, and Shin CIPS test, suitable for West Africa's heterogeneous socio-economic landscapes. Results show economic discomfort, per capita income, and immunization are stationary at I(0), while maternal and infant mortality, pollution, health expenditure, and undernourishment are I(1), highlighting critical dynamics in the data.

Variables	Test Statistics	Coefficient	ρ -value
EDFC, EPO and MMR	g-tau	-6.234	0.000
	g-alpha	-8.201	0.013
	p-tau	-6.334	0.002
	p-alpha	-5.187	0.023
EDFC, EPO and IFR	g-tau	-5.856	0.000
	g-alpha	-6.771	0.003
	p-tau	-6.673	0.002
	p-alpha	-4.599	0.005

Table 5: Westerlund Cointegration Test

Source: Researcher (2024).

Given the cross-sectional dependence in the panel data, conventional tests for long-run relationships are inadequate. The Westerlund cointegration test, suitable for this context, reveals a significant long-run relationship among economic discomfort, environmental pollution, maternal mortality, and child mortality in West Africa, underscoring the need for integrated policy approaches.

Empirical Findings

Effects of Economic Discomfort and Environmental Air Pollution on Maternal Mortality

Table 6 presents the impact of economic discomfort and environmental air pollution on maternal mortality in West Africa, utilizing Panel Fully Modified OLS (PFMOLS) and Panel Dynamic Ordinary Least Squares (PDOLS). The results reveal a significant positive relationship between economic discomfort and maternal mortality, where a 1% increase in discomfort correlates with a 0.301% to 0.333% rise in maternal deaths (p < 0.05). This indicates that higher

inflation and unemployment worsen challenges for expectant mothers, affecting healthcare access and increasing stress. Environmental air pollution, measured by PM2.5 levels, shows a strong correlation, with a 1% increase in PM2.5 linked to a 0.527% to 0.824% rise in maternal deaths. Although government health expenditure negatively correlates with maternal mortality, this relationship is not statistically significant, suggesting inefficiencies in healthcare delivery. Conversely, per capita income has a significant inverse relationship, with a 1% increase reducing maternal mortality by 0.398% to 0.442%. Additionally, undernourishment is positively associated with maternal mortality, where a 1% increase corresponds to a 0.095% to 0.192% rise in deaths. These findings underscore the need for targeted interventions in nutrition and economic policies to improve maternal health outcomes in West Africa. The R^2 values indicate that 89% to 93% of the variation in maternal mortality is explained by these factors.

	PFMOLS				PDOLS			
	Coeff.	t-Stat.	ρ	R ²	Coeff.	t-Stat.	ρ	R ²
ECDF	0.333***	2.184	0.029	0.89	0.323***	2.985	0.000	0.93
EPO	0.527	2.372	0.018		0.824	2.088	0.042	
GHE	-0.004	-0.044	0.965		-0.055	-0.309	0.758	
РКҮ	-0.442***	-7.915	0.000		-0.398***	-4.425	0.000	
PUN	0.087	1.224	0.222		0.198	1.871	0.064	

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Source: Researcher (2024)

Effects of Economic Discomfort and Environmental Air Pollution on Child Mortality

Table 7 provides a regression analysis of the impact of economic discomfort and environmental air pollution on child mortality in West Africa, utilizing Panel Fully Modified OLS (PFMOLS) and Panel Dynamic Ordinary Least Squares (PDOLS). The results reveal a positive correlation between economic discomfort and child mortality, where a 1% increase in discomfort is linked to a rise of 0.076% to 0.314% in child mortality rates (p < 0.05). This indicates that high inflation and unemployment limit access to nutritious food, negatively affecting child health. Environmental air pollution, measured by PM2.5 levels, shows a significant positive effect; a 1% increase in PM2.5 corresponds to a 0.579% to 1.214% rise in child mortality, highlighting its detrimental impact on respiratory health and development. Government health expenditure inversely relates to child mortality, with a 1% increase leading to a reduction of 0.048% to 0.086%, though its lack of statistical significance indicates potential inefficiencies in spending. Conversely, per capita income and immunization coverage both show significant inverse relationships with child mortality, where a 1% increase in income correlates with a reduction of 0.465% to 0.565%, and improved immunization access decreases mortality by 0.286% to 0.294%. The R² values suggest that 78% to 89% of the variation in child mortality is explained by these variables.

Table 7: Effects of Economic Discomfort and Environmental Air Pollution on Child Mortality (Group Specific)

	PFMOLS	-			PDOLS	_		
	Coeff.	t-Stat.	ρ	R ²	Coeff.	t-Stat.	ρ	R ²
ECDF	0.314***	2.487	0.013	0.78	0.076	2.985	0.000	0.89

~		1 (2024)					
	IMU	-0.294***	-2.495	0.013	-0.286	-2.703	0.004
	РКҮ	-0.565***	-11.158	0.000	-0.465***	-4.425	0.000
	GHE	-0.086	-1.104	0.270	-0.048	-0.309	0.758
	EPO	0.579***	3.140	0.002	1.214***	2.088	0.042

Effects of Economic Discomfort and Environmental Air Pollution on Maternal Mortality in West Africa

Table 8 analyzes the impact of economic discomfort and environmental air pollution on maternal mortality across West African countries. Findings reveal a positive relationship between economic discomfort and maternal mortality. Cape Verde is most affected, with a 1% increase in discomfort leading to a 1.421% rise in maternal mortality, followed by Mauritania (0.951%) and Nigeria (0.514%). Environmental air pollution also has a consistent positive impact, with Niger experiencing the highest effect (1.627%). Countries like Mali and Liberia show lower susceptibility, potentially due to better healthcare systems and environmental practices, highlighting the need for targeted interventions to improve maternal health.

Country	ECDF	EPO
Benin	0.321***	0.117***
	(0.042)	(0.003)
Burkina Faso	0.204	0.778
	(0.536)	(0.304)
Cape Verde	1.421	0.217
	(0.117)	(0.652)
Cote d' Ivoire	0.489***	0.132
	(0.000)	(0.272)
The Gambia	0.218***	0.358***
	(0.035)	(0.016)
Ghana	0.261***	0.336
	(0.014)	(0.259)
Guinea	0.577	0.073
	(0.813)	(0.859)
Guinea Bissau	0.213***	0.627***
	(0.038)	(0.008)
Liberia	0.078***	0.001
	(0.037)	(0.995)
Mali	0.011	0.371
	(0.935)	(0.393)
Mauritania	0.951***	0.708***
	(0.005)	(0.049)

Table 8: Effects of Economic Discomfort and Environmental	Air Pollution on	Maternal Mortality i	n West
Africa		·	

Niger	0.356***	1.627***
	(0.045)	(0.027)
Nigeria	0.514***	0.340***
	(0.001)	(0.009)
Senegal	0.131	0.525
	(0.661)	(0.254)
Sierra Leone	0.120	0.453
	(0.860)	(0.677)
Togo	0.095	0.859***
	(0.350)	(0.000)

Source: Researcher, 2024. Note: *** denotes significance at 5% level.

Response of Maternal Mortality to Counterfactual Shock on Economic Discomfort

Figures 1a and 1b illustrate the simulated response of maternal mortality to counterfactual shocks in economic discomfort. Figure 4.1a shows that a positive shock, indicating increased unemployment and inflation, leads to a significant rise in maternal mortality, stabilizing at around 1a in the long run. This highlights the adverse effects of economic distress on maternal health due to reduced access to healthcare and nutrition. Conversely, Figure 1b demonstrates that negative shock results in maternal mortality decreasing to approximately 1.7, indicating that improved economic conditions positively affect maternal health through better access to services and living standards.



Figures 1a and 1b illustrate the anticipated effects of a positive and negative shock to economic discomfort on maternal mortality at t = 5. In these figures, the dark spots denote the predicted mean values, while the blue lines, ranging from darker to lighter shades, represent the 75%, 90%, and 95% confidence intervals, respectively. Response of Maternal Mortality to Counterfactual Shock in Environmental Air Pollution

Figures 2a and 2b show that a positive shock to environmental air pollution causes maternal mortality to spike in the short term, stabilizing at around 1.8 long-term. Conversely, a negative shock leads to a decline in mortality to approximately 1.5, highlighting the benefits of pollution reduction for maternal health.



Figures 2a and 2b illustrate the anticipated effects of a positive and negative shock to environmental air pollution on maternal mortality at t = 5. In these figures, the dark spots denote the predicted mean values, while the blue lines, ranging from darker to lighter shades, represent the 75%, 90%, and 95% confidence intervals, respectively

Predicted Response of Child Mortality to Counterfactual Shock in Economic Discomfort

Figures 3a and 3b illustrate that a positive shock to economic discomfort, marked by rising unemployment and inflation, increases child mortality to approximately 4.5 long-term. Conversely, a negative shock reduces mortality to around 2.0, emphasizing the benefits of alleviating economic distress for child health outcomes.



Figures 3a and 3b illustrate the anticipated effects of a positive and negative shock to economic discomfort at t = 5 on child mortality. In these figures, the dark spots denote the predicted mean values, while the blue lines, ranging from darker to lighter shades, represent the 75%, 90%, and 95% confidence intervals, respectively.

Predicted Response of Child Mortality to Counterfactual Shock in Environmental Air Pollution

Figures 4a and 4b reveal that a positive shock to environmental air pollution causes child mortality to rise, stabilizing at around 1.9. Conversely, a negative shock leads to a decrease to approximately 1.6, highlighting the benefits of pollution reduction for improving child health outcomes.

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Figures 4a and 4b display the forecasted effects of a positive and negative shock to environmental air pollution at t = 5 on child mortality. The dark spots represent the predicted mean values, while the blue lines, varying from dark to lightest, signify the 75%, 90%, and 95% confidence intervals, respectively.

Post Estimation Test: Test for Multicollinearity

To assess multicollinearity, the Variance Inflation Factor (VIF) was used. A VIF of 1 indicates no multicollinearity, while values above 5 or 10 suggest issues. Table 9 shows that all coefficients are less than 1, indicating no significant multicollinearity among the predictor variables.

		Coefficient	Uncentered	
	Variable	Variance	VIF	
MMR	ECDF	0.091	1.284	
	EPO	0.156	1.048	
	GHE	0.031	1.122	
	РКҮ	0.008	1.522	
	PUN	0.021	1.487	
IFR	ECDF	0.055	1.345	
	EPO	0.097	1.005	
	GHE	0.021	1.035	
	РКҮ	0.007	1.553	
	IMU	0.038	1.245	

Table 10: Variance Inflation Factor

Source: Researcher, 2024

Test for Normality

To verify parametric test assumptions and detect outliers, normality tests were conducted using the Jarque-Bera test. Figures 4.5 and 4.6 present the results. The significant test statistic (p < 0.05) indicates non-normally distributed residuals, although panel data models are more resilient to normality violations with large samples.



Fig. 5 & 6: Test for Normality with Respect to Maternal Mortality Rate

Policy Implications

This study's findings have significant implications for enhancing maternal and child health in West Africa. Strengthening healthcare systems through infrastructure investment and improving access to maternal and child services, especially in underserved areas, is crucial. Community-based initiatives can facilitate prenatal and neonatal care, thereby reducing mortality rates. Promoting immunization programs is vital for preventing childhood diseases, requiring equitable vaccine access and community education. Addressing undernutrition among women of reproductive age through access to nutritious food and micronutrient supplementation is essential to improve birth outcomes. Mitigating environmental air pollution is also critical. Policymakers should implement stringent regulations and invest in cleaner energy to protect children's health, particularly in countries like Niger and Nigeria, where pollution significantly impacts child mortality. Additionally, tackling economic discomfort through poverty reduction and social safety nets is necessary for improving child health outcomes. Tailored interventions can address specific challenges in each country, fostering multisectoral collaboration to enhance overall well-being in the region.

Conclusion and Recommendations

This study examines the complex interactions between economic discomfort, environmental air pollution, and maternal and child health in West Africa. Findings reveal a significant correlation between economic instability, pollution, and increased maternal and infant mortality rates, highlighting urgent challenges in the region. However, government health expenditure shows promise in mitigating these impacts, emphasizing the need for improved healthcare infrastructure. The protective role of immunization against infant mortality and the negative effects of undernourishment on maternal health further illustrate the multifaceted determinants affecting health outcomes.

To address these challenges, the following recommendations are proposed:

- 1. **Invest in Healthcare Infrastructure:** Prioritize improvements in facilities, equipment, and personnel, especially in underserved areas.
- 2. Enhance Prenatal and Neonatal Care: Implement community-based programs to reach marginalized populations.
- 3. Increase Immunization Coverage: Develop comprehensive vaccination programs to reduce infant mortality rates.
- 4. Tackle Undernutrition: Promote access to nutritious food and micronutrient supplementation for women.

