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A Digital Accounting Framework for Enhancing Solvency and Financial Evaluation in Non-Bank Financial Institutions: Evidence from Egypt

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Abstract

Purpose and Design: This study develops a Digital Accounting Framework grounded in Basel III, the amended Egyptian Accounting Standards (EAS)—particularly those addressing intangible assets—and the recent FRA Board Decree No. 137/2025 on Financial Solvency Standards for Non-Banking Financial Institutions (NBFIs). The purpose is to integrate solvency regulation with accounting and auditing standards to strengthen financial solvency and evaluation in Egypt's NBFI sector. **Method and Approach:** A comparative applied methodology is adopted. First, a regulatory analysis examines FRA Decree 137/2025 and related FRA resolutions on capital adequacy, liquidity, and risk concentration. Second, the study maps Egyptian Accounting Standards against IFRS/IAS benchmarks, focusing on IAS 36 (Impairment), IAS 38 (Intangible Assets), and IFRS 9 (Financial Instruments). Third, applied case studies from Egyptian NBFIs test how a digital accounting framework improves solvency reporting and financial evaluation in digital environments. **Findings:** The results show that incorporating IFRS-aligned digital reporting within the FRA's solvency framework strengthens capital buffers, enhances liquidity monitoring, and improves the valuation of intangible-rich companies. The proposed model reduces inconsistencies between accounting reports and regulatory solvency ratios, while providing FRA and auditors with clearer stress-testing and solvency evaluation tools. **Originality and value:** The study's originality lies in combining: 1) Basel III solvency regulation, 2) Egyptian Accounting Standards (amended for intangibles and fair value), 3) FRA Decree 137/2025 and prior solvency decrees within a single digital accounting and auditing framework. This integrated approach has not been empirically applied in Egypt's NBFIs. **Theoretical, Practical, and Social Implications:** Theoretically, the paper extends solvency research by embedding accounting and auditing standards into prudential regulation. Practically, it provides FRA, auditors, and policymakers with a roadmap for harmonizing solvency ratios with accounting evaluations.

Socially, it promotes investor protection, transparency, and financial stability, reinforcing Egypt's vision for a resilient non-bank financial sector.

Keywords

Digital Accounting, Basel III, Egyptian Accounting Standards, IFRS, FRA Decree 137/2025, Financial Solvency, Financial Evaluation, Non-Bank Financial Institutions, Intangible Assets, Comparative Applied Study, Egypt

1. Introduction

1.1. Background and Context

Non-bank financial institutions (NBFIs) have become a cornerstone of Egypt's diversified financial system. They include microfinance, leasing, factoring, insurance, and mortgage finance companies that collectively support inclusive growth and economic resilience. Over the past decade, NBFIs have expanded access to credit for small and medium enterprises (SMEs) and individuals excluded from the banking sector. However, their growing systemic relevance has exposed weaknesses in capital adequacy, liquidity, and solvency management, requiring an integrated regulatory and accounting response.

The Financial Regulatory Authority (FRA), as Egypt's principal regulator for non-bank financial activities, has undertaken major reforms to ensure transparency, governance, and solvency across all NBFIs. A key milestone was the issuance of the FRA Board Decree No. 137/2025, which established unified solvency requirements aligned with international standards such as Basel III, Solvency II, and IFRS 9 and 17. The decree aims to harmonize capital adequacy, liquidity ratios, provisioning, and disclosure practices among NBFIs. It also supports Egypt's Vision 2030 strategy for financial inclusion and sustainable development.

Solvency represents the capacity of an institution to meet its long-term obligations while maintaining adequate capital buffers and liquidity. It is therefore central to investor confidence, risk stability, and macroeconomic balance (Altman, 2019; IMF, 2020). In the era of digital transformation, solvency management has moved beyond static balance-sheet ratios to data-driven, automated, and predictive approaches that leverage accounting digitalization and regulatory technologies (RegTech and SupTech) (Arner et al., 2020; Chen et al., 2021). Thus, financial reporting accuracy and the digital integration of accounting data now form a crucial part of solvency assessment.

1.2. Problem Statement

Despite these reforms, the Egyptian NBFI sector continues to face solvency challenges. Many institutions exhibit weak capital adequacy ratios, insufficient provisioning, and limited liquidity risk management. Empirical studies (Barth et al., 2020; El-Masry, 2021) reveal inconsistencies between financial reporting under Egyptian Accounting Standards (EAS) and the solvency ratios required by the

FRA, leading to mismatched risk evaluations and delayed regulatory action.

Furthermore, intangible assets such as software, digital platforms, and data repositories are often excluded from solvency calculations, underestimating institutional strength in digital-intensive sectors (Lev, 2018) This disconnect between regulatory and accounting perspectives raises a key problem: the absence of a unified digital accounting framework that links solvency measurement, financial reporting, and regulatory supervision within Egypt's non-bank financial system.

1.3. Research Objectives

This study seeks to address these gaps by:

1) Evaluating the effectiveness of FRA Decree No. 137/2025 in enhancing solvency among Egyptian NBFIs.

2) Comparing the decree's provisions with Basel III, Solvency II, and IFRS frameworks.

3) Designing a digital accounting framework that integrates regulatory solvency standards with accounting and auditing principles.

4) Testing the proposed framework empirically through financial analysis of Egyptian NBFIs.

5) Formulating policy recommendations to strengthen solvency and financial reporting practices.

Through these objectives, the research contributes both theoretically and practically by providing a structured model that integrates prudential regulation with accounting innovation, addressing a crucial gap in Egypt's financial governance landscape.

1.4. Research Questions

To achieve these objectives, the study explores the following questions:

1) To what extent has FRA Decree 137/2025 improved solvency management in Egyptian NBFIs?

2) How do FRA standards compare with Basel III, Solvency II, and IFRS requirements?

3) What are the key deficiencies in integrating solvency assessment with accounting frameworks?

4) How can digital accounting systems enhance solvency monitoring and regulatory reporting?

5) What policy reforms are necessary to ensure sustainable solvency and transparency in NBFIs?

1.5. Scope of the Research

The research focuses on NBFIs operating under FRA supervision, covering the period 2019-2023. It examines a representative sample of 30 institutions across microfinance, leasing, factoring, and insurance. Both quantitative solvency ratios and qualitative regulatory analyses are applied to evaluate the alignment between EAS, IFRS, and FRA requirements. The study's scope includes a comparative as-

sessment between Egypt's regulatory framework and international best practices from the EU, India, and South Africa, reflecting similar emerging market conditions (OECD, 2021; BIS, 2017).

1.6. Structure of the Study

The paper is organized as follows:

1) Introduction: presents the background, problem, objectives, and scope.

2) Literature Review: examines prior studies on solvency, financial regulation, and digital accounting.

3) Theoretical Framework: integrates solvency theories with digital accounting concepts.

4) Digital Accounting Framework: develops the proposed model linking regulation and reporting.

5) Methodology: outlines data collection, variables, and analysis techniques.

6) Results and Discussion: presents empirical findings and comparative analysis.

7) Policy Recommendations: provides practical guidance for regulatory reform.

8) Conclusion: summarizes contributions and future research directions.

This structure maintains a logical progression from conceptual foundations to empirical validation and policy synthesis. It ensures that the proposed digital accounting framework not only contributes to academic literature but also offers a policy tool for regulators, auditors, and NBFI managers to enhance solvency, transparency, and resilience in Egypt's evolving financial sector.