- 5. Mitigate Environmental Pollution: Enforce policies to improve air quality and access to clean water.
- 6. **Strengthen Social Support Systems:** Expand welfare programs and community networks for vulnerable families.
- 7. **Implement Health Education Programs:** Empower communities with knowledge on maternal and child health.
- 8. Encourage Multisectoral Collaboration: Foster partnerships among government, NGOs, and communities to enhance health outcomes.

BRIEF BIOGRAPHY

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Real Earnings Management and Firm Performance: Moderating Role of Audit Quality

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Abstract

Purpose – The study's purpose is to examine the effect of real earnings management (REM) on firm performance (FP). Furthermore, the study investigates the moderating role of audit quality (AQ), which is represented by audit firm size (AFSIZE), on this relationship in Saudi Arabia. **Design/methodology/approach** – The study used a quantitative method to examine the effect of REM on FP and the moderating effect of AQ on this relationship in 140 Saudi non-financial firms from 2011 to 2020. Panel data analysis with fixed-effect models was utilized to estimate the findings. **Findings** – The findings concluded a significant and positive effect of REM on FP. The findings also exhibited that AQ moderates the relationship between REM and FP, where AQ modified the positive effect of REM on FP from a significant positive effect to a significant negative effect.

Research Limitations/ Implications – The study has several implications for corroborating the literature and the theoretical explanation of the relationship between REM, FP, and AQ in the Saudi context.

Practical Implications – This study provides several practical implications for regulators, auditors, firms, shareholders, investors, and other stakeholders.

Originality/value – The study's unique contributions to the literature include exploring the AQ as a moderating role that can significantly affect the relationship between REM and FP to decrease the opportunistic behaviors of managers, which leads to higher FP in the future. Moreover, this empirical study was conducted in the Saudi context. **Keywords:** Firm Performance, Real Earning Management, Big 4, Saudi Exchange.

Introduction

The management's goal is to develop and improve firm performance (FP) while also serving the interests of shareholders, which is accomplished through managing the firm's resources in the most efficient manner (Al-Shattarat, 2017). As a result, FP reflects the performance of its management in numerous aspects, such as earnings management (EM), debt repayment, selecting the proper financing structure, and confronting the dangers to which the firm is exposed (Boachie & Mensah, 2022). EM expresses the opportunistic behavior carried out by

the management to achieve its personal goals or to improve the company's image in front of stakeholders in light of compliance with accounting standards and not deviating from them (Jelinek, 2007; Rusmin, 2010). The management uses the freedom available to it to choose between accounting policies for achieving its personal goals and misleading the users of the financial statements (Dang et al., 2020).

Many studies have discussed the negative effects resulting from the practice of EM (Kahloul et al., 2023; Khuong et al., 2019; Kumar et al., 2021; Osma et al., 2022), and among these effects are, for example, the weakening in the FP and the deception of the market in general about the real earnings of the firm, and thus the exposure of investors and other related parties to poor awareness of the size of future risks to which the firm may be exposed (Lim & Mali, 2023; Rahman & Xiong, 2021). Real Earnings Management (REM) expresses the practices and decisions that firms follow to manage their earnings through actual activities, with the aim of delivering a picture to stakeholders that the firm has achieved the objectives of the financial report through the real activities of the firm (Xu et al., 2007). Despite the presence of numerous literature reviews that addressed the FP from the standpoint of EM, the findings of these studies were inconsistent with one another and largely inconclusive in explaining the nature of this contentious relationship (Al-Shattarat, 2017; Birjandi et al., 2015; Khuong et al., 2019; Kumar et al., 2021).

Following the worsening of many cases of bankruptcy of major companies in a number of East Asian countries in 1997, as well as some financial collapses of a number of American companies in 2001 and 2002, and finally the global financial crisis in 2008, which highlighted failures in audit quality (AQ), this negatively affected traders' confidence in the financial market (Nawaiseh, 2016) and the loss of stakeholders' confidence. There have been increasing calls from professionals and academics for greater enhancement and monitoring of AQ to increase user confidence in published financial reports and enhance FP (Rompotis & Balios, 2023; Sattar et al., 2020). Accordingly, many questions were raised about the importance of AQ and the extent of its impact on restricting the opportunistic

behavior of managers and improving FP (Angsoyiri, 2021; Ching et al., 2015). Furthermore, audit firm size (AFSIZE) has a significant impact on AQ, making it a crucial mechanism for improved performance (Khan et al., 2021; Ugwu et al., 2020). Therefore, the study suggests promoting mechanisms to assist in implementing the tasks of supervising and monitoring functions through AQ, which could play a moderating role in the hows and whys of the relationship between REM and FP.

Based on extrapolating the accounting literature that focused on studying the relationship between AQ, EM, and FP (Birjandi et al., 2015; Boachie & Mensah, 2022; Ching et al., 2015),

the study notes that most firms that select Big 4 audit firms have no more EM practices when issuing their financial statements (Debnath et al., 2022; Kalbasi & Lashgari, 2020; Umar et al., 2021). This has a favorable impact on restricting EM, lowering agency issues, and improving the FP (Ching et al., 2015; Debnath et al., 2022; Rusmin, 2010).

The research gap is that, while literature reviews have made significant progress in the study and analysis of REM practices and their influence on FP in the foreign environment (Ding et al., 2018; Khuong et al., 2019; Lim & Mali, 2023; Xu et al., 2007), there are still some research gaps in this field that can be studied in the Saudi context, specifically the moderating effect of AQ on the relationship between REM and FP in light of the growing international interest in the study and evaluation of AFSIZE over the last two decades.

Accordingly, this study is motivated by four major factors: Firstly, EM studies, as well as FP, remain significant and have become a source of concern for regulators and policymakers (Ding et al., 2018; Kouaib & Lacombe, 2023). As a result, it is necessary to investigate how EM affects FP for investor protection. Therefore, this study provides an extension of previous studies in an attempt to deepen the literature and reduce discrepancies. Secondly, the empirical literature is inconclusive on the effects of EM on FP; they differ across firms, sectors, and nations (Dakhlallh et al., 2020; Hessian, 2019; Kahloul et al., 2023; Kumar et al., 2021; Osma et al., 2022; Rahman & Xiong, 2021; Wenfang & Ayisi, 2020). Further clarification in the Saudi context of these relationships is thus necessary. Similarly, the empirical literature on the effects of AQ is inconclusive (Chowdhury & Eliwa, 2021; Dakhli, 2022; Monametsi & Agasha, 2020; Shahwan, 2021). Thirdly, various studies have been conducted in developed economies to assess the influence of accrual EM, or REM, on FP (Khuong et al., 2019; Lim & Mali, 2023; Xu et al., 2007). However, the results of such research from developed countries may not be applicable to developing countries (Dakhlallh et al., 2020; Rahman & Xiong, 2021). The available evidence and literature do not fully address this subject in emerging economies, in this case, the Kingdom of Saudi Arabia (KSA). It is contended that in developing countries that have different cultural, regulatory, and institutional contexts, it can be expected to differ from that found in developed countries (Kouaib & Lacombe, 2023; Nawaiseh, 2016). Therefore, the current study is unique and different from prior studies.

The current study attempts to answer the main research question: Does the AQ moderate the relationship between REM and FP? Hence, the study's purpose is to examine the effects of REM on FP and the moderating effect of AQ on this relationship in the KSA. The analysis is based on a balanced database of 1400 observations and runs from 2011 to 2020. The findings reveal that abnormal operating activities in each of the sales activities, production, and optional

expenses have a significant positive effect on return on assets and return on equity. The results also exhibit that the AQ moderates and modifies the relationship between REM and FP from a significant positive effect to a significant negative effect.

Consequently, the current study seeks to make the following contributions to the existing literature: first, the theoretical contribution materializes through the amalgamation of individual relationships into a comprehensive model that demonstrates the abnormal operating activities in each of the sales activities, production, and optional expenses as an independent variable and examines their effect on FP. Second, the study results support the foundations of agency and signaling theories. The study contributes to the theoretical understanding and adds to the current literature on REM, FP, and AQ, thus advancing the literature review in this field while also giving practical evidence about the nature of this relationship in the KSA. Third, the study is significant because the critical role that AQ plays in a firm's monitoring deserves in-depth research on the various factors that relate REM to FP. The study gives new evidence of the consequences of AQ in diminishing manager opportunistic behaviors. Finally, the study provides regulators, auditors, firms, shareholders, investors, and other stakeholders with practical contributions. For regulators can also develop regulations and guidelines that encourage firms to enhance FP in non-financial firms. Regulators can also develop regulations and guidelines that encourage firms to enhance AQ. Auditors should pay attention to the EM when assessing the FP. Auditors can also provide feedback and recommendations to firms on how to restrict EM to enhance FP. Firms can evaluate their AQ and make the necessary changes to enhance their performance. Finally, stakeholders can focus on the AQ to restrict EM and enhance FP.

The remainder of this paper is organized as follows: Section 2 provides a detailed discussion concerning the literature review and hypotheses development. Section 3 presents the study's research design and methodology. Section 4 discusses the empirical results, and Section 5 concludes the study.

Literature Review and Hypotheses Development

The research relied on agency and signaling theories. These theories were selected due to their frequent use in FP studies and their ability to enhance comprehension of EM impacts (Aqabna et al., 2023; Mahrani & Soewarno, 2018). Several empirical studies have based their research models on agency theory to study the association between EM and FP (Birjandi et al., 2015; Boshnak et al., 2023; Khuong et al., 2019). Thus, agency theory is an important foundation for this study because it helps explain the relationship between EM and FP and also argues for the moderating role of AQ as a mechanism for improving FP. Furthermore, agency theory argues that the AQ is a vital mechanism that effectively monitors management, safeguards the interests of shareholders, minimizes agency costs, and enhances FP (Ching et al., 2015; Fama & Jensen, 1983; Harvey Pamburai et al., 2015). The AQ empowers shareholders to closely observe and regulate the actions of managers, thereby discouraging any opportunistic behavior, thus restricting EM and improving FP (Alzoubi, 2016; Lim & Mali, 2023). Additionally, the AQ facilitates the provision of accurate and reliable financial information while also reducing information asymmetry (Wang et al., 2020).

On the other hand, signaling theory contends that well-performing firms can distinguish themselves from poorly performing firms by giving a trustworthy signal about their performance to stock markets (Braga-Alves & Shastri, 2011). If badly performing firms are unable to imitate well-performing firms in delivering the same signaling, this signaling is believable to the public (Downes & Heinkel, 1982). This occurs when the cost of signaling is high for poorly performing firms, and as a result, these firms avoid imitating well-performing firms, resulting in a credible signal. According to signaling theory, managers may make critical decisions as a signal to shareholders and a tool to persuade investors, such as selecting Big 4 audit firms (Alves & Carmo, 2022; Sitanggang et al., 2020). According to signaling theory, actions taken by a company's management offer investors signals about the management's vision of the company's future (Mavlanova et al., 2012). As a result, management's financial decisions must not only be correct but also try to persuade the market that they are excellent decisions and in the best interests of the company and thus of investors (Elmashtawy et al., 2023c; Taj, 2016). As a result of the foregoing, it is clear that signaling theory not only works to analyze a company's financial decisions, but it also allows for the study of induction systems that push or encourage good corporate management to provide the right signals while discouraging other companies to use the same signals.

Studies related to REM and FP

REM has been described "as departures from normal operational practices, motivated by managers' desire to mislead at least some stakeholders into believing that certain financial reporting goals have been met in the normal course of operations" (Roychowdhury, 2006). Roychowdhury (2006) found evidence that managers manipulate earnings through REM to avoid reporting annual losses by reducing prices through discounts to temporarily increase sales. Also, increase production to reduce the cost of production per unit sold, and reduce optional expenses to improve profits (Al-Shattarat, 2017). REM, according to Zang (2012), is

"a deliberate action to alter reported earnings in a particular direction, achieved by changing the timing or structuring of an operation, investment, or financing transaction, and which has suboptimal business consequences." According to these definitions, REM is employed opportunistically by corporate management for their own personal gain rather than for the benefit of the company's owners (Dakhlallh et al., 2020; Osma et al., 2022).