2. Literature Review

2.1. Concept of Financial Solvency

Financial solvency represents the capacity of financial institutions to meet long-term obligations and remain viable under adverse economic conditions. It reflects not only liquidity and profitability but also governance and strategic stability (Altman, 2019; IMF, 2020; Borio, 2021) Solvency combines both quantitative and qualitative dimensions—quantitative through capital adequacy ratios, liquidity coverage, and risk-weighted assets; qualitative through internal controls, management competence, and market discipline (Barth et al., 2020; Gorton & Metrick, 2022; Bushman & Williams, 2015).

Empirical literature emphasizes solvency as a determinant of systemic financial stability. Laeven & Levine (2018) find that capital adequacy significantly reduces contagion risk and enhances confidence in financial markets. Similarly, IMF (2022) reports that countries with stringent solvency supervision exhibit greater resilience during global crises. In emerging markets, inadequate solvency assessment often leads to institutional failures and credit disruptions (Demirgüç-Kunt et al., 2023; Beck & Cull, 2020).

For non-bank financial institutions (NBFIs), solvency is particularly critical due

to the diversity of their business models—leasing, factoring, insurance, and microfinance—each carrying different risk exposures (El-Masry, 2021). Unlike banks, NBFIs rely heavily on non-deposit funding and operate under narrower capital bases, making accurate solvency assessment indispensable for their sustainability and regulatory credibility (Claessens & Kodres, 2015).

2.2. International Standards and Benchmarks

The global regulatory landscape defines solvency through three interlinked frameworks: **Basel III**, **Solvency II**, and **IFRS-based accounting standards**. Each framework governs specific institutional categories but collectively shapes a universal model for solvency evaluation and financial resilience (FSB, 2021), as shown in Table 1.

Table 1. Key international solvency standards.

Framework	Sectoral Focus	Core Ratios/Requirements	Key References
Basel III	Banks & NBFIs	CAR ≥ 12%; LCR ≥ 100%; NSFR ≥ 100%	BIS (2017); IMF (2020)
Solvency II	Insurance	Risk-based capital; actuarial reserves	Eling & Schmeiser (2017)
IFRS 9	Financial instruments	Expected Credit Loss (ECL) approach	IASB (2018)
IFRS 17	Insurance contracts	Actuarial valuation of liabilities	KPMG (2021)

- **Basel III** (BIS, 2017; Demirgüç-Kunt et al., 2022) introduces capital buffers, liquidity standards, and leverage ratios to strengthen systemic stability. It requires a minimum Capital Adequacy Ratio (CAR) of 12%, Liquidity Coverage Ratio (LCR) of 100%, and Net Stable Funding Ratio (NSFR) of 100%. These thresholds ensure institutions maintain sufficiently high-quality liquid assets and stable funding sources to survive market stress scenarios (BCBS, 2023).
- **Solvency II**, applied to insurance entities, emphasizes risk-based capital, actuarial evaluation, and enterprise-wide risk management (Eling & Schmeiser, 2017). It extends solvency oversight to operational, market, and underwriting risks, ensuring a holistic approach to capital requirements.
- **IFRS 9** (IASB, 2018) and **IFRS 17** (KPMG, 2021) provide accounting standards for recognizing expected credit losses (ECL) and valuing insurance contracts respectively. Together, they create a forward-looking accounting foundation that enhances solvency prediction and disclosure.

Comparative analyses by the OECD (2021) and the World Bank (2022) highlight that adherence to these frameworks significantly improves regulatory transparency and investor trust. Integration of prudential and accounting rules reduces regulatory arbitrage, facilitates cross-border supervision, and enhances the comparability of financial statements across jurisdictions (Bischof & Daske, 2023).

2.3. Digital Transformation and Solvency

Technological innovation is reshaping solvency analysis through the emergence of digital accounting systems, RegTech (Regulatory Technology), and SupTech (Supervisory Technology). Arner et al. (2020) demonstrate that automated data integration and predictive analytics enable supervisors to assess solvency positions in real time. These technologies improve compliance monitoring and minimize manual reporting delays, promoting efficiency and accuracy in solvency measurement (Bischof & Daske, 2023; Allen et al., 2022).

The application of **Big Data**, **Artificial Intelligence (AI)**, and **cloud computing** allows financial institutions to detect early signs of solvency distress. Chen et al. (2021) argue that AI-driven models increase precision in credit-risk classification, while PwC (2022) finds that digital reporting strengthens both internal governance and external audit reliability. Deloitte (2023) confirms that digitized solvency processes reduce information asymmetry between regulators and institutions, supporting proactive regulatory intervention (Berg et al., 2020).

In advanced economies, digital solvency systems integrate accounting data into supervisory dashboards, facilitating real-time liquidity and capital tracking. This convergence of accounting and regulation creates a "digital bridge" that allows solvency ratios to be dynamically updated based on transactional data rather than static quarterly reports (Auer, 2019).

Digital transformation thus transcends technology; it redefines institutional behavior and accountability. It pushes NBFIs toward transparent disclosure, better governance, and enhanced investor communication. As the World Bank (2021) notes, economies embracing digital supervision experience more stable non-bank sectors and stronger financial inclusion outcomes (UNCTAD, 2023).

2.4. Egyptian Context and FRA Regulations

Egypt's non-bank financial sector has undergone significant reform and expansion over the past decade. The **Financial Regulatory Authority (FRA)** serves as the unified regulator responsible for insurance, leasing, factoring, microfinance, mortgage, and consumer finance institutions. Despite this institutional consolidation, solvency management practices in many NBFIs remain fragmented and inconsistent with global standards.

Earlier regulatory efforts were dispersed across multiple decrees—each addressing specific sectors without a harmonized solvency model. The issuance of **FRA Board Decree No. 137/2025** marked a turning point. It introduced integrated solvency requirements based on Basel III, Solvency II, and IFRS frameworks, aiming to strengthen capital adequacy, liquidity, and provisioning standards across NBFIs.

The decree specifies uniform risk-weighted capital ratios, liquidity coverage ratios, and provisioning requirements that mirror international practices. It also obliges NBFIs to implement digital reporting mechanisms to ensure timely submission of solvency and liquidity data to the FRA. However, implementation remains uneven among institutions due to differences in digital readiness and ac-

counting infrastructure.

Several empirical studies assess the Egyptian case. Abdel-Khalik (2019) and El-Masry (2021) observe that many NBFIs still apply outdated solvency calculations based on historical-cost accounting rather than fair value. Hassan et al. (2020) argue that this misalignment between accounting and solvency standards leads to underestimation of risk exposure and weak regulatory intervention (Abdel-Baki, 2022).

Moreover, intangible assets—such as brands, licenses, software, and digital platforms—are often excluded from solvency valuations. This exclusion distorts the true financial position of technology-driven institutions (Lev, 2018). EAS amendments have not yet fully addressed the fair-value treatment of intangibles or their interaction with solvency indicators, creating inconsistency between financial statements and regulatory capital reports (Haskel & Westlake, 2018).

Table 2 presents Comparative Literature.

Table 2. Comparative literature: International vs. Egyptian context.

Key Dimension	International Findings	Egyptian Findings	Main References
Capital Adequacy	Basel III CAR ≥ 12% ensures resilience	Many NBFIs below 12%; thin equity buffers	BIS (2017); FRA (2023)
Liquidity Standards	LCR and NSFR strictly applied	Partial compliance; liquidity stress observed	IMF (2020); El-Masry (2021)
Provisioning	IFRS 9 ECL enhances credit loss accuracy	Incomplete IFRS 9 adoption	IASB (2018); Abdel-Khalik (2019)
Digital Reporting	RegTech improves transparency	Slow adoption and manual data exchange	Arner et al. (2020); FRA (2023)
Governance	Independent boards strengthen solvency	Limited oversight and weak enforcement	OECD (2021); Barth et al. (2020)

The comparative review underscores persistent structural and operational gaps between Egyptian NBFIs and international benchmarks. Even though FRA Decree 137/2025 has aligned legal requirements with global frameworks, the practical integration of accounting and solvency systems remains a major challenge.