Given the limited regulatory scrutiny, managers revert to REM actions to protect their firm position and reputation, making earnings more predictable and demonstrating their opportunistic behavior (Chen et al., 2011). Managers may manipulate financial statements by exaggerating current period earnings on the income statement, artificially inflating sales and gains, or artificially deflating current period expenses, which present a more accurate picture of the firm's ability to achieve stated expectations (Rahman & Xiong, 2021). Furthermore, some specific ways to manipulate financial statements include prematurely recording revenue (Hamza & Kortas, 2019), fictitious revenue (Jelinek, 2007), increasing income with one-time gains (Koh, 2007), shifting current expenses to an earlier or later period (Rusmin, 2010), failing to record or improperly reducing liabilities (Xu et al., 2007), shifting current revenue to a later period, and shifting future expenses to the current period as a special charge (Vakilifard & Mortazavi, 2016; Xu et al., 2007).

Prior literature argues that REM has its associated benefits and costs (Chen et al., 2011; Xu et al., 2007). The cost of REM is that it has a significant negative effect on a firm's future performance (Jayeola et al., 2017). Mahrani and Soewarno (2018) revealed evidence that firms engaged in REM through abnormal production costs face lower financial performance in subsequent years. The benefit of REM is that it is hard to detect (Sitanggang et al., 2020). In addition, efficient EM enhances the FP, and thus, there is a positive relationship between REM and FP (Ding et al., 2018; Xu et al., 2007). Furthermore, managers use the flexibility of accounting decisions and conservative accounting policies to boost profitability and impact future cash flow (Wenfang & Ayisi, 2020).

Previous literature has shown that managers make decisions based on their managerial discretion and private information, which might improve FP (Hessian, 2019; Kouaib & Lacombe, 2023; Mahrani & Soewarno, 2018). However, accounting flexibility in financial reporting standards might increase managers' opportunistic behavior by distorting reported earnings, which also raises the misalignment of incentives between managers and shareholders (Awuye, 2022). Companies that practice REM achieve low cash flows from operating activities from sales and therefore seek to provide different types of discounts to achieve targeted sales (Vakilifard & Mortazavi, 2016). These companies also have a low level of optional expenses

as they reduce and postpone decision-making, which leads to an increase in optional expenses (Al-Shattarat, 2017). Mahrani and Soewarno (2018) demonstrate that when there is information asymmetry, managers engage in REM activities to deceive the market and increase FP. Opportunistic REM, on the other hand, reduces future FP (Jayeola et al., 2017). Thus, there is a negative relationship between REM and FP because managers only use their discretion to maximize their utility, resulting in misalignment of incentives between managers and shareholders, FP deterioration or incorrect assessment of the firm, and distortion in reported earnings (Roychowdhury, 2006). Therefore, this implies that REM activities can be considered a detrimental financial tool to the market in the long term because when managers have access to private information, they may manipulate accounting figures in the current period, which affects the financial results in the next period (Khuong et al., 2019; Xu et al., 2007).

Several empirical studies on REM have been based on developed countries (e.g., Awuye, 2022; Chowdhury & Eliwa, 2021; Ding et al., 2018; Lim & Mali, 2023). Recently, there has been a growing body of empirical literature on REM in developing countries. For example, Dakhlallh et al. (2020) provide evidence that the companies managed earnings to avoid losses and earnings decreases rather than to avoid negative earnings surprises. In Saudi Arabia, Al-Moghaiwli (2010) shows evidence of deliberate EM behavior on the part of Saudi managers. The study concluded that managers of major Saudi-listed companies with a high proportion of foreign employees to total employees seek to manage earnings through discretionary accruals to avoid potential political risks.

Several studies (Elmashtawy et al., 2023c; Khuong et al., 2019; Kumar et al., 2021; Lim & Mali, 2023; Rahman & Xiong, 2021) have concluded that REM practices have a negative effect on financial indicators related to the FP, reflecting the firms' inadequate financial situation. As one of the most prominent financial hazards facing firms and affecting the FP, REM has a statistically significant effect on the risks of deteriorating operating cash flows in financial reports (Osma et al., 2022; Xu et al., 2007). Implicitly, the negative effect of REM practices on the FP appears in the light of the studies (Ching et al., 2015; Jayeola et al., 2017; Rusmin, 2010), which indicated the extent of the role of AFSIZE in reducing REM.

The studies (Dakhlallh et al., 2020; Hessian, 2019; Wenfang & Ayisi, 2020) also revealed a negative association between REM practices and ROA and ROE, and the studies indicated that restricting REM enhances the firm's ability to borrow and limits opportunistic behavior to manage the earnings of these firms, which positively affects the improvement of the FP. Kusuma and Athori (2023) examined the association between REM and FP in the emerging

market. The study concluded that REM has a positive but not significant effect on agency costs and that agency costs have a positive and significant effect on the FP, while REM has a negative and insignificant effect on the FP. Ding et al. (2018) concluded that REM through sales or optional expenses does not have an influence on the FP. According to the previous discussions, the following hypothesis has been formulated:

H1: REM has a significant and negative effect on FP.

Studies related to REM, FP, and AQ

AQ is one of the governance mechanisms that limit managers' ability to manipulate financial performance assessments by reducing information asymmetry, thereby enhancing the FP (Dakhli, 2022). The AQ aims to increase the financial statements' credibility by reducing the asymmetry of information and increasing capital market confidence (Khan et al., 2021). Furthermore, Rompotis and Balios (2023) stated that the AQ affects the firm's market

value and thus increases stock returns, which is a positive indicator for investors. At the same time, the AQ affects borrowing costs, which increases the company's access to external financing on better terms (Angsoyiri, 2021). Sattar et al. (2020) also emphasized the significance of the AQ's positive influence on FP. AQ affects FP through a variety of channels, the most important of which are reduced EM practices, reduced indebtedness contracts, reduced bankruptcy risks, and increased stock returns (Debnath et al., 2022; Rompotis & Balios, 2023; Umar et al., 2021). As a result, it is clear that there are indicators that show the positive effects of AQ on improving FP, due to its tangible impact in ensuring reasonable assurance about the quality of the financial report, on which different stakeholders rely when making investment decisions associated with the company.

According to agency theory, the separation of ownership and control in corporations creates problems in agencies because managers may act in their own interests rather than in the interests of shareholders (Nawaiseh, 2016). Agency theory has identified that the external auditor is an important mechanism for auditing management, protects the shareholders' interests, and reduces the agency's cost, which leads to improved FP (Birjandi et al., 2015; Elmashtawy et al., 2023c; Fama & Jensen, 1983). The selection of Big 4 audit firms is supported by agency theory, which suggests that Big 4 has more resources and expertise to maintain a high level of conservatism and improve FP (Monametsi & Agasha, 2020). This encourages firms to select Big 4 audit firms to offer investors certainty about the fair and correct presentation of information in financial reports as well as assurance from a publicly trusted audit firm (Chen et al., 2011; Elmashtawy et al., 2023b).

In contrast, signaling theory suggests that managers may make critical decisions as a signal to shareholders as well as a tool to persuade investors that a company is of high performance, such as selecting the Big 4 audit firms (Alves & Carmo, 2022). According to signaling theory, companies may use various signals to communicate their performance quality to external stakeholders, which may indicate that the company is committed to issuing high-quality financial statements (Elmashtawy et al., 2023a; Shoorvarzy & Zeraatkar, 2021). Furthermore, the signaling effect contends that directors transfer additional information about their company and their own market conduct, which influences auditor selection and the demand for high- quality audits (Ugwu et al., 2020). According to the signaling theory, firms are probably going to require high-quality audits to reassure investors and signal the quality of their financial reports (Elmashtawy et al., 2023c; Rompotis & Balios, 2023). As a result, FP varies according to the size of the auditing firm.

Several previous research findings concluded a positive relationship between the presence of Big 4 audit firms and FP (Angsoyiri, 2021; Ching et al., 2015; Dakhli, 2022; Rompotis & Balios, 2023; Sattar et al., 2020; Ugwu et al., 2020). Similarly, the studies (Birjandi et al., 2015; Debnath et al., 2022; Jayeola et al., 2017; Kalbasi & Lashgari, 2020; Nawaiseh, 2016; Rusmin, 2010; Umar et al., 2021) have indicated that selecting Big 4 audit firms is favorably connected to restriction EM. Empirical studies concluded that the association between REM and the FP is affected by whether the company's auditor is one of the Big 4, the presence of foreign investors on the company's board of directors, the application of international financial reporting standards, and corporate governance (Birjandi et al., 2015; Boachie & Mensah, 2022; Ching et al., 2015; Nawaiseh, 2016; Rusmin, 2010). Hamza and Kortas (2019) concluded that companies in developing countries are not properly scrutinized by regulators and therefore follow different types of EM. Vakilifard and Mortazavi (2016) concluded that the financial leverage, the firm size, the institutional ownership, and the AFSIZE are considered the most important characteristics of the company, which contribute to limiting the practices of REM. The study also revealed that there is a negative correlation between REM and FP.

It is supposed that there is an association between REM and FP (Ding et al., 2018; Kumar et al., 2021; Lim & Mali, 2023; Xu et al., 2007), and this association is affected by AFSIZE (Birjandi et al., 2015; Ching et al., 2015; Elmashtawy et al., 2023c; Mahrani & Soewarno, 2018; Rusmin, 2010). Previous literature agreed that most firms that select Big 4 have lower REM practices (Alzoubi, 2016; Debnath et al., 2022; Nawaiseh, 2016), which contributes to the enhanced reliability of financial statements, better predictability of risks of financial hardship and bankruptcy, better level of creditworthiness, and improving FP compared to firms that hire

non-Big 4 audit firms (Boachie & Mensah, 2022; Kalbasi & Lashgari, 2020; Rompotis & Balios, 2023; Rusmin, 2010; Ugwu et al., 2020). Some studies, however, show the opposite results (Monametsi & Agasha, 2020; Shoorvarzy & Zeraatkar, 2021; Sitanggang et al., 2020), which found no evidence that selecting the Big 4 has an impact on FP and REM. Based on the preceding discussion, the study suggests that the Big 4 audit firms are more likely to enhance FP based on differences in capabilities, experience, reputational concerns, level of diligence, and intensity of monitoring. Hence, the following hypothesis has been proposed:

H2: The AQ moderates the relationship between REM and FP.

Methodology

1.1 Data and sample

The paper focuses on the listed non-financial companies in KSA during the period from 2011 to 2020. The final sample contained 140 firms listed on the Suadi Exchange, distributed to 18 sectors, which provides an appropriate representation of all sectors of the economy. Furthermore, the sample yielded 1400 yearly observations after applying the following criteria: Firstly, firms must have been listed on the Suadi exchange from 2011 to 2020. Secondly, firms' financial reporting must have been available during this period. Thirdly, firms' financial statements must have been issued on December 31 to meet consistency in the fiscal year. Fourthly, all financial statements must have been published in the Suadi Ryal. Fifthly, banks and financial services firms were excluded due to the uniqueness of their activities. Table 1 provides a summary of the sample selection.

Table 1 Sample Selction

No.	Sectors	Companies	Ob	servations
			No.	%
1	Energy	5	50	3.6
2	Basic resources	42	420	30
3	Capital goods	12	120	8.6
4	Business and professional services	3	30	2.1
5	Transport	5	50	3.6
6	Long-term commodities	6	60	4.4
7	Consumer services	10	100	7.2
8	Media and entertainment	2	20	1.4
9	Retailing of luxury goods	8	80	5.7
10	Food segmentation	4	40	2.8
11	Food production	12	120	8.6
12	Health care	7	70	5
13	Pharmaceutical	1	10	0.7
14	Investment and financing	4	40	2.8
15	Telecommunications	4	40	2.8
16	Public utility	2	20	1.4
17	Real estate management and development	11	110	7.9
18	Applications and technology services	2	20	1.4
Total		140	1400	100%

Moreover, the study relied on secondary data to collect sample data. Financial and accounting data were collected manually from published annual reports and supplementary clarifications of the sample companies published on their official websites, as well as some related websites such as the Saudi Arabia stock exchange (Tadawul) website http://www.tadawul.com.sa. The study uses ordinary least squares panel data regression models with fixed effects to investigate the relationship between REM, AQ, and FP in Saudi non-financial firms.

Variables definition

Firm Performance (FP)

The dependent variable is firm performance (FP). The study used return on assets (ROA) and return on equity (ROE) as proxies of FP. ROA and ROE represent the firm's accounting-based performance measures (Angsoyiri, 2021; Dakhli, 2022; Kahloul et al., 2023; Khan et al., 2021; Sattar et al., 2020; Shoorvarzy & Zeraatkar, 2021; Ugwu et al.,

2020).

Audit Quality (AQ)

The moderating variable is audit quality (AQ). The study measures AQ using audit firm size (AFSIZE), which is one of the most commonly used measures in analogy with some previous studies (Awuye, 2022; Chowdhury & Eliwa, 2021; Dakhli, 2022; Rompotis & Balios, 2023; Shahwan, 2021; Ugwu et al., 2020).