Additionally, cultural and institutional factors—such as limited financial literacy, resistance to digital transformation, and dependence on manual accounting—slow the reform process. As a result, risk-based supervision is still developing, and stress testing remains largely descriptive rather than model-based. Without digital integration, regulators cannot access real-time solvency metrics, hindering proactive intervention and crisis prevention.

2.5. Gaps in Literature and Study Contribution

The reviewed studies reveal several research gaps that justify the present study.

1) Integration Gap:

While numerous international studies analyze solvency frameworks, few inte-

grate them with accounting and auditing standards in a digital context (Vives, 2021). Most literature treats regulatory and accounting dimensions separately, failing to capture how digital accounting can operationalize prudential standards. This disconnect is especially apparent in emerging markets like Egypt (World Bank, 2023).

2) Empirical Gap:

Existing Egyptian research on NBFI solvency is largely descriptive. Quantitative evaluations of FRA's unified decree are scarce, and there is limited empirical testing of digital accounting's role in solvency enhancement. As Cihak & Suss (2020) note, developing economies often adopt global standards formally but struggle with empirical validation and measurement consistency.

3) Digitalization Gap:

Although international research (Arner et al., 2020; Deloitte, 2023) documents how RegTech and SupTech reshape solvency supervision, few studies explore these tools' implementation within Egyptian NBFIs. The literature lacks a conceptual framework that merges digital accounting with solvency governance at the institutional level (Bhimani & Willcocks, 2019).

4) Comparative Policy Gap:

The global experience—especially in the EU, South Africa, and India—shows that digital solvency systems improve regulatory efficiency (OECD, 2021; World Bank, 2022). Yet Egyptian research has not fully benchmarked local practices against these international cases. A systematic comparative study is needed to identify policy adaptations suitable for Egypt's hybrid financial ecosystem.

5) Conceptual and Theoretical Gap:

Existing theories of solvency primarily focus on banking sectors. The extension of these frameworks to NBFIs remains underdeveloped. There is a need to reinterpret solvency within a digital accounting paradigm that reflects new forms of financial assets and intangible resources (Lev, 2018; Teece et al., 1997).

Accordingly, this study contributes by:

1) Developing a Digital Accounting Framework that integrates regulatory solvency metrics with accounting and auditing standards under FRA supervision.

2) Providing empirical evidence from Egyptian NBFIs on the practical impact of FRA Decree 137/2025.

3) Benchmarking Egypt's solvency and digital transformation against global standards.

4) Offering policy recommendations to enhance FRA's digital supervision and reporting mechanisms.

By bridging the intersection between accounting, regulation, and technology, this research fills a critical void in the literature. It conceptualizes solvency not merely as a financial measure but as a digitally enabled governance function that ensures accuracy, transparency, and resilience in the NBFI sector.

This integrated view aligns with the global transition toward data-driven regulation, where accounting systems and solvency supervision operate as synchro-

nized components of a single digital ecosystem. The outcome is expected to advance both academic understanding and policy design, guiding future research on digital solvency frameworks in Egypt and other emerging markets (Teece, 2024).

3. Theoretical Framework

3.1. Theoretical Foundations of Solvency

The concept of solvency lies at the intersection of **financial stability, risk management, and regulatory economics**. It represents an institution's ability to absorb losses and sustain long-term operations, thereby safeguarding systemic integrity (Altman, 2019; IMF, 2024).

From a structural viewpoint, **Modigliani and Miller's Capital Structure Theory** (Modigliani & Miller, 1963) posits that solvency outcomes depend on the balance between debt and equity, directly influencing cost of capital and resilience during downturns. This perspective has evolved into the **Risk-Based Capital paradigm** underlying global solvency frameworks as shown in **Table 3**.

Table 3. Theories related to solvency.

Theory	Focus	Implication for Solvency	Key References
Capital Structure (M&M, 1963)	Equity vs. Debt balance	Determines capital adequacy and cost of capital	Modigliani & Miller (1963); Altman (2019)
Financial Intermediation	Systemic stability	Adequate capital reduces contagion	Diamond (1984); Holmstrom & Tirole (1997)
Value-at-Risk (VaR)	Market risk measurement	Quantifies solvency resilience under stress	Jorion (2007); Cihak & Suss (2020)
Stress-Testing	Risk-based resilience	Evaluates solvency during crises	BIS (2017); BCBS (2023)
Dynamic Provisioning	Forward-looking reserves	Enhances solvency stability	Laeven & Majnoni (2022); IMF (2024)
Governance Theory	Oversight and control	Ensures financial discipline and transparency	OECD (2024); Hassan et al. (2020)
Institutional Theory	Regulatory legitimacy	Shapes solvency norms and enforcement	DiMaggio & Powell (1983); Arner et al. (2024)

Financial Intermediation Theory (Diamond, 1984; Holmstrom & Tirole, 1997) adds a macro-prudential lens, arguing that sufficient capital buffers mitigate contagion and preserve market confidence. The theory highlights that undercapitalised financial intermediaries can transmit systemic distress, especially in non-bank financial institutions (NBFIs).

In emerging economies such as Egypt, solvency represents not only financial

endurance but also institutional credibility. It links capital efficiency with governance quality, digital readiness, and regulatory trust (Arner et al., 2024; World Bank, 2023). Thus, solvency theory extends beyond balance-sheet metrics to encompass multi-dimensional determinants including digital adaptation and institutional behaviour.

3.2. Capital Adequacy and Risk Management Theories

Capital adequacy remains the nucleus of solvency theory. According to Berger et al. (2017), solvency is a function of risk-weighted assets and the ability of equity to absorb unexpected shocks. **Basel III** translates this concept into operational rules by prescribing capital buffers, leverage ratios, and liquidity thresholds (BIS, 2017; BCBS, 2023).

Risk Management Theories, such as **Value-at-Risk (VaR)** (Jorion, 2007) and **Stress-Testing Models** (Cihak & Suss, 2020), provide analytical mechanisms for quantifying solvency risk. They establish mathematical boundaries for acceptable exposure and capital sufficiency. More recent frameworks emphasise **forward-looking provisioning** under **IFRS 9** and actuarial calibration under **IFRS 17**, which align accounting standards with prudential objectives (IASB, 2021; PwC, 2024).

Furthermore, the **Dynamic Provisioning Theory** (Laeven & Majnoni, 2022) connects cyclical loan-loss reserves to financial resilience. Empirical applications in Spain, Kenya, and India show that predictive provisioning enhances solvency stability (IMF, 2024; Ghosh, 2021). Egypt's FRA Decree 137/2025 implicitly reflects this evolution by integrating risk-based capital and provisioning metrics.

Hence, capital adequacy and risk management theories converge on the principle that solvency is not static but adaptive—a continuous balance between regulatory foresight, financial buffers, and digital intelligence.

3.3. Governance and Institutional Perspectives

Solvency is also a governance phenomenon. **Institutional Theory** (DiMaggio & Powell, 1983) suggests that regulatory structures shape firms' solvency practices through coercive, mimetic, and normative mechanisms. Compliance with capital and liquidity standards becomes institutionalised behaviour rather than reactive compliance (OECD, 2024).

Corporate Governance Theory (Shleifer & Vishny, 1997) extends this logic by emphasising that independent boards, effective audit committees, and transparent reporting systems act as stabilising forces that reinforce solvency. Governance thereby operates as both a **risk-control mechanism** and a **trust-building function** (Barth et al., 2020; Hassan et al., 2020).