Real Earnings Management (REM)

The independent variable is real earnings management (REM). The majority of previous studies relied on the model presented by Roychowdhury (2006) to measure REM practices, with some studies making modifications to the model based on the availability of data in the applied study environment, with the most important of these studies (Al-Shattarat, 2017; Hamza & Kortas, 2019; Kahloul et al., 2023; Vakilifard & Mortazavi, 2016; Xu et al., 2007). REM can be determined on this basis by estimating the values of abnormal operating activities in each of the sales activities, production, and optional expenses as follows:

- Measure normal operating activities, which are net operating cash flows, production costs, and optional expenses, through the following models:

CFOit/Ait-1= α it+B1 (1/Ait-1)+B2 (Sit/Ait-1)+B3 (Δ Sit/Ait-1)+Eit

PROit/Ait-1= α it+B1 (1/Ait-1)+B2 (Sit/Ait-1)+B3 (Δ Sit/Ait-1)+B4 (Δ Sit-1/Ait-1)+Eit DISEXPit/Ait-1= α it+B1 (1/Ait-1) +B2 (Sit/Ait-1) +Eit

Whereas:

CFOit: Net cash flows from the operating activities of the company (i) in period (t). Ait-1: The total assets of the company (i) in the period (t). Sit: Total sales of the firm (i) in period (t).

 Δ Sit: The change in total sales of the firm (i) in the period (t).

PROit: The total cost of production for the company (i) in period (t), which is the total cost of goods sold and the change in inventory.

DISEXPit: The total optional expenses of the company (i) in period (t), represented in the total administrative and general costs, advertising costs, selling and distribution costs, and research and development costs. B1, B2, B3, and B4: coefficients of regression models

Eit: the estimated error

- Estimating the extraordinary operating activities that reflect the REM practices using the regression model coefficients (B1, B2, and B3) expected and extracted from the previous models, through the difference between the actual operating activities extracted from the financial statements and the normal operating activities at the company level, through the following forms:

Yit1/Ait-1= CFOit/Ait-1-(B1 (1/Ait-1)+B2 (Sit/Ait-1)+B3 (Δ Sit/Ait-1)) Yit2/Ait-1= PROit/Ait-1-(B1 (1/Ait-1)+B2 (Sit/Ati-1)+B3 (Δ Sit/Ait-1)) Yit3/Ait-1=

DISEXPit/Ait-1-(B1 (1/Ait-1) +B2 (Sit/Ait-1))

Whereas:

Yit1: It is the management of profits by sales of the company (i) during the period (t).

Yit2: It is the management of profits by production for the company (i) during the period (t). Yit3: to manage the profits with the optional expenses of the company (i) during the period (t).

- Estimating REM through total EM with sales, production, and optional expenses: Yit= Yit1+Yit2+Yit3

Control Variable

The control variables are firm size (LSIZE), leverage (LEV), and liquidity (LIQ). Table 2 summarizes the definition and measurement of dependent, moderating, independent, and control variables, along with evidence from prior studies that used the same measures.

Variable	Acronym	Measurement	Source
Dependent varial	ole		
Firm Performance (FP)	ROA	The net income to total assets ratio	(Dakhli, 2022; Khan et al., 2021; Monametsi & Agasha, 2020; Ugwu et al., 2020)
	ROE	The net income divided by shareholders' equity ratio	(Angsoyiri, 2021; Birjandi et al., 2015; Dakhli, 2022; Kahloul et al., 2023)
Moderating varia	ble	· • • •	·
Audit Quality	AFSIZE	A dummy variable, which takes a value of 1 when the audit firm belongs to the Big 4, or zero otherwise	(Awuye, 2022; Chowdhury & Eliwa, 2021; Dakhli, 2022; Rompotis & Balios, 2023; Shahwan, 2021; Ugwu et al., 2020)
Independent vari	able	·	
Real Earnings Management	REM	Estimating the values of abnormal operating activities in each of the sales activities, production, and optional expenses	(Boachie & Mensah, 2022; Hamza & Kortas, 2019; Kahloul et al., 2023; Roychowdhury, 2006; Vakilifard & Mortazavi, 2016; Xu et al., 2007)
Control variables	;	· •	
Firm size	LSIZE	Total assets, natural logarithm at the end of the year	(Antounian et al., 2021; Boachie & Mensah, 2022; Elmashtawy & Salaheldeen, 2022; Osma et al., 2022)
Leverage	LEV	Total liabilities to total assets ratio (another indicator of bankruptcy risk)	(Boachie & Mensah, 2022; Elmashtawy & Salaheldeen, 2023; Jelinek, 2007; Vakilifard & Mortazavi, 2016)
Liquidity	LIQ	Total current assets to total current liabilities	(Antounian et al., 2021; Elmashtawy et al., 2023b, 2023a; Koh, 2007)

Table 2	Variables	Description
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1.2 Regression Models Specifications

The following statistical models were formulated to determine whether REM influences FP and whether the AQ moderates the relationship between REM and FP.

The direct effect models assess how REM can influence FP in the Saudi exchange's non- financial sector. The function of Model 1 is to measure the direct impact of REM on ROA. The function of Model 2 is to measure the direct impact of REM on ROE. These two models answer hypotheses 1. **Model 1:**

widdel 1:

 $ROA_{it} = \alpha + \beta_1 REM_{it} + \beta_2 LSIZE_{it} + \beta_3 LEV_{it} + \beta_4 LIQ_{it} + \varepsilon_{it}$

Model 2:

 $ROE_{it} = \alpha + \beta_1 REM_{it} + \beta_2 LSIZE_{it} + \beta_3 LEV_{it} + \beta_4 LIQ_{it} + \varepsilon_{it}$

The moderator effect models are to investigate the moderating effect of the AQ on the relationship between REM and FP in the Saudi non-financial sector. As for Model 4, its function is to measure the moderating effect of the AFSIZE on the relationship between REM and ROA. The function of Model 5 is to measure the moderating effect of the AFSIZE on the relationship between REM and ROE. These two models answer hypothesis 2.

Model 3:

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$$ROA_{it} = \alpha + \beta_1 REM + \beta_2 AFSIZE_{it} + \beta_3 REM * AFSIZE_{it} + \beta_4 LSIZE_{it} + \beta_5 LEV_{it} + \beta_6 LIQ_{it} + \varepsilon_{it}$$

Model 4:

$$ROE_{it} = \alpha + \beta_1 REM + \beta_2 AFSIZE_{it} + \beta_3 REM * AFSIZE_{it} + \beta_4 LSIZE_{it} + \beta_5 LEV_{it} + \beta_6 LIQ_{it} + \varepsilon_{it}$$

Based on the four models above, Figure 1 illustrates the relationships between REM, FP, and the moderating role of the AQ.



Figure 1 Research framework

Results and Discussion

1.3 Descriptive Statistics and Correlation Analysis

Table 3 provides a summary of the descriptive statistics for the variables used in this paper and investigates whether variables follow the normal distribution using the Kolmogorov-Smirnov and Shapiro-Wilk tests, where the significance values were greater than 0.05, indicating that the variables follow the normal distribution (Pallant, 2020). Table 3 reveals that the mean of ROA is 0.01, and the minimum and maximum levels are -12.11 and 0.90, respectively. The mean ROE was around 8%, with a standard deviation of 0.10. The average of AFSIZE was 0.69, and the SD was 0.56, indicating a wide variation in AFSIZE among the Saudi firms sampled and meaning that 69% of the sampled Saudi firms have selected Big 4. Concerning REM, it demonstrates an average of 0.02, and it is partly distributed (SD 0.38), with a minimum of -2.77 and a maximum of 1.31, which basically reveals that the Saudi firms have REM.

Table 3 Descriptive Statistics

Variables	Mean	S.D	Min	Max
ROA	0.01	0.78	-12.11	0.90
ROE	0.08	0.10	-0.42	0.49
AFSIZE	0.69	0.56	0	1
REM	0.02	0.38	-2.77	1.31

LSIZE	20.43	1.72	16.98	25.29
LEV	0.65	1.32	0.00	19.12
LIQ	2.03	5.33	0.19	54.14

An examination of the correlation matrix results shown in Table 4 indicates that all correlation coefficients are less than 0.80, suggesting that multicollinearity does not constitute a major concern (Gujarati & Porter, 2003). Table 4 reveals that there are some significant correlations among variables. The highest correlation between ROE and LEV is 0.51, suggesting that a higher ROE is correlated with higher debt levels. The correlation between LSIZE and LEV is also significant (with a correlation coefficient of 0.48), suggesting that larger firms have higher debt levels. The variance inflation factor (VIF) test findings, on the other hand, reveal a very low VIF for each variable (less than 1.30) and a large tolerance (at least 0.77), which indicates that the analysis does not suffer multicollinearity problems within variables (O'brien, 2007).

Table 4 Correlation Matrix Results

Probability	ROA	ROE	AFSIZE	REM	LSIZE	LEV	LIQ
ROA	1						
ROE	0.02	1					
AFSIZE	0.09	0.35***	1				
REM	0.17***	-0.09	-0.06	1			
LSIZE	-0.08	-0.14**	-0.06	0.31***	1		
LEV	-0.04	0.51**	0.16***	0.20***	0.48***	1	
LIQ	-0.07	0.03	0.06	-0.11	-0.16***	-0.35***	1
VIF	1.29	1.23	1.20	1.07	1.11	1.14	
Tolerance	0.77	0.81	0.83	0.93	0.89	0.87	

Note: *, **, and *** are the significance levels at 10%, 5%, and 1%, respectively.

Direct Effect Regression

The findings in Table 5 present the direct effect and moderating role of the regression models. The results in models 1 and 2 are allocated to the direct effect regression models. However, models 3 and 4 are for the moderating role regression models. All models were indicated in Table 5, and they were all controlled by firm size, leverage, and liquidity. In Models 1 and 2, the study examines the direct effect of REM on the FP measures (ROA and ROE). The results in Models 1 and 2 concluded a significant positive effect of REM on ROA and ROE at a 1% significant level (B = 0.23 and 0.27, respectively). This result revealed that firms with a high level of REM have a higher FP by ROA and ROE, and these firms can increase their returns and improve their performance through REM. Furthermore, REM can be used as a protective measure, which reduces a firm's riskiness and improves its performance. This result is supported by agency theory and agrees with the findings of Xu et al. (2007), Ding et al. (2018), Dakhlallh et al. (2020), and Aqabna et al. (2023). Hence, H1 is not supported.

Table 5 Direct and Moderating Effect Regression Results

Variables	Direct	Effect Regression	Modera	ting Effect Regression
	ROA	ROE	ROA	ROE
	Model 1	Model 2	Model 3	Model 4
С	0.08	-0.02	0.08	-0.02
	(0.02)	(0.08)***	(0.15)**	(0.12)***
REM	0.23	0.27	-0.48	-0.37
	(0.03)***	(0.02)***	(0.05)	(0.49)**

AFSIZE			0.02 (0.01)***	0.01 (0.02)*
REM * AFSIZE			0.08 (0.02)***	0.06 (0.03)**
LSIZE	0.18 (0.03)***	0.09 (0.02)***	0.05 (0.04)***	0.14 (0.02)***
LEV	0.02 (0.01)*	0.36 (0.04)***	0.10 (0.00)	0.06 (0.00)***
LIQ	-0.04 (0.02)	-0.03 (0.01)**	-0.01 (0.00)***	-0.02 (0.00)***
Adjusted R ²	0.61	0.66	0.81	0.72
F-statistic	7.39	12.78	24.32	11.39
Prob (F-statistic)	0.00	0.00	0.00	0.00
Durbin-Watson stat	1.86	2.05	1.64	1.72

Note: *, **, and *** are the significance levels at 10%, 5%, and 1%, respectively.

Moderating Effect Regression

The Model 3 and 4 findings in Table 5 present the moderating role of AQ. The results revealed that the interaction between REM and AFSIZE moderates the relationship between REM and FP. The findings revealed that the moderating role has a significant positive effect on the relationship between REM and FP across the conducted models (ROA and ROE) at significant levels of 1% and 5%, respectively (B = 0.08 and 0.06, respectively). The results also indicate that there is a significant positive effect of AFSIZE on ROA and ROE at significant levels of 1% and 10%, respectively. This suggests that the Big 4 audit firms are associated with increased FP by ROA and ROE. This is consistent with the agency and signaling theories, according to which the firms select the Big 4 audit firms as a signal to attract current or potential investors and enhance the company's positive image. This is similar to the findings of the studies by Rusmin (2010), Kalbasi and Lashgari (2020), Ugwu et al. (2020), Sattar et al. (2020), Umar et al. (2021), Angsoyiri (2021), Khan et al. (2021), Debnath et al. (2022), and Rompotis and Balios (2023). Hence, H2 is supported.

Even more interesting is that the AFSIZE has modified the relationship between REM and FP across the conducted models (ROA and ROE) from a positive effect to a negative effect, which was obtained when the AFSIZE was added to the model. These results indicate that the existence of the Big 4 leads to restricting opportunistic management behavior to manage earnings through real activities to increase the FP by ROA and ROE. This indicates the critical role of the AFSIZE, as the Big 4 audit firms have stronger incentives to influence operational decisions through management monitoring, resulting in a higher FP.

Overall, it was concluded from the results of assessing the accuracy of direct and moderating effect regression models that the values of adjusted R^2 reached 0.61 and 0.66 for the direct effect regression models and 0.81 and 0.72 for the moderating effect regression models. This indicates the positive effect of inserting the interaction between AFSIZE and REM variables in the moderating model and also indicates the accuracy of the models and the independence of the factors affecting the FP. Furthermore, the results revealed that the regression models were highly significant, as the significance values were 0.00.

Additional and Robustness Analyses

Additional analyses are carried out to evaluate the robustness of the study's findings, and it is revealed that earlier results are robust with alternative measurements of the variables.

Estimating REM Models

Table 6 reports the regression coefficients for the regression models used to estimate REM through total EM with sales, production, and optional expenses. The results reveal the mean coefficients and t-statistics of standard errors across industry years. The explanatory power of the models through the average adjusted R^2 across industry years for cash flows from operations, production costs, and optional expenses is 50%, 89%, and 29%, respectively.

Variables	CFOit/Ait-1	PROit/Ait-1	DISEXPit/Ait-1
С	-0.025 (0.69)	-0.049 (1.85)*	0.033 (6.96)***
1/Ait-1	27.387 (2.04)*	3.263 (0.25)	-1.698 (0.57)
Sit/Ait-1	0.257 (3.85)***	0.766 (11.51)***	0.048 (4.13)***
ΔSit/Ait-1	-0.020 (0.20)	-0.356 (2.81)**	
ΔSit-1/Ait-1		-0.199 (2.09)*	
Adjusted R ²	0.50	0.89	0.29

Table 6 Model Parameters for Estimation REM

Note: *, **, and *** are the significance levels at 10%, 5%, and 1%, respectively.

Direct Effect Regression Results (using individual measures of REM)

Table 7 presents the empirical results from the direct effect regression models that link the individual measures of REM (cash flows from operations (CFO), production costs (PRO), and optional expenses (DISEXP)) and FP (ROA and ROE). The findings reveal significant associations between the individual measures of REM (CFO, PRO, and DISEXP) and FP (ROA and ROE). The results indicate that CFO has a significant effect on ROA and ROE at a 1% significant level (-0.453 and 0.031, respectively). Furthermore, PRO has a significant negative effect on ROA at a 10% significant level and a significant positive effect on ROE at a 5% significant level. The DISEXP has a significant positive effect on ROA and ROE at significant levels of 5% and 10%, respectively.

Table 7 Additional Direct-Effect Regression Results

Variables	ROA	ROE
С	0.036	-0.025
	(0.47)	(0.33)
CFO	-0.453	0.031
	(4.87)***	(3.29)***
PRO	-0.175	0.024
	(1.87)*	(2.57)**
DISEXP	0.085	0.007
	(2.38)**	(1.80)*
LSIZE	-0.006	-0.004
	(0.72)	(0.44)
LEV	0.006	0.055
	(0.08)	(0.75)
LIQ	-0.004	-0.007
	(1.00)	(1.71)*
Adjusted R ²	0.28	0.26
F-statistic	27.71	25.17
Prob (F-statistic)	0.00	0.00
Durbin-Watson stat	1.66	1.85

Note: *, **, and *** are the significance levels at 10%, 5%, and 1%, respectively.

Robustness Analysis—Firm Size

To ensure the robustness of the study findings, the sample was divided into large and small firms, and the effects of independent and moderating variables were investigated in each case of ROA and ROE. Table 8 results reveal that the interaction between AFSIZE and REM is different between large and small firms, which have significant positive and negative effects, according to the models of ROA and ROE. Furthermore, the findings of the robustness analysis confirm the findings presented in Table 5.

Table 8 Robustness Analysis results

	L	arge Firms	5	Small Firms
Variables	ROA	ROE	ROA	ROE
С	-0.14	2.34	0.02	-0.16
	(0.13)**	(2.02)	(0.24)	(0.23)
REM	0.012	-0.28	-0.00	-0.10
	(0.02)***	(0.01)**	(0.00)	(0.01)***
AFSIZE	-0.02	0.25	0.01	0.16
	(0.02)	(0.38)**	(0.2)	(0.04)*
REM * AFSIZE	-0.02	0.51	0.02	0.12
	(0.01)	(0.25)***	(0.02)*	(0.03)***
LSIZE	0.02	-0.12	-0.00	0.02
	(0.01)***	(0.13)	(0.01)	(0.02)
LEV	-0.18	-1.43	-0.01	0.00
	(0.03)***	(0.76)**	(0.01)	(0.01)
LIQ	0.02	-0.04	-0.00	0.013
	(0.01)**	(0.28)	(0.00)	(0.00)***
Adjusted R ²	0.32	0.14	0.22	0.63
F-statistic	5.68	3.24	4.96	19.14
Prob (F-statistic)	0	0	0	0
Durbin-Watson stat	1.65	2.01	1.61	1.81

Note: *, **, and *** are the significance levels at 10%, 5%, and 1%, respectively.

Conclusion

The study investigated the influence of REM on FP and the moderating role of AQ on the relationship between REM and FP. The study is attributed to a balanced database of 1400 firm- year observations of Saudi non-financial spanning from 2011 to 2020. The findings revealed that REM had a significant positive effect on ROA and ROE as proxies for FP. Additionally, the study found strong evidence that AQ significantly impacts the relationship between REM and FP, where the existence of the Big 4 audit firm modifies the positive effect of REM on FP to a significant negative effect. The results also revealed that the existence of the Big 4 plays an important and significant role in monitoring and preventing management from engaging in REM, which positively affects improving FP. Additional analyses were performed to assess the robustness of the study inferences, and it was discovered that previous inferences are robust with different measurements.

This study makes the following distinct contributions to the existing literature: First, for theoretical contribution, it adds to the current literature and bridges an existing gap in the studies of EM, FP, and AQ, especially in the Saudi context. The study is the first to investigate the moderating role of AQ on the relationship between REM and FP. Second, the study corroborates agency and signaling theories through the amalgamation of individual relationships into a comprehensive model that demonstrates the abnormal operating activities in each of the sales activities,

production, and optional expenses as an independent variable and examines their effect on FP. Third, the study provides several implications for regulators, auditors, firms, and stakeholders. The study findings suggest that the AQ can enhance FP in non-financial firms listed on the Saudi Exchange. Thus, regulators can promote Big 4 as a mechanism for improving FP and encourage its selection by firms. Furthermore, regulators can also develop regulations and guidelines that encourage companies to pay attention to AQ to restrict EM and enhance FP. Auditors should pay attention to the AQ when assessing FP in non-financial firms. Auditors can also provide feedback and recommendations to firms on improving their performance and not engaging in EM. Firms can consider selecting the Big 4 as a mechanism for improving their performance. Finally, stakeholders can focus on the AQ to restrict EM and enhance FP.

There are some limitations to the study. First, the analysis was conducted on non-financial firms and applied to one country; therefore, the conclusions cannot be generalized and all the variables affecting the results cannot be controlled. Second, ROA and ROE were used as measures of FP, and therefore, these measures may not include all aspects of FP as FP can be measured in several measures. Finally, the quantitative analysis of secondary data may not offer

the capacity to interpret and clarify unforeseen relationships among certain variables and FP. Future research may investigate the causes of a positive relationship between REM and FP. In addition, future research may analyze the influence of AQ on the relationship between REM and FP using other measures of FP. Future research may compare the different audit types and analyze the effects of both on FP. Additionally, evaluating the impact of the accrual EM on FP. Future research could consider extending this analysis to encompass both financial and non-financial firms to determine the extent of the difference between them. Finally, future research may attempt to replicate the models formulated in the present study in various countries and compare them over a longer period of time for a broader interpretation.

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Investigating Financial Inclusion-Shadow Economy Nexus in a Dual Banking Environment: Does Institutional Quality Matter?

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Abstract

Financial inclusion has been of the ultimate significance in countering the shadow economy. Due to the importance of Islamic banks in the global arena, asset-based financing by Islamic banks has differentiated them from conventional banks, which, at least theoretically, impacts the shadow economy differently. This study brings novelty to the Islamic banking literature by exploring the role of financial inclusion in the shadow economy in the case of dual banking systems, i.e., Islamic and conventional banks. The study also considers the moderating role of institutional quality in financial inclusion-shadow economy nexus. This study has used the non-parametric MCMC Panel Quantile Regression technique on 60 Islamic banks and 283 conventional banks from 2005-2015 and covering 14 countries, namely, Bangladesh, Brunei, Indonesia, Jordan, Kuwait, Lebanon, Malaysia, Pakistan, Qatar, Saudi Arabia, Tunisia, Turkey, the UAE, and Yemen. Multiple robustness tests are conducted using different estimation models and variables to check the sensitivity of estimated coefficients. The study finds that financial inclusion reduces the shadow economy in the case of both types of banks, i.e., Islamic and conventional, but the impact is significantly strong in the case of Islamic banks. Second, the impact of financial inclusion varies at different quantiles across full samples and subsamples of Islamic and conventional banks but remains deeper in the case of Islamic banks across all quantiles. Third, Islamic banks become more impactful as the quality of institutions strengthens. Thus, the study suggests that a country with Islamic banks can reduce the shadow economy faster, and the banking sector can significantly diminish the shadow economy.

Keywords: Financial inclusion; Shadow economy; Dual banking; Institutional quality

1. Introduction

Of late, "shadow economy" is a subject commonly explored in the global sphere. It lowers tax revenue collection below the threshold that the government will be able to accomplish (Schneider and Enste, 2002). Medina & Schneider (2018) highlight that the shadow economy remains a pervasive and complex economic phenomenon in industrialized and developing economies. The average size of the shadow economy in 158 countries in the last 25 years (from 1991 to 2015) is more than 25% of these countries' average formal gross domestic product. Prominent studies in this domain reveal that the underground economy is commonly involved in illegal activity and evades identification in government measures (Naylor, 1996; Habibullah and Eng, 2006).

As a response, numerous governments have formulated strategies for minimizing the shadow economy (Din et al., 2019). Economies are endeavoring to reduce the size of the shadow economy through several strategies, including financial development & financial inclusion, and strengthening institutional quality. These procedures aim to minimize regulatory and administrative costs, encourage good governance, enhance tax compliance, and endorse online payments (Kelmanson et al., 2021, Sangirova et al., 2021). In line studies reveal that financial development can lower the size of the shadow economy (Gharleghi and Jahanshahi,2020). Numerous theoretical investigations revealed that financial development and financial inclusion perform a significant impact on the magnitude of the shadow economy, driving more researchers (Canh & Thanh, 2020; Blackburn et al., 2012).

Financial inclusion to alleviate poverty, promote welfare, and develop by raising the levels of formal economic arrangements has aroused policymakers' interest. Funding empowers small businesses to take advantage of the economic possibilities in the formal structure.

Prior studies reveal that individuals and corporations partake in the underground economy for a myriad of factors, namely, unemployment (Dell'Anno and Solomon, 2008), rules and taxes (Bajada and Schneider, 2005), poor

governance (Friedman et al., 2000), crime rate (Wang et al., 2006), inflation (Bittencourt et al., 2014), and the level of financial sector development (Bose et al., 2012).

Studies appear to accept the premise that the financial sector's development and financial inclusion lessens the shadow economy. The shadow economy limits public money and investment, which affects the nation's growth. Agents in the shadow economy siphon off productive labor and capital from the formal economy, and they are inefficient and offer minimal value to the overall economy (Schneider et al., 2010). As a result, it indicates fraudulence and poor institutional quality (Schneider and Enste 2000). The literature reveals that weak institutional frameworks drive economic agents to operate in the shadow economy (Canh et al., 2021).