Recent empirical studies confirm that countries with strong governance codes exhibit higher capital adequacy and lower insolvency risk (World Bank, 2023; Arner et al., 2024). Within Egypt, the **FRA's governance reforms** under Decree 137/2025 provide a foundation for institutional resilience but remain constrained

by implementation capacity and digital oversight (El-Masry & Abdelsalam, 2021).

Digital governance introduces a new layer to institutional theory: data transparency, algorithmic supervision, and predictive auditing mechanisms extend governance into the digital domain (Deloitte, 2023; OECD, 2024). Thus, solvency governance becomes both human and algorithmic—balancing ethical oversight with computational intelligence.

3.4. Digital Transformation Theories

The digital revolution has redefined solvency management from static capital monitoring to continuous, data-driven resilience. **Technology Acceptance Model (TAM)** (Davis, 1989) explains how decision-makers adopt digital tools such as RegTech, SupTech, and AI-based solvency analytics. Adoption depends on perceived usefulness and ease of integration into existing workflows (Chen et al., 2021).

Dynamic Capabilities Theory (Teece et al., 1997) further asserts that institutions sustain solvency when they can reconfigure resources and processes in response to technological change. This dynamic adaptability distinguishes resilient NBFIs from vulnerable ones (World Bank, 2023; Deloitte, 2024).

Emerging digital frameworks—**Digital Twin Modeling**, **Blockchain Assurance**, and **AI-Driven Stress Testing**—transform traditional solvency concepts into predictive intelligence (PwC, 2024; Arner et al., 2024). These tools allow regulators to simulate capital adequacy, liquidity, and provisioning scenarios in real time. In Egypt's context, such digital integration supports the Financial Regulatory Authority's (FRA) vision of creating a **smart solvency ecosystem** under Decree 137/2025.

3.5. Integrated Theoretical Model of Solvency

To bridge theoretical gaps, this research develops a **Smart Solvency Integration Model (SSIM)**—a unified framework combining financial, governance, and digital theories. It conceptualises solvency as a **dynamic equilibrium** between capital strength, risk management, governance efficiency, and technological agility.

The model rests on four interdependent pillars (**Table 4**).

Table 4. Integrated theoretical model.

Dimension	Underlying Theory	Operationalization in the Study
Capital Adequacy	Capital Structure, Basel III	CAR, capital buffers, leverage ratios
Risk Management	Stress-testing, IFRS 9	ECL models, liquidity and solvency simulations
Governance	Institutional & Governance Theory	Board independence, audit oversight
Digital Readiness	TAM, Dynamic Capabilities	RegTech integration, digital solvency reporting

1) Capital Adequacy Layer: rooted in Modigliani & Miller (1963) and Basel III (BIS, 2017); solvency (S) increases with capital ratio (CAR) and buffer adequacy.

2) Risk Management Layer: derived from IFRS 9 and stress-testing theory (Cihak & Suss, 2020); solvency stability depends on accurate provisioning (PR) and liquidity coverage (LCR).

3) Governance Layer: informed by Institutional and Governance theories (OECD, 2024; Hassan et al., 2020); audit independence (AI) and board oversight (BO) moderate solvency outcomes.

4) Digital Transformation Layer: based on TAM and Dynamic Capabilities (Teece et al., 1997); digital readiness (DR) enhances data transparency and predictive resilience.

Mathematically, the model can be expressed as:

$$S = f(\text{CAR, LCR, PR, AI, BO, DR})$$

where solvency (S) is a nonlinear composite of financial ratios, governance indicators, and digital maturity levels. The functional relationship implies that higher CAR, stronger governance (AI × BO), and advanced digital readiness (DR) yield exponentially higher solvency resilience.

3.6. The Proposed Conceptual Framework: Quantum-Cognitive Solvency Dynamics

Building on these theoretical foundations, the study introduces the **Quantum–Cognitive Smart Solvency Framework (QCSSF)**—a cognitive-analytical model that perceives solvency as a *probabilistic adaptive process* governed by both human and machine intelligence (Arner et al., 2024; Chen & Arner, 2023).

The framework assumes that solvency (S) evolves dynamically through feedback loops between financial and non-financial subsystems. Cognitive algorithms interpret risk signals, while quantum-inspired computing enables multi-scenario simulation. This dual logic enhances accuracy, predictive power, and transparency in solvency regulation as shown in **Table 5**.

Table 5. Key interactions and feedback dynamics.

Interaction	Mechanism	Outcome
Capital ↔ Risk	Risk-weighted buffers adjusted by stress models	Enhanced solvency shock absorption
Governance ↔ Digital	Audit oversight integrated into RegTech analytics	Automated ethical compliance
Digital ↔ Provisioning	AI predicts default probabilities under IFRS 9	Real-time provisioning accuracy
Policy ↔ Market	FRA regulations adaptive to sectoral feedback	Institutional resilience and trust

The **Quantum-Cognitive Equation of Solvency (QCES)** can be symbolically represented as shown in Table 6.

Table 6. Theoretical interactions within the quantum-cognitive solvency framework.

Theoretical Pillar	Core Variable	Interaction Logic	Expected Effect on Solvency
Capital Adequacy Theory	CAR, buffers	Risk-based capital ratio	Positive (+)
IFRS-Based Risk Theory	ECL, LCR	Expected credit loss resilience	Positive (+)
Governance Theory	AI, BO	Oversight and ethical alignment	Positive (+)
Digital Readiness Theory	DR, RegTech index	Predictive supervision and transparency	Strong Positive (++)
Cognitive Integration	Quantum-AI coupling	Scenario-based forecasting	Non-linear multiplier (+++)

$$S_t = \alpha\left(CAR_t + LCR_t\right) + \beta\left(GOV_t \times DR_t\right) + \gamma\left(ECL_t\right) + \varepsilon_t$$

where α, β, γ represent sensitivity coefficients calibrated through Structural Equation Modeling (SEM) in Chapter 7. This formulation captures the multidimensional causality between quantitative (capital, liquidity, provisioning) and qualitative (governance, digitalisation) drivers of solvency.

3.7. Conceptual Synthesis

This chapter established the theoretical nucleus of the research. It integrates capital adequacy, risk management, governance, and digital transformation into a unified solvency paradigm. The proposed **Quantum-Cognitive Smart Solvency Framework (QCSSF)** redefines solvency as a *dynamic*, *learning-oriented*, *and technology-augmented system*—one that aligns financial resilience with digital intelligence and ethical governance.

The framework forms the intellectual foundation for the **empirical validation model** (Chapter 5) and directly informs the **policy implications** discussed in Chapters 7 and 8.

4. Digital Accounting Framework for Solvency & Evaluation

4.1. Introduction to Digital Accounting Framework

Digital accounting has emerged as a transformative force in financial reporting and solvency assessment (Warren et al., 2015). For NBFIs, digital environments facilitate real-time monitoring, integration with regulatory systems, and predictive analytics. The FRA's Decree No. 137/2025 implicitly recognizes this shift but lacks an explicit digital framework. This chapter proposes a smart digital accounting framework to align solvency and evaluation practices with international stand-

ards such as Basel III, Solvency II, and IFRS 9/17 (PwC, 2022; Deloitte, 2023).

4.2. Components of Digital Solvency Framework

The framework consists of four core components as shown in **Table 7**.

Table 7. Components of the digital solvency framework.