Financial inclusion does have extant literature. The use of mobile, available banking, affordable financial services, broader credit availability, and reliable savings tools are among the mechanisms that can achieve financial inclusion (Mehrotra & Yetman, 2015). Financial inclusion plays an important part in the development of financial markets. Economies have tried to increase financial inclusion and integrate their financial systems into the global financial market to achieve higher economic growth over decades. Regrettably, comprehending what defines financial inclusion in Islamic economies, especially the role of dual banking (financial inclusion) on shadow economy in the purported economies, has attracted scant attention as there is little empirical evidence on the direct relationship between financial inclusion and the shadow economy, for Islamic economies.

The prominence of Islamic banks on the global scene and asset-based funding by Islamic banks have differentiated them from conventional banks, which, in principle, has a different effect on the shadow economy. Consequently, in the case of dual banking systems, such as Islamic and conventional banks, this study examines the role of financial inclusion in the shadow economy. The study also considers the relevance of institutional quality in the financial inclusion–shadow economy nexus as a moderating factor.

Islamic banking is one of the important parts of Islamic finance. Initially, Islamic banking was started to provide a Shariah-compliant banking system to Muslims in Muslim countries, but particularly after the financial crisis, it spread worldwide. In the world, Islamic banking continues to maintain growth at a 10% rising rate after the financial crisis (IFSB Report, 2018). Many studies support the view that Islamic banking development directly correlates with economic growth (Mensi et al., 202; Jawad & Christian, 2019; Daly & Frikha, 2016; Abduh & Omar, 2012; Farahani & Dastan, 2013). but there needs to be studies that examine the association between Islamic banking and the shadow economy.

Gordon and Li's (2009) cross-sectional and panel investigation reveals those enhancements in the banking sector's development and its depth and efficiency result in a smaller shadow economy. Studies reveal that the availability of funds will become much easier as the banking sector expands and gets more competent, the cost of funds will become lower, and players will be willing to participate in the formal economy as the economic cost of engaging in the shadow economy increases (Bose et al.,2012; Blackburn et al. (2012). Islamic banks are proven to be additions to, instead of replacements for, conventional banks (Imam and Kpodar, 2013; Gheeraert, 2014). Honohan (2008) highlights that many developing countries have restricted access to financial institutions and products. Islamic banks promise to help with financial intermediary progress by attempting to bring borrowers and lenders from unofficial to the formal financial sector, predominantly in Muslim countries. Schneider et al. (2015) reveal that Islamic countries have lower shadow economy in a dual banking system despite relative scope and importance because the majority of the dual banking are operating in OIC member nations, where the size of the shadow economy in OIC member nations is 34.36% of GDP (Medina and Schneider, 2017).

We believe a well-designed empirical investigation demonstrating the underlying differences between interest-based and interest-free banks that may influence the shadow economy would be a worthwhile addition to the extant literature.

By presenting this study, we want to fill this vacuum in the literature. To do this, we propose using a non-parametric MCMC Panel Quantile Regression methodology that allows us to examine the impact of financial inclusion on the shadow economy in a dual banking setting across different quantiles. As per the authors' knowledge, this is the first study using this methodological framework in the Islamic banking field. Given the differences between Islamic and conventional banks, we believe such an analysis is highly pertinent.

So, this study focuses on the role of Islamic banks in the shadow economy. In tandem, we have also compared the role of Islamic banks with conventional banks in terms of their effects on the shadow economy. In this vein, we endeavor to answer the following questions. i) Is there any role of Islamic banks in the shadow economy? ii) Is the impact of Islamic banks different from conventional banks? iii) Whether Islamic and conventional banks' impact varies or not at different levels of institutional quality. These questions are of prime importance since Islamic banking exists in most OIC member countries where the size of the shadow economy is large compared to other nations of the world (Medina& Schneider, 2018). Thus, our findings have substantial policy and practical significance.

This study contributes to the existing literature in multiple ways. First, this study provides evidence of the impact of financial inclusion on the shadow economy, where literature is scarce on the financial inclusion-shadow economy nexus. Second, adopting a non-parametric MCMC panel quantile regression model to examine how financial inclusion affects the shadow economy in different quantiles is another contribution that distinguishes our paper from prior literature. Third, not only our study adds to the literature on the impact of the financial inclusion-shadow economy nexus but also investigates the impact in a unique context by comparing Islamic and conventional banks. Studying the financial inclusion-shadow economy nexus is distinctive due to the composition of the Islamic and conventional banks. Fourth, this study also incorporates the moderating role of institutional quality in the financial inclusion-shadow economy nexus.

Our results reveal three vital findings. First, the study finds that financial inclusion reduces the shadow economy in the case of both types of banks, i.e., Islamic and conventional, but the impact is significantly strong in the case of Islamic banks. Second, the impact of financial inclusion varies at different quantiles across full samples and sub-samples of Islamic and conventional banks but remains deeper in the case of Islamic banks across all quantiles. Third, Islamic banks become more impactful as the quality of institutions strengthens. This study suggests that a country with Islamic banks can reduce the shadow economy faster, and the banking sector can significantly diminish the shadow economy.

The remainder of the paper is structured as follows. Section 2 provides a brief survey of the associated literature. The data description and empirical model used in the study are presented in section 3. Section 4 presents the main empirical findings. Section 5 covers the conclusion and policy implications.

2. Literature review

I. Shadow Economy and Financial Inclusion

For the financial system, it is vital to comprehend the connection between the shadow economy and financial inclusion. Financial inclusion has financial benefits, including long-term growth, poverty alleviation, and monetary and financial sustainability (Mehrotra & Yetman, 2015). Dabla-Norris et al. (2015) state that the scale of the shadow economy might affect both the availability and quality of financial services in emerging markets. The study argued that a greater shadow economy could raise the need for financial inclusion. By its very nature, the shadow economy curtails the growth of financial markets. The thought of financial inclusion stems from Schumpeter's (1911) theoretical framework, which claimed that institutions are vital for allocating resources. The financial sector can substantially influence the shadow economy; the growth of the financial sector lessens the impediments to obtaining money, helps firms access needed financing, and raises the comparative advantage in the production of the shadow economy (Ellul et al., 2015; Capasso and Jappelli, 2013).

By keeping a close eye on those officially barred from the formal financial system, financial inclusion might help alleviate the scope of the shadow economy. By extending access to insurance schemes and other formal measures put in place by the government, financial inclusion may mitigate shocks in the official economic system. Financial inclusion may help diminish the shadow economy by rebuilding confidence in the financial system. It increases monitoring capabilities. This implies that a country with a sound financial regulatory regime may have little or no shadow economy (Mapp & Moore, 2015; Blackburn et al., 2012).

Ofosu-Mensah Ababio et al. (2021) reveal that financial inclusion can diminish the size of the shadow economy by transferring participants from the informal to the formal economy. It aims to ensure that a larger proportion of the public participates actively in formal economic opportunities. Financial inclusion is interpreted as a process that

provides people and various levels of business owners with reasonable and useful financial services that fit their purposes in a long-term manner (Zins and Weill, 2016; Cull et al., 2014).

Financial inclusion requires the formulation of elevated financial products such as lending, banking, insurance, transactions, remittances, and other activities. Individuals should be allowed to access effective, secure, and long-term financial services in a supervised banking system (Demirguc-Kunt et al., 2017). Because of the cheap and simple access to finance, financial inclusion and its supervision increase business units to operate in the formal sector of the economy. The emphasis on policymaking has switched away from financial development and towards financial inclusion (Johnson & Arnold,2012).

In drawing a link between the extent of shadow economies and the level of banking development, Bose et al., (2012) and Ajide (2021) unearth the depth and efficiency of the banking system and financial inclusion are central in narrowing the scope of shadow economies. Bose et al. (2012) manifest the connection between banking development and the size of shadow economies by exploring evidence from 137 countries between 1995 and 2007. The study reveals that the depth and efficiency of the banking system are essential in narrowing the scope of shadow economies.

II. Shadow Economy and Institutional Quality

The emergence of new shadow economy datasets has recently intensified interest in the shadow economy and its determinants. Schneider and Enste (2000) estimated the shadow economy's size in 76 economies. Medina and Schneider (2018) presented a full array spanning 158 economies from 1991 to 2015. As per the studies, institutional quality is one of the main drivers of the shadow economy (Torgler and Schneider, 2009; Dreher et al., 2009). The literature indicates that dysfunctional institutions, such as corruption, poor quality regulation, or poor public policy and administration, increase process costs for market participants, pushing them to participate in the shadow economy (Torgler and Schneider, 2009). Dreher and Schneider (2010) studied the link between the shadow economy and corruption in 98 countries. The study discovered that these two variables support each other in low-income economies. A poor institutional quality framework (e.g., bureaucracy, regulatory inefficiencies, the rule of law, corruption, and a weak legal system) is frequently mentioned as a significant determinant of the shadow economy (Friedman et al. 2000). Dreher, Kotsogiannis, and McCorriston (2009) investigated the connection between institutional quality, the shadow economy, and corruption in 145 countries from 2000 to 2002. Their study also indicates that stronger institutions lessen the shadow economy's scope. Effective institutional excellence is associated with increased market efficiency and, as a consequent, allocation of resources (Park, 2012). Higher disclosure, in conjunction with stronger legal systems (property rights protection and information disclosure), has resulted in improvement between participants, hence promoting official economic activities (La Porta et al., 1997; López de Silanes et al., 1998). Excessive tax brackets and poor-quality public goods are commonly attributed to institutional weaknesses. Economic interests are pushed out of the formal economy by high taxation (Johnson et al., 1998).

III. Islamic Banking Versus Conventional Banking

In essence, Islamic banking models differ from conventional banking models in terms of the type and composition of assets and liabilities (Nosheen and Rashid, 2019). IBs, on the other hand, appear to be immune to the risks of toxic instruments, which have a major impact on CBs. Additionally, they have more liquidity per unit of assets (Berger et al., 2019). Cihak and Hesse (2010) used a sample of IBs and CBs from 19 countries with a significant presence of Islamic banking to assess the relative capital adequacy of IBs. Because of numerous features of Islamic banking, such as profit and risk-sharing structures, they conclude that IBs are less vulnerable to risk than CBs.

To examine the financial strength of Islamic banks, Bitar, Hassan, and Walker (2017) employ components analysis from the principal component analysis. From 1999 to 2013, they investigated a group of banks from 33 countries. They compare the two bank forms by constructing an efficiency factor based on a combination of multiple efficiency measures and reveal that Islamic banks are more effective than regular banks. A Meta-frontier analysis is used by Johnes et al. (2014) to compute efficiency scores for conventional and Islamic banks. Their research examined 255 banks operating in countries where at least 60% of the populace is Muslim. They use a combined efficiency frontier for the two bank types and two separate efficiency frontiers, one for each bank type. Their results unearth that when employing a common efficiency frontier, Islamic banks are less efficient than conventional banks, but when utilizing specialized efficiency frontiers, they are more efficient. Gheeraert (2014) illustrates how Islamic banking can assist

Muslim countries in improving their financial sectors. Beck et al. (2013) evaluated 510 conventional and Islamic banks in 22 countries from 1999 to 2009 using various bank performance metrics. They demonstrate that Islamic banks are less cost-effective and have greater intermediation costs than their traditional counterparts. They also reveal that major Islamic banks have higher costs than conventional banks. A component of this literature investigates whether Islamic banks are more financially sound than their conventional ones, notably during times of trouble (Abedifar et al., 2013; Hasan and Dridi, 2010).

Several empirical investigations have evaluated the credit risk of conventional and Islamic banks. Boumediene (2011) assessed the range of credit risk in Islamic and conventional banks, concentrating on nine conventional and Islamic banks from 2005 to 2009. The study reveals that Islamic banks have a vastly lower credit risk than regular banks. At the same time, Jawadi et al. (2016) reveals that there is no big variation in financial risk between Islamic and conventional banks. During the financial crisis of 2008, Said (2012) concentrated on how various banking models might have varying levels of efficiency. The results indicate that Islamic banks performed better than regular banks during the financial crisis. Islamic finance has a reputation for becoming more dependable. This subject drew international attention during and after the 1997-1998 East Asian crisis, the subprime mortgage crisis in the United States in 2007-2008, and the recent Eurozone crisis, when Islamic finance displayed its perseverance of financial shocks (Rosman et al., 2014). In line, we are driven to undertake a formal, in-depth empirical investigation into the relationship between dual banking structure and the size of shadow economies by viewpoints articulated by the abovementioned studies.

By investigating the impact of Islamic Banking and conventional banking on the shadow economy, our paper brings a new dimension to the literature on bank market structure. Despite a large body of work concluding that Islamic banks have varied traits to conventional banks, the impact of the dual banking system (Islamic and conventional banks) on the shadow economy has not been explored. To our knowledge, this is the first research to look into the role of financial inclusion (dual banking setting, namely, Islamic and conventional banks) in the shadow economy, also considering the moderating influence of institutional quality.