Component	Description	Digital Tools	Reference
Capital Adequacy	Real-time CAR monitoring	AI-driven ratio calculators	BIS (2017)
Liquidity	LCR & NSFR integration	Cloud-based dashboards	IMF (2020)
Provisioning	IFRS 9 ECL models	Predictive analytics	IASB (2018)
Insurance Valuation	IFRS 17 actuarial reserves	Actuarial software	KPMG (2021)
Governance	Risk & audit oversight	RegTech & SupTech	OECD (2021)

1) Capital Adequacy Monitoring: automated computation of CAR and buffers.

2) Liquidity Management: integration of LCR and NSFR with real-time reporting.

3) Provisioning & Valuation: dynamic application of IFRS 9 ECL models and IFRS 17 actuarial valuations.

4) Governance & Oversight: digital dashboards for boards, auditors, and FRA regulators (Arner et al., 2020; Chen et al., 2021).

4.3. Integration with Basel III and IFRS Standards

The framework explicitly aligns with:

- Basel III: Capital and liquidity metrics automated via RegTech platforms.
- Solvency II: Application of actuarial models in insurance solvency.
- IFRS 9: Digital modeling of ECL for provisioning.
- IFRS 17: Standardized digital valuation of insurance contracts (Eling & Schmeiser, 2017; IASB, 2018).

This integration ensures that Egyptian NBFIs comply with global requirements and produce comparable solvency reports.

4.4. Role of Intangible Assets and Financial Evaluation

Intangible assets (brands, licenses, software, customer databases) are increasingly critical in NBFIs. Yet, they remain under-evaluated in solvency analysis (Lev, 2018). The framework introduces digital valuation models for intangibles using fair value techniques consistent with IFRS 13 and Egyptian Accounting Standards (EAS). This enhances transparency and comparability in financial evaluation (Barth et al., 2020) as shown in **Table 8**.

Table 8. Intangible assets in solvency evaluation.

Type of Intangible Asset	Valuation Method	Relevance to Solvency	Reference
Brand Value	Discounted cash flow (DCF)	Strengthens capital base	Lev (2018)
Software & Platforms	Replacement cost	Supports digital operations	IFRS 13
Licenses & Permits	Market comparables	Enhances regulatory compliance	IASB (2018)
Customer Data	Data monetization models	Improves valuation accuracy	OECD (2021)

4.5. Comparative Evidence from International Practice

Several countries provide useful benchmarks:

- South Africa (SAM): Digital solvency reporting under Solvency Assessment and Management framework (Eling & Schmeiser, 2017).
- India (NBFC Reforms): Basel III-aligned solvency requirements with phased RegTech adoption (IMF, 2020).
- EU (Solvency II + IFRS 17): Integrated actuarial and digital solvency reporting (OECD, 2021).

Evidence shows that digital integration improves compliance, enhances supervisory efficiency, and reduces systemic risks (PwC, 2022; Deloitte, 2023).

4.6. Summary

This chapter proposed a smart digital accounting framework that integrates solvency, liquidity, provisioning, valuation, and governance within a digital ecosystem. By aligning with Basel III, Solvency II, and IFRS standards, the framework enhances the resilience and transparency of Egyptian NBFIs. Importantly, it introduces the valuation of intangible assets and leverages digital technologies (RegTech, AI, SupTech) to bridge gaps in current FRA regulations.

5. Research Methodology

5.1. Research Design

In alignment with the objectives of the study, the methodology is structured around the following sub-sections: research design, population and sampling, data collection methods, measurement and variables, and ethical considerations. Each section justifies the choices made and links them to international research practices (Sekaran & Bougie, 2020).

The research adopts a mixed-method research design that integrates qualitative and quantitative approaches. This design was chosen to ensure a balanced analysis of regulatory frameworks and empirical evidence (Creswell & Plano Clark, 2017).

The qualitative component focuses on content analysis of regulatory decrees,

Egyptian Accounting Standards (EAS), FRA guidelines, and international frameworks (Basel III, Solvency II, IFRS 9, IFRS 17). This helps to contextualize FRA Decree No. 137/2025 within both local and global benchmarks (Saunders et al., 2019).

The quantitative component relies on case study evidence and financial data from selected NBFIs operating in Egypt. Key solvency ratios (CAR, LCR, NSFR) and stress-testing results are used to evaluate resilience and financial soundness (BIS (2017); IMF, 2020). The integration of statistical tools provides objective evidence to support theoretical insights (Sekaran & Bougie, 2020).

This design also incorporates comparative analysis with successful international experiences (e.g., South Africa's SAM, India's NBFC reforms, EU Solvency II), ensuring that lessons are transferable and policy-relevant for Egypt (OECD, 2021; World Bank, 2022).

Overall, the mixed-method design provides triangulation, enhances validity, and aligns with the research objective of proposing an amended solvency framework for Egyptian NBFIs.

5.2. Population and Sampling

The population of this study comprises non-bank financial institutions (NBFIs) regulated by the Financial Regulatory Authority (FRA) in Egypt, including consumer finance companies, microfinance institutions, leasing and factoring companies, mortgage finance entities, and insurance companies. This population was selected as it represents the entities directly affected by FRA Decree No. 137/2025.

The study adopts a purposive sampling technique (Saunders et al., 2019), focusing on institutions with significant market share and financial reporting transparency. A total of 30 institutions were selected, covering the major NBFI sectors. This ensures adequate representation while allowing for comparative and empirical analysis.

The criteria for inclusion are as shown in Table 9.

Table 9. Sampled institutions (Illustrative).

Sector	Number of Companies	Selection Criteria
Consumer Finance	6	Market share > 10%, financial transparency
Microfinance	8	Licensed MFIs, portfolio size > EGP 200 m
Leasing & Factoring	5	Dual activity companies regulated by FRA
Mortgage Finance	4	Companies with >5 years operations
Insurance & Reinsurance	7	Firms adopting IFRS 17 transition plans
Total	**30**	-

1) Licensed by FRA.

2) Availability of financial statements (2019-2023).

3) Engagement in solvency-related activities (capital adequacy, liquidity, provisioning).

4) Relevance to comparative international benchmarks.

This sample provides a robust basis for empirical testing of solvency indicators, stress-testing, and comparative evaluation with international standards (BIS (2017); IMF, 2020).

5.3. Data Collection Methods

This study employs a combination of primary and secondary data sources to ensure validity and triangulation (Creswell, 2018; Saunders et al., 2019).

Primary Data

Primary data was collected through semi-structured interviews with experts from the FRA, auditors, and executives of selected NBFIs. These interviews focused on solvency requirements, digital reporting readiness, and challenges of implementing Basel III and IFRS standards in Egypt. In addition, a questionnaire was distributed to financial managers of the sampled institutions to gather quantitative evidence on capital adequacy, liquidity practices, and provisioning strategies.

Secondary Data

Secondary data included financial statements (2019-2023) of sampled institutions, FRA decrees and circulars, Egyptian Accounting Standards (EAS), and international benchmarks (Basel III, Solvency II, IFRS 9, IFRS 17). Academic journals and reports from IMF, World Bank, and OECD were also reviewed to enrich the comparative analysis (BIS (2017); OECD, 2021).

5.4. Measurement and Variables

To empirically evaluate solvency and financial resilience, the study adopts a set of independent and dependent variables consistent with international standards (Basel III, Solvency II, IFRS 9, IFRS 17) and FRA regulations (Decree 137/2025) as shown in Table 10.

Table 10. Variables and measurement.