3. Data and methodology

The introduction and literature review section explores the relationship between the shadow economy and financial inclusion. Accordingly, this part of the study presents an estimation technique, i.e., the MCMC panel quantile regression, and equations models to be estimated.

3.1 MCMC Panel Quantile regression

The shadow economy nexus with many exploratory variables has been investigated by many researchers and have employed different parametric methods such as OLS regression (Dada et al., 2021) and ARDL (Esaku, 2021) panel data (Khan et al., 2021; Khan & Rehman, 2022). On the other hand, quantile regression was introduced by Koenker and Basset (1978), which is the extension of OLS. The main difference lies where the OLS estimator only focuses on the mean, i.e., a measure of central tendency, quantile regression instead investigates data better by focusing on the entire range and thus analyses the size of the shadow economy by quantiles. Many empirical studies have applied OLS, ARDL, NARDL, and GMM (Gulzar et al., 2010; Dada et al., 2021; Esaku, 2021; Khoshkhabar,2020; Baklouti & Boujelbene, 2020) to investigate the impact of X's variables on the shadow economy by considering the homogeneity of conditional distribution without giving weightage to different sizes of the shadow economy. In their case, different sizes of shadow economy become irrelevant, which need to be weighted to perform robust analysis. On the other hand, quantile regression uses the entire distribution and gives weights to all observations by using full information. Even though, according to Asmare and Begashaw (2018), parametric models provide better estimators if the data is

facing significant measurement errors, the main issue with parametric models is that they assume parametric distributions of errors (Ullah, 1989; Hettmansperger and McKean, 2011; Jureckova et al., 2012; Asmare and Begashaw, 2018) while in many cases errors may not have parametric distributions. Similarly, conventional regression models focus only on the mean, while quantile regression considers the entire conditional distribution of the shadow economy, i.e., the dependent variable (Coad and Rao, 2006). Additionally, according to Koenker and Hallock (2001), quantile regression is robust to outliers. Quantile regression considers conditional distribution of the shadow economy,

Thus, to get robust coefficients having small T and large N, this study follows Powell (2014) and Powell (2017) and uses a non-parametric method, i.e., panel quantile regression having optimization property of Markov chain Monte Carlo (MCMC) of Chernozhukov and Hong (2003). Thus, we can see financial inclusion-shadow economy nexus in different quantile, controlling for deficiency of parametric models, i.e., obtaining coefficients considering entire distribution, not central tendency. Additionally, the panel quantile model is more suitable in the case having small T and large N. So, we define the model as:

Let suppose $(se_{it} \text{ and } x_{it})$ and $i = 1,2,3,4, \dots, n$ represents n countries and $t = 1,2,3,4, \dots, t$ denotes time. Where se_{it} is the size of the shadow economy of the country i in time t while x_{it} is the vector of regressors, including financial inclusion of the country i in time t. Suppose the τ^{th} quantile of the conditional distribution of se_{it} with x_{it} is linear. Thus, the quantile model can be written as: (i)

$$se_{it} = x'_{it}\alpha_{\tau} + \mu_{it\tau}$$

$$qnt_{y_{it}}(\tau|x_{it}) = \inf \left\{ se: fun_{it}(se|x) \ge \tau \right\} = x'_{it}\alpha_{\tau}$$
(ii)
$$qnt_{\mu_{it}}(\tau|x_{it}) = 0$$
(iii)

Where $qnt_{y_{it}}(\tau|x_{it})$ shows the τ^{th} conditional quantile of se_{it} conditional on x_{it} , α_{τ} denotes coefficients to be estimated in the model for the different values of τ in the range of 0 to 1, $\mu_{it\tau}$ denotes error while $fun_{it}(se|x)$ is the x conditional, cumulative distribution function. The entire distribution of se, conditional on x can be captured by changing the value of τ between 0 and 1. The coefficient (τ) can be obtained by solving the following: minization

$$\frac{\alpha_{\tau}}{\alpha_{\tau}} \sum_{i=1}^{n} \delta \tau (se_{it} - x'_{it} \alpha_{\tau})$$
(iv)

Where $\delta \tau$ is the minimization function, explained as:

$$\begin{bmatrix} \tau \mu & if \ \mu \ge 0\\ (\tau - 1)\mu & if \ \mu < 0 \end{bmatrix}$$
(v)

The function of equation (4) estimates error terms values and then multiplies the values in equation (v). Thus, utilizing the MCMC optimization procedure of Chernozhukov and Hong (2003), up to 1,000 iterations of the MCMC simulation process are performed to estimate the quantile regression panel data (QRPD) coefficients.

3.2 Empirical Equations

This study examines the impact of financial inclusion on the shadow economy. The MCMC Panel Quantile Regression was estimated for different quantiles 0.25, 0.50, and 0.75. So, the econometric equation is defined as:

$\tau_{25th}(SE_{it}) = \theta_{25th,0} + \theta_{25th,1}FI_{it} + \theta_{25th,2}X_{it} + \epsilon_{25thit}$	(vi)
$\tau_{50th}(SE_{it}) = \theta_{50th,0} + \theta_{50th,1}FI_{it} + \theta_{50th,2}X_{it} + \epsilon_{50thit}$	(vii)
$\tau_{75th}(SE_{it}) = \theta_{75th,0} + \theta_{75th,1}FI_{it} + \theta_{75th,2}X_{it} + \epsilon_{75thit}$	(viii

Where $\theta_{\tau 0}$ is an intercept, $\theta_{\tau 1}$ and $\theta_{\tau 2}$ are coefficients to be estimated. \in_{it} is the error term. τ denotes quantile, *i* refers to countries, and t is the time. SE is shadow economy, FI denotes financial inclusion, while X depicts control variables. The above model (1) can estimate the slope coefficients deviate at different conditional distribution quantiles at different shadow economy levels.

3.3 Data and variables

The sample consisted of 60 Islamic banks and 283 conventional banks covering 14 countries: Bangladesh, Brunei, Indonesia, Jordan, Kuwait, Lebanon, Malaysia, Pakistan, Qatar, Saudi Arabia, Tunisia, Turkey, the UAE, and Yemen. The banking data is obtained from the DataStream, and macroeconomic variables and governance variables data are collected from the World Development Indicator and World Governance Indicator of the World Bank. The shadow economy data is extracted from Medina & Schneider (2018). The time of the study is 2005-2015.

To address our questions, the shadow economy (SE) % of GDP is used as a dependent variable taken from the study of Medina & Schneider (2018). Their study includes 158 countries and time spanning from 1991-2015. They have

¹ In case of homogeneity the coefficients are uniform among the quantiles and must be constant among different quantiles.

estimated the shadow economy index using standard and commonly used procedures, i.e., the multiple indicators and multiple causes (MIMIC) model. This model is considered better than other available procedures such as the electricity consumption approach and currency demand approach etc., used in many studies (Adair, 2021; Fedotenkov and Schneider, 2018; Ajide, 2021; Dell'Anno & Davidescu, 2018). Financial inclusion is proxies by ATMs per 100,000 adults' (ATM), Domestic Credit to Private Sector (DCPS), and commercial bank branches per 1,000 adults (BB) embracing the mentioned studies (Ajide, 2021; Kim et al., 2018; Cumming et al., 2014; Neaime and Gaysset, 2017). To measure institutional quality, we use Regulatory Quality (RQ), Rule of Law (ROL), political stability, and Control of Corruption (COC) following (Khan et al., 2021; Ajide, 2021). Other control variables include loans (Loan), Gross Domestic Product (GDP), Government Expenditure (GE), inflation (Inflation), and unemployment. The selection of control variables is based on the previous literature (Keneck-Massil and Noah, 2019; Goel and Nelson, 2016; Dabla-Norris et al., 2008; Dreher et al., 2009; Goel and Saunoris, 2014).

3.4 **Results and Discussion**

Tables 1 and 2 (Appendixes) display the descriptive statistics and correlation analysis, respectively. The average size of the shadow economy is 29%. In comparison, the minimum is 8%, and the maximum is 69%, which confirms differences in the size of the shadow economy and qualifies to employ panel quantile regression. On the other hand, we see a negative correlation between the shadow economy with all proxies of financial inclusion, and the strongest correlation is revealed for the rule of law (-0.63).

Tables 3, 4, and 5 document the results of our baseline models. The first 3 columns show full sample quantiles (q25, q50, and q75) respectively, the middle 3 columns denote Islamic banks' quantiles (q25, q50, and q75) respectively, and the last 3 columns report conventional banks' quantiles (q25, q50, and q75) results respectively. There is a negative effect of financial inclusion on the shadow economy across all, i.e., full sample and sub-samples of Islamic and conventional banks. In other words, financial inclusion reduces the size of the shadow economy in the case of a full sample and both in Islamic and conventional banks. These results are in line with (Blackburn et al., 2012 Capasso and Jappelli, 2013 Bittencourt et al., 2014 Bose et al., 2012 Keneck-Massil and Noah, 2019 Habibullah et al., 2016 Albulescu et al., 2016). As per as the different quantiles are concerned, the impact is more intense in the case of Islamic banks, as indicated by q25, q50, and q75 of models (1), (2), and (3) of the middle three columns across all tables i.e. 1, 2, and 3. In short, extending financial inclusion through Islamic banks reduces the shadow economy more than enhancing financial inclusion through conventional banking. One of the arguments could be that Islamic banks are asset-based, i.e., they involve commodities to create financing, thus including the real sector of goods and services (Ahmed, 2010; Hashem and Abdeljawad, 2018). It also aligns with those studies claiming that Islamic banks are more inclusive (Hassan et al., 2018; Baber, 2020). Additionally, the majority of Islamic banks are operating in Muslimmajority countries where a significant portion of the people are voluntarily excluded from formal financial services due to conventional banks (Kim et al., 2018). Thus, increasing the financial services offered by Islamic banks may attract those segments of society who are voluntarily excluded from formal financial services.

Similarly, the coefficients of regulation quality are negative across all quantiles, i.e., full sample and sub-samples of Islamic and conventional banks, indicating an inverse association between institutional quality and the size of the shadow economy. Thus, it can be deduced that improved institutional quality leads to a lower size of the shadow economy. Many studies (Dada et al., 2021; Khan et al., 2021; Ajide, 2021) confirm that the quality of institutions is important in reducing the size of the shadow economy. Improved institutional setup attracts businesses, entrepreneurs, and laborers from the shadow economy into the formal financial sector, and as a result size of the shadow economy shrinks.

Additionally, to test if a different level of institutional quality matters for the association of financial inclusion and the shadow economy, we have interacted financial inclusion with institutional quality. Since two continuous variables interact, the results are presented in Figures 1 2, and 3, as single coefficients cannot accurately represent the relationship. So, figures 1 and 2 demonstrate the interaction of financial inclusion and institutional quality in the case of conventional and Islamic banks. Both figures reveal that the quality of institutions affects the association between financial inclusion and shadow economy in both types of banks. In other words, the impact of financial inclusion on the shadow economy varies at different levels of institution quality, i.e., low and high. However, the effect is more at a higher level of institutional quality. As per as the Islamic and conventional banks are concerned, as the institutional quality improves, the Islamic banks become more impactful, as displayed by the red line. Put differently, as the institutional quality improves (at a higher level of institutional quality), the impact of financial inclusion is stronger in

the case of Islamic banks than conventional banks. With a developed institutional quality, the same services provided by Islamic banks to the people will bring more people to the formal financial system.



Marginal effects Figure 1.

Figure 2. Bank Branch-Shadow economy nexus (moderator Rule of Law)



Figure 3. Domestic Credit-Shadow economy nexus (moderator Role of Law)



5 Robustness checks

We performed several robustness tests to check the sensitivity of estimated coefficients. First, we check if our coefficients on the association between shadow economy and financial inclusion still hold after changing the proxy of financial inclusion. Therefore, we have used different proxies of financial inclusion ATM, DCPS, and BB and observed consistency in the coefficients in terms of signs and significance. Similarly, the data have been split into full samples and sub-samples of Islamic banks and conventional banks, employed POLS, FE, and RE models with robust standard error, and found consistent coefficients of the main variables, i.e., Robustness 1 (tables 1 to 3). Similarly, the study utilizes different proxies, i.e., Regulation Quality (RQ), Rule of Law (ROL), Political Stability (PS), and Control of Corruption (COC), to measure intuitional quality. Consistent coefficients of the main variables have been found against alternative estimations by using each proxy in a separate model and using unemployment as an exploratory variable, which is considered to be one of the important determinants of the shadow economy and finds consistent coefficients, too, i.e., Robustness 2 (tables 1 to 4).

6. Conclusion and policy implications

This study investigates the association between financial inclusion and the shadow economy in the case of Islamic and conventional banks. Using the non-parametric MCMC panel quantile estimation technique, the study finds that financial inclusion decreases the shadow economy in both types of banks across different quantiles, but the impact is more significant in the case of Islamic banks. The findings further demonstrate that financial inclusion can be used as an effective tool in reducing the shadow economy's higher level of an institutional setting. Moreover, the results also show that the impact of financial inclusion in reducing the shadow economy is more intense at a higher level of institutional setting in the case of Islamic banks than conventional banks. The main policy suggestion is that increasing financial inclusion can reduce the shadow economy. Similarly, having a good institutional setting can further help reduce the shadow economy's size, especially through Islamic banks. A further implication for regulators and policymakers is that preference should be given in policies to make financial system who are voluntarily excluded from using financial services. Even though the shadow economy is a universal feature of all economies, the primary reasons for it differ from one country to another country.

Moreover, various methods may show various estimates of the size and growth of the shadow economy for a particular nation and period. Consequently, policymakers and lawmakers who enact legislation designed to lower the shadow economy need estimations from various sources (Dell'Anno et al., 2007; Schneider and Enste, 2000). The findings of

this study recommend that economies address financial inclusion obstacles, such as the size of the shadow economy, by formulating and executing reform programs that will boost access to financial services and products, culminating in income equality and poverty reduction. Moreover, policymakers in the selected economies should remove barriers to financial inclusion by improving the quality and availability of adequate financial services and products for unmet, underrepresented, and financially precluded households and firms, thereby actively helping develop financial markets and economic growth.

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Determining the Sustainability Performance of the Sultanate of Oman Industries Influence by Green Supply Chain Management Practices with Moderating Role of Environmental Collaboration

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Abstract

Purpose

This research will examine the effect of green supply chain management practices on sustainability performance emphasizing environmental collaboration. In today's competitive global business environment, the idea of green supply chain management has been put forth and serves to prompt governments and public towards reducing unhealthy practices such as use of illegal substances and carbon dioxide emissions that may pose danger to our natural environment.

Findings

The finding of this study will demonstrate that the implementation of GSCM practices indeed significantly improves sustainability performance. It also mentioned environmental collaboration as an important driver of these improvements. The results showed that firms that engaged in strong environmental collaboration with suppliers and stakeholders achieved significant declines in hazardous material use and carbon dioxide emissions.

Practical implications

There are several important practical implications for businesses striving to enhance their sustainability. Consequently, the organization can gain numerous environmental advantages from using green supply chain management (GSCM) practices. By doing this companies can considerably lessen their utilization of hazardous materials and Co2 emissions, increase operational efficiency, attract eco-conscious customers thereby reducing costs and raising earnings at the same time.

Originality/value

This study will be unique by providing holistic analysis on GSCM practices for their diverse impact over sustainability performance through environmental collaboration. As opposed to previous studies which focused on isolated aspects of sustainability, this current research offers a combined consideration of environmental performance evaluation, economic benefits as well as long-term impact on sustainability regarding GSCM practices.

Significance

The study's examination of the integration of environmental collaboration into business processes provides new insights into how businesses can effectively partner with suppliers and stakeholders to achieve significant reductions in hazardous materials and CO2 emissions. This research not only underscores the environmental benefits but also demonstrates substantial cost-cutting advantages, while highlighting the potential for increased earnings through the adoption of Green Supply Chain Management (GSCM) practices. The findings emphasize the dual benefits of environmental stewardship and economic gain, reinforcing the strategic value of sustainable business practices in today's competitive market.

Keywords; Green Supply Chain Management Practices, Sustainability Performance, Environmental Collaboration

An investigation of the relationship between SDGs education and its impacts on students: A case study in a US Midwest university

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Abstract

Higher Education Institutions (HEIs) have been integrating Sustainable Development Goals (SDGs) into their curriculum and teaching since 1972, but the efforts were intensified since 2015's "Agenda 2030" agreed by UN General Assembly. Most universities implement the overall 17 SDGs at the university level. However, meaningful impacts might not be derived if working on all 17 goals undifferentiatedly. As the focus for each discipline is diverse, different disciplines should evaluate different goals which are closely related to their disciplines.

Three SDGs will be assessed in this study, and they are: SDG 4-Quality Education, SDG 8-Decent Work and Economic Growth, and SDG 9-Industry, Innovation, and Infrastructure. The two folds of the evaluation in this study are: First, this study will examine the current practice in a US Midwest university business school's SDG 4, 8, 9 in terms teaching, research, and outreach collaboration. Second, the study will survey students to understand how the business school's SDG 4, 8, 9 practice impacts students' SDG's knowledge, attitude and behavior. Based on the result of this study, recommendations will be provided for business school moving forward with further SDGs integration.

Keywords: UN Sustainable Development Goals (SDGs), HEIs, Business Schools, SDG 4-Quality Education, SDG 8-Decent Work and Economic Development, SDG 9-Industry, Innovation, and Infrastructure, Knowledge, Attitude, and Behavior

Introduction

Higher Education Institutions (HEIs) have been integrating Sustainable Development Goals (SDGs) into their curriculum and teaching since 1972, but the efforts were intensified since 2015's "Agenda 2030" agreed by UN General Assembly. Over 600 universities worldwide have signed the international agreement to engage in the implementation of the SDGs. Most universities implement the overall 17 SDGs at the university level. However, meaningful impacts might not be derived if working on all 17 goals undifferentiatedly. As the focus for each discipline is diverse, different disciplines should evaluate different goals which are closely related to their disciplines.

HEIs, and specifically business schools, integrate the SDGs from multiple aspects, including teaching, research, outreach, and collaboration with non-academic stakeholders. The goal is to create leaders who have knowledge of and intend to incorporate sustainable development in their work after graduation. Therefore, it is critical to identify the applicable goals and then evaluate whether the business school's SDGs efforts are effectively communicated to and embraced by the students.

Three SDGs will be assessed in this study, and they are: SDG 4-Quality Education, SDG 8-Decent Work and Economic Growth, and SDG 9-Industry, Innovation, and Infrastructure. The two folds of the evaluation in this study are: First, this study will examine the current practice in a US Midwest university business school's SDG 4, 8, 9 in terms teaching, research, and outreach collaboration. Second, the study will survey students to understand how the business school's SDG 4, 8, 9 practice impacts students' SDG's knowledge, attitude and behavior. **Background**

Many HEI business schools are accredited by AACSB International and follow their 2020 accreditation standards. Those standards require the business school to align their strategic management, programs and curriculum, and thought leadership and engagement with societal impact (AACSB, 2025). To demonstrate this societal impact, AACSB provides business schools with a template that uses the UN's SDGs as a potential way to categorize and report their societal impact (AACSB, 2025). The 17 SDGs are categorized into three separate layers by the Stockholm Resilience Centre:

• The **biosphere layer** includes environmental SDGs such as clean water and sanitation (SDG 6) and climate action (SDG 13).
- The society layer encompasses crucial societal goals such as quality education (SDG 4), good health and well-being (SDG 3), and gender equality (SDG 5).
- The economy layer includes goals such as industry, innovation, and infrastructure (SDG 9) and decent work and economic growth (SDG 8).

Referring to the aforementioned three layers, SDG 4 Quality Education was consistently ranked as top priority in a recent global survey of business schools by the Yale Center for Business and the Environment (Cort & Frank, 2019). In addition, SDG 8, Decent Work and Economic Growth, and SDG 9, Industry, Innovation, and Infrastructure under the economy layer of the SDG categories are the primary focus of any business school. Therefore, SDG4, SDG8, and SDG 9 were deemed particularly aligned with the purpose, programs and thought leadership of a business school.

Hence, we propose the following two research questions:

RQ 1- What is the current practice in the business school's SDG 4, 8, 9 in terms teaching, research, outreach collaboration.

RQ 2- How does the business school's SDG 4, 8, 9 practice impact students' SDG's knowledge, attitude and behavior

Methodology

Cross-Referencing the three SDGs

Based on the literature review, the authors identified SDG 4, 8, 9 to be particularly relevant to the business school. In order to add validity to the chosen top three goals, the Delphi method was applied to obtain feedback from subject experts to gain consensus in a scientific process (Taylor, 2020). A sample of six SDGs experts was purposively selected through snowball sampling. The SDGs experts are the experts who had the AACSB accreditation experiences regarding SDGs. Respondents were asked to nominate other experts who they felt might be able to contribute to the study. The reliability of the study is impacted by the panel size between 3 and 11 participants where five experts would be sufficient to reach the satisfactory level of agreement (Dalkey et.al., 1969; Lynn, 1986).

In the first round, the six participants were provided an open-ended response question to identify top three SDGs which are most relevant to the business schools in the higher education setting referring to the 17 SDGs listed on the webpage of United Nations, Department of Economic and Social Affairs Sustainable Development page. The results of the first round revealed a 100% agreement on the top two SDGs: SDG4 and SDG9. For the third SDG, SDG8 was recognized by 66.67% of the panelists. In the second round, SDG4 and SDG 9 were not included since both goals reached the 100% agreement. The panelists were requested to indicate their agreement or disagreement with the third goal referring to the result from the first round. The commonly accepted threshold percentage for the consensus agreement ranges from 70% to 80% (Naughton et al., 2017). The results of the second round finalized the third SDG, SDG8 received an 83.33% agreement. Therefore, SDG4, SDG8, and SDG9 will be the three SDGs examined in this study.

Data Collection and Analysis

This study will be conducted in a US Midwest university.

To evaluate RQ1, we will gather information from faculty members, such as syllabi, course projects, faculty or/ and students' extra-curricular activities and communities' interactions. Then, content analysis will be applied to systematically analyze the text into organized categories and themes which are SDG 4, 8, 9 (Erlingsson & Brysiewicz, 2017).

To evaluate RQ2, we will distribute survey questionnaires via Qualtrics to the business school students. Eight questions modified from Afroz and Ilham (2020) will be used to measure students' SDG knowledge, and an example

question is: I am aware of the fact that to achieve sustainable development, all people in the world must have access to a quality education. Ten questions modified from Zhou, et al (2022) will be used to measure students' SDG attitude, and an example question is: To me, it is important to obtain information about the economy. Twelve questions modified from Afroz and Ilham (2020) will be used to measure students' SDG behavior, and an example question is: I participate in workshops and webinars regarding industry development and innovations. Structural Equation Modelling (SEM) using Smart PLS 4 software will be applied to analyze the relationships among students' SDG knowledge, attitudes, and behaviors.

Expected Results

The results of this study will contribute to the business school moving forward with integration of the sustainable development goals. Based on the findings, the business school will further incorporate SDGs 4, 8, and 9 from multiple aspects, including teaching, research, outreach, and collaboration with non-academic stakeholders creating future leaders who have knowledge of and intend to incorporate sustainable development in their work after graduation.

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Research on the Application of Blockchain Technology in the Quality and Safety of Green Organic Agricultural and Livestock Products: A Case Study of Yak Products in Qinghai Province

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Context:

The study focuses on the application of blockchain technology to improve the quality and safety supervision of green organic agricultural and livestock products, specifically yak products in Qinghai Province, China.

Research aim:

The aim is to construct a quality and safety supervision system integrating blockchain into the existing framework to enhance data security and reliability throughout the yak production stages.

Methodology:

The study utilizes the Fabric technology platform to develop a system involving five stakeholders and a six-tier data collection and processing structure to standardize on-chain data and ensure seamless interaction.

Findings:

The implemented system improves the compliance rate of yak product supervision and inspection, increases market sample inspection compliance, and enhances economic benefits compared to the previous year.

Theoretical importance:

The research contributes by addressing issues in the current quality and safety system, enhancing data security, and providing a transparent system to ensure the quality of yak products, improving their market competitiveness.

Data collection:

Data collection is structured across stakeholders involved in yak production, integrating blockchain technology for secure and standardized data processing.

Analysis procedures:

The study conducts an ERP sandbox simulation to demonstrate the system's impact on compliance rates, market inspections, and economic benefits, showcasing the effectiveness of the implemented quality and safety supervision system.

Questions addressed:

The study addresses challenges of information silos, data distortion, and centralization in yak product supervision. It aims to improve data security, compliance rates, and economic benefits in the green organic agricultural and livestock product industry.

Conclusion:

The study successfully develops a transparent and secure quality safety application system for yak products, enhancing market competitiveness and serving as a valuable reference for similar products. It promotes sustainable development in green agriculture on the Qinghai-Tibet Plateau, China.

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