Variable	Type	Measurement/Indicator	Reference
Financial Solvency (SOLV)	Dependent	CAR, LCR, NSFR	BIS (2017), IMF (2020)
Capital Adequacy (CAR)	Independent	Equity/Risk-weighted Assets	Basel III
Liquidity (LIQ)	Independent	HQLA/Net cash outflows	Basel III
Provisioning (PROV)	Independent	ECL models (IFRS 9)	IFRS 9

Continued

Governance (GOV)	Independent	% Independent board members, audit committee	OECD (2021)
Digital Readiness (DIGI)	Independent	RegTech adoption, FRA SupTech linkage	World Bank (2022)
Risk Management (RISK)	Independent	Stress-testing frameworks, contingency plans	BIS (2017)

Dependent Variable

- Financial Solvency (SOLV): Measured by solvency ratios, including Capital Adequacy Ratio (CAR), Liquidity Coverage Ratio (LCR), and Net Stable Funding Ratio (NSFR) (BIS (2017); IMF, 2020).

Independent Variables

1) Capital Adequacy (CAR): Equity capital/risk-weighted assets.

2) Liquidity (LIQ): High-quality liquid assets/net cash outflows.

3) Provisioning (PROV): Loan loss provisions and expected credit loss (ECL) under IFRS 9.

4) Governance (GOV): Percentage of independent board members, existence of audit committee.

5) Digital Readiness (DIGI): Adoption of RegTech systems, reporting integration with FRA's SupTech.

6) Risk Management Practices (RISK): Presence of stress-testing frameworks and contingency funding plans.

These variables were selected to capture both financial indicators and institutional drivers that influence solvency and evaluation.

5.5. Ethical Considerations and Limitations

The study adheres to established research ethics to ensure credibility, transparency, and respect for participants (Resnik, 2020). Informed consent was obtained from interviewees and survey participants, ensuring voluntary participation and confidentiality of responses. Sensitive financial data were anonymized to protect company identity, while compliance with FRA regulations and GDPR principles was strictly maintained. Researcher bias was minimized through triangulation and validation of data across multiple sources (Saunders et al., 2019).

6. Case Studies Analysis

6.1. Introduction to Case Studies

Case studies provide in-depth insights into how solvency frameworks are implemented in practice. For Egyptian NBFIs, examining real cases helps identify gaps in applying FRA Decree No. 137/2025, particularly in relation to Basel III, Solvency II, and IFRS standards (Yin, 2018). This chapter analyzes three representative cases across different sectors to illustrate strengths, weaknesses, and lessons learned as shown in **Table 11**.

Table 11. Overview of case studies.

Sector	Company (Anonymous)	Key Feature	Solvency Relevance
Microfinance	MFI-A	Large outreach (>1 m clients)	High credit risk, IFRS 9 provisioning
Leasing & Factoring	LFC-B	Dual activity firm	Exposure to liquidity mismatch
Insurance	INS-C	Leading insurer	IFRS 17 transition, actuarial reserves

6.2. Selection of Case Studies

The cases were selected purposively from the study's sample of 30 institutions (see Chapter 5). Selection criteria included: 1) regulatory significance, 2) availability of financial data, and 3) diversity of sectors. The final cases represent microfinance, leasing & factoring, and insurance—sectors most directly impacted by solvency requirements (Saunders et al., 2019).

6.3. Case Study 1: Microfinance Institution

Microfinance Institution A (MFI-A) serves over one million clients. While it shows strong outreach and profitability, solvency analysis reveals weaknesses in provisioning practices. IFRS 9 adoption remains partial, with reliance on incurred-loss models instead of forward-looking ECL (Abdel-Khalik, 2019). Stress-testing indicates vulnerability to credit shocks, particularly under inflationary conditions. The institution highlights the importance of integrating digital credit scoring tools and IFRS 9-compliant provisioning to enhance solvency (IMF, 2020).

6.4. Case Study 2: Leasing & Factoring Company

Leasing & Factoring Company B (LFC-B) operates as a dual activity firm. Its capital adequacy ratio (CAR) is above the FRA minimum (12%), yet liquidity coverage ratio (LCR) is frequently below 100%, reflecting maturity mismatches between receivables and obligations (El-Masry, 2021). Digital dashboards for liquidity monitoring are absent, weakening compliance with Basel III. This case demonstrates the urgency of RegTech adoption to ensure real-time liquidity management.

6.5. Case Study 3: Insurance Company

Insurance Company C (INS-C) is among the largest insurers in Egypt, currently transitioning to IFRS 17. The company has invested in actuarial systems, but solvency analysis reveals underestimation of long-term liabilities. Stress-testing under Solvency II models shows that reserves fall short by nearly 8% under extreme scenarios (Eling & Schmeiser, 2017). Governance structures, particularly audit committees, are also weak, limiting oversight over solvency practices.

6.6. Comparative Insights

Comparing the three cases reveals several themes:

- Microfinance struggles with provisioning and credit risk.
- Leasing & Factoring face liquidity mismatches and weak digital monitoring.
- Insurance suffers from gaps in actuarial valuation and governance.

These insights align with international findings where NBFIs in emerging markets face systemic weaknesses in solvency compliance (OECD, 2021; World Bank, 2022). Importantly, all cases highlight the absence of integrated digital frameworks as a critical limitation.

7. Empirical Findings and Results

7.1. Data Analysis Framework

This study employs a mixed-methods comparative empirical design integrating quantitative, qualitative, and benchmarking approaches to evaluate the solvency implications of FRA Decree 137 (2025) for Egyptian non-bank financial institutions (NBFIs). The framework aligns descriptive evidence with hypothesis testing (H - H5), ensuring results are both theory-driven and policy-relevant (Saunders et al., 2019; Creswell, 2018; Yin, 2018).

Quantitative strand. Financial-ratio analysis covers Capital Adequacy (CAR), Liquidity Coverage (LCR), Net Stable Funding (NSFR), and leverage. Statistical tools include descriptive analysis, t-tests, regression, and stress-testing. Panel regression models link solvency outcomes with provisioning adequacy, governance quality, digital adoption, and firm size (Bryman, 2016; Barth et al., 2020; FSB, 2023; BIS, 2024).

Qualitative strand. Semi-structured interviews with regulators, auditors, and executives capture institutional challenges, governance gaps, and technological readiness. Coding follows thematic analysis principles using NVivo (El-Masry & Abdelsalam, 2021; IAASB, 2023).

Benchmarking strand. Findings are compared with Basel III, EU Solvency II, South Africa's SAM, India's NBFC reforms, and Kenya's MFI supervision, providing global calibration (World Bank, 2021; RBI, 2023; SARB, 2024; EIOPA, 2024; IMF, 2024; WEF, 2022). This triangulated framework secures analytical rigour and international comparability.

7.2. Research Hypotheses

To evaluate regulatory effectiveness, five testable hypotheses were formulated:

- H1: Capital Adequacy: Egyptian NBFIs maintain CAR below FRA and international benchmarks.
- H2: Liquidity: Liquidity mismatches persist, with LCR and NSFR below 100 %.
- H3: Provisioning: Weak IFRS 9 ECL implementation undermines solvency.
- H4: Digital Transformation: RegTech/InsurTech adoption strengthens solvency compliance.
- H5: Governance and Audit: Stronger governance and ISA-based oversight en-

hance solvency resilience.

These hypotheses are tested sequentially through descriptive statistics (7.3), benchmarking (7.4), stress testing (7.5), regression analysis (7.6), and qualitative triangulation (7.7).

7.3. Descriptive Analysis of Solvency Indicators

Descriptive statistics provide initial evidence on whether NBFIs meet FRA 137/2025 thresholds and international prudential norms (BCBS, 2023; EIOPA, 2024) as shown in Table 12.

Table 12. Descriptive overview of solvency indicators.

Indicator	FRA Threshold	Leasing	Factoring	MFIs	Insurance	Consumer Finance
CAR (%)	≥12	11 - 13	≈11	9 - 11	13 - 15	10 - 11
LCR (%)	≥100	95 - 100	85 - 95	80 - 95	~100	90 - 95
NSFR (%)	≥100	90 - 95	85 - 95	75 - 95	100 - 105	85 - 95
Leverage (×)	≤10	8 - 12	8 - 12	5 - 7	6 - 8	10 - 12
IFRS 9 ECL	Full	Partial	Weak	Weak	Strong (IFRS 17)	Weak

1) Capital Adequacy (CAR) —Testing H1

- Regulatory threshold: CAR ≥ 12% (FRA).
- Observation: Leasing/factoring ≈ 11% - 12%; MFIs/consumer finance ≈ 9% - 11%; large insurers ≈ 13% - 15%.
- Interpretation: H1 supported—most sectors remain undercapitalised relative to FRA and Solvency II benchmarks (≈ 18% - 20%).

2) Liquidity (LCR and NSFR)—Testing H2

- Thresholds: LCR ≥ 100%, NSFR ≥ 100%.
- Observed: Factoring & MFIs (LCR 85% - 95%, NSFR 75% - 95%), consumer finance (90% - 95%), leasing (95% - 100%), insurance (~100%).
- Inference: H2 confirmed—systemic liquidity mismatches persist, particularly among smaller MFIs and factoring firms (PwC, 2022; WEF, 2024b).

3) Leverage Profile

- Constraint: FRA ceiling ≤ 10× equity.
- Observed: Leasing and consumer finance often 10 - 12×; MFIs 5 - 7×; insurers 6 - 8×. High leverage intensifies fragility (BIS, 2024).

4) Provisioning and Credit Risk—Testing H3

- Requirement: Full IFRS 9 ECL adoption.
- Finding: Under-provisioning is common in factoring, MFIs, and consumer finance; insurers are more compliant via IFRS 17 (El-Masry & Abdelsalam, 2021; IASB, 2023; EFRAG, 2024).
- Conclusion: H3 validated—weak ECL practices remain a key solvency constraint.

5) Actuarial Reserves (IFRS 17)

Larger insurers apply best-estimate liabilities and risk margins, whereas smaller firms face capacity shortages (Hassan et al., 2020; SOA, 2023).

Summary:

Descriptive evidence supports H1 - H3 and provides the baseline for benchmarking (7.4) and regression testing (7.6).

7.4. Comparative Benchmarking against FRA Requirements

While descriptive evidence identified overall solvency weaknesses, this section benchmarks each sector's performance against FRA Decree 137 (2025) and global prudential regimes—Basel III, Solvency II, SAM, and India's NBFC reforms (World Bank, 2021; BCBS, 2023; RBI, 2023; EIOPA, 2024; SARB, 2024).

1) Capital Adequacy—H1

The FRA mandates a minimum CAR of 12 per cent.

Empirical results show:

- Leasing and factoring firms: ≈55% non-compliant.
- MFIs: ≈70% below threshold.
- Consumer finance: ≈60% non-compliant.
- Insurance: ≈35% non-compliant (small insurers most affected).

By contrast, EU Solvency II requires solvency margins of 18 - 20 per cent (EIOPA, 2024).

Hence, H1 is confirmed—systemic undercapitalisation persists across Egyptian NBFIs (IMF, 2024; IFC, 2023).

2) Liquidity Coverage—H2

Thresholds of LCR ≥ 100% and NSFR ≥ 100% remain unmet for many entities.

Findings reveal: factoring and MFIs show only 25% - 30% compliance, consumer finance ≈ 40%, leasing ≈ 60%, and insurance ≈ 70%.

Compared with South Africa's SAM and India's NBFC rules (which impose stress-tested liquidity reserves for six months), FRA's enforcement is nascent (World Bank, 2021; RBI, 2023; SARB, 2024).

Thus, H2 is strongly supported—liquidity mismatches are systemic.

3) Provisioning and Risk Management—H3

Although FRA requires full IFRS 9 compliance, ≈65% of factoring and consumer finance firms and ≈70% of MFIs fail to reach adequate provisioning levels.

Insurance firms perform better under IFRS 17, yet small entities lag behind.

Internationally, the EU and Kenya mandate real-time credit-risk scoring and ECL stress tests (EFRAG, 2024; World Bank, 2021).

Hence, H3 is confirmed—weak provisioning undermines solvency across sectors.

4) Integrated Benchmarking Insights

Highest compliance appears in insurance and large leasing firms; lowest in MFIs and consumer finance. Overall, benchmarking underscores the need for a stronger supervisory culture and digital reporting infrastructure (Arner et al., 2024;

OECD, 2024).

7.5. Stress Testing Results

Stress testing provides a forward-looking assessment of resilience under three macro-financial shocks required by FRA 137 (2025):

1) Interest-rate increase (+500 bps), 2) credit-default shock (+20% in household and MFI defaults), and 3) liquidity shock (−25% in short-term funding).

Key Sectoral Responses as shown in Table 13.

Table 13. Average stress-test impact on solvency ratios.

Shock Scenario	Leasing	Factoring	MFIs	Insurance	Consumer Finance
Interest +500 bps	−2% CAR	−3% CAR	−3% CAR	−1% CAR	−4% CAR
Credit +20%	−2% CAR	−3% CAR	−4% CAR	−1% CAR	−3.5% CAR
Liquidity −25%	−15% LCR	−20% LCR	−25% LCR	−5% LCR	−20% LCR

- Interest-rate shock: CAR declined 2 - 3 p.p. for leasing, 3 p.p. for factoring, and >4 p.p. for consumer finance. Insurers show relative resilience.
- Credit shock: MFIs' CAR fell from 10% to 7%; consumer finance down 3 - 4 p.p.; factoring exposed to SME defaults. Insurers absorbed losses via actuarial reserves (El-Masry & Abdelsalam, 2021).
- Liquidity shock: LCR fell to 65% - 70% for MFIs and factoring; to 75% - 80% for consumer finance; insurance barely affected due to portfolio buffers (BIS, 2024).

Interpretation. Stress tests confirm:

- H1 indirectly—capital fragility persists.
- H2 strongly—liquidity vulnerability is systemic.
- H3 supported—weak provisioning magnifies losses.
- Egypt's pattern resembles India's early NBFC crisis and South Africa's pre-SAM vulnerabilities (IMF, 2024; BIS, 2024).

7.6. Regression and Correlation Analysis

This section provides formal statistical validation of the hypotheses through panel regressions and correlation tests across the five NBFI sectors.

Model Specification as shown in Table 14.

Table 14. Panel regression outcomes.

Variable	β	t	p	Hypothesis
Capital Adequacy (CAR)	0.41	3.85	0.001	H1 confirmed
Liquidity (LCR/NSFR)	0.36	2.92	0.004	H2 confirmed
Provisioning (IFRS 9)	0.52	4.11	<0.001	H3 strongly confirmed
Digital Adoption Index	0.29	2.35	0.018	H4 confirmed
Governance Quality	0.44	3.67	0.001	H5 confirmed

$$\text{Solvency}_{it} = \alpha + \beta_1 \text{CAR}_{it} + \beta_2 \text{Liquidity}_{it} + \beta_3 \text{Provisioning}_{it} + \beta_4 \text{DigitalAdoption}_{it} + \beta_5 \text{Governance}_{it} + \epsilon_{it}$$

Dependent variables include CAR, LCR, and NSFR; independent variables represent provisioning adequacy (IFRS 9), digital adoption index, governance quality, and firm size. Hausman tests determined fixed-effects appropriateness (Saunders et al., 2019; Chiu & Taylor, 2023).

Correlation Matrix (Highlights)

- CAR × Provisioning r = 0.62 ($p < 0.01$).
- Liquidity × Digital Adoption r = 0.47 ($p < 0.05$).
- Governance × Solvency r = 0.55 ($p < 0.01$).
- Firm Size × Solvency positive and significant (IMF, 2024).

Regression Results

Model fit: $R^2 = 0.67$; Adj. $R^2 = 0.64$; $F = 21.8$ ($p < 0.001$).

Interpretation

All five hypotheses are supported. Provisioning (IFRS 9) emerges as the strongest predictor of solvency, followed by governance and capital adequacy. Digital adoption also shows a positive, statistically significant association, reinforcing RegTech and InsurTech importance (Arner et al., 2024; EBA, 2024; OECD, 2024).

7.7. Qualitative Findings from Interviews

While quantitative analyses validated solvency challenges statistically, qualitative evidence enriched contextual understanding through semi-structured interviews with regulators, auditors, and senior executives from leasing, factoring, MFIs, insurance, and consumer-finance firms.

Themes were extracted via NVivo-assisted thematic coding (Braun & Clarke, 2019; Denzin, 2012; IAASB, 2023).

1) Regulators' Insights

Officials from the Financial Regulatory Authority (FRA) acknowledged that Decree 137/2025 advanced prudential thresholds and partial convergence with Basel III and Solvency II.

However, three weaknesses remain:

1) Fragmented data infrastructure;

2) Delayed digital reporting; and

3) Limited supervisory analytics for MFIs and consumer finance.

4) They recommended RegTech dashboards and risk-based supervision aligned with global peers (Arner et al., 2024; BIS, 2024).

2) Auditors' Perspectives

External auditors observed tangible improvements in IFRS 9 and 17 implementation—especially among insurers—but under-provisioning persisted in factoring and consumer-finance entities.

They emphasised stronger mandates under ISA 315, 540, and 570, and greater auditor access to real-time credit data (El-Masry & Abdelsalam, 2021; IAASB, 2023; PwC, 2024).

3) Executives' Perspectives

Leasing executives cited rising leverage costs and competition; MFI managers expressed concern that FRA's thresholds may constrain outreach to low-income borrowers; insurers identified an actuarial-skills shortage; consumer-finance heads highlighted liquidity fragility and reliance on wholesale funding.

Across groups, consensus emerged that phased digital adoption and capacity-building are prerequisites for sustainable solvency compliance (IMF, 2024; OECD, 2024).

4) Cross-Stakeholder Synthesis

Stakeholders agreed that digital transformation enhances solvency oversight but diverged on its pace and cost.

Collectively, the interviews confirm that governance quality, data reliability, and professional competence are decisive enablers of Decree 137/2025's success.

7.8. Cross-Sector Comparative Findings

Integrating all empirical strands—descriptive, benchmarking, stress-testing, regression, and interviews—provides a holistic comparison across the five NBFI sectors, benchmarked to Basel III, Solvency II, SAM, and NBFC India frameworks as shown in Table 15.

Table 15. Cross-sector comparative solvency insights (Condensed).

Sector	Strengths	Weaknesses	Policy Lesson
Leasing	Large firms approach CAR 12% - 13%; moderate liquidity	High leverage (8 - 12× equity) in smaller entities	Gradual leverage caps with transitional relief
Factoring	Growing SME market integration	Liquidity mismatch and weak IFRS 9 ECL	Mandatory liquidity stress tests and digital provisioning models
MFIs	Broad financial-inclusion reach	Lowest CAR and NSFR (≤90%)	Tailored solvency thresholds and capacity building
Insurance	IFRS 17 adoption and sound CAR (13% - 15%)	Actuarial skill deficit in small insurers	Expand actuarial training and risk-based regulation
Consumer Finance	Rapid market growth	Weak CAR (≈10%), funding concentration	Diversify funding sources and tighten IFRS 9 enforcement

Summary of Hypotheses Validation (H1 - H5).

H1 - H3 are empirically confirmed across datasets; H4 (digital adoption) and H5 (governance) are substantiated by qualitative triangulation.

Firms with higher digitalisation and independent audit committees exhibit measurably stronger solvency ratios (Chiu & Taylor, 2023; EBA, 2024; FSB, 2023).

7.9. Policy Implications from Results

The integrated analysis demonstrates meaningful progress under FRA 137/2025 but highlights persistent solvency asymmetries.

Key implications and global analogues are summarised below in Table 16.

Table 16. Mapping findings to policy implications.

Finding (H1 - H5)	Policy Action	International Benchmark
H1: Undercapitalisation	Introduce graduated capital buffers (+2% - 4%) and counter-cyclical rules	Basel III (BCBS, 2023)
H2: Liquidity deficits	Mandate quarterly stress tests and liquidity facilities for NBFIs	SAM/NBFC India (RBI, 2023)
H3: Weak provisioning	Digital ECL monitoring via RegTech platforms	EU ECL stress tests; Kenya MFIs (World Bank, 2021)
H4: Digital readiness	Deploy centralised API-based solvency reporting systems	Singapore MAS (2023); EBA (2024)
H5: Governance quality	Strengthen ISA audit mandates and board independence criteria	OECD Governance Framework (2024)

Strategic Perspective

A phased digital transition, reinforced professional accreditation, and data-governance reform are pivotal to sustain compliance.

By 2030, the proposed SMART-based solvency governance model could position Egypt's NBFIs among emerging-market leaders in regulatory quality and technological resilience (IMF, 2024; OECD, 2024; BIS, 2024; WEF, 2024a).

8. Discussion and Interpretation

8.1. Introduction

This chapter interprets and integrates the empirical findings presented in Chapter 7 with the theoretical and empirical literature established in Chapter 2 and the proposed conceptual framework in Chapter 3. The results confirmed the five hypotheses (H1 - H5) regarding capital adequacy, liquidity, provisioning, digital transformation, and governance in Egyptian non-bank financial institutions (NBFIs). The discussion expands the meaning of these results through three complementary dimensions:

1) Analytical—evaluating the implications of solvency and risk-based supervision;

2) Comparative—positioning Egypt's outcomes against international frameworks such as Basel III, Solvency II, and the South African SAM model; and

3) Normative—extracting regulatory and institutional lessons for FRA reforms and emerging-economy contexts (BCBS, 2023; World Bank, 2023; IMF, 2024; Bhimani & Willcocks, 2019).

The objective of this discussion is to synthesise the empirical patterns into theoretical coherence and regulatory relevance. The findings demonstrate that the FRA Decree 137/2025 initiated a transformative stage in solvency regulation, yet persistent gaps in capital, liquidity, provisioning, and governance hinder full convergence with global standards (OECD, 2024; Barth et al., 2020; Demirgüç-Kunt et al., 2021).

8.2. Revisiting Research Hypotheses (H1 - H5)

The empirical findings validated all proposed hypotheses, confirming that solvency resilience is multi-dimensional.

- H1 (Capital Adequacy): Most Egyptian MFIs and consumer finance firms remain undercapitalised, averaging 9% - 11% CAR, below the FRA's 12% threshold. The results align with global findings that undercapitalisation is endemic to emerging non-bank systems (Ahmed & El-Sayed, 2022; Ghosh, 2021; FSB, 2022).
- H2 (Liquidity): Systemic mismatches were identified, with LCR and NSFR values below 100%. Similar liquidity fragility was reported by IMF (2024) in African NBFCs (Allen et al., 2021).
- H3 (Provisioning): Under-provisioning under IFRS 9 was widespread, confirming the ECL model's incomplete implementation (El-Masry & Abdelsalam, 2021; IASB, 2021; Bischof et al., 2021).
- H4 (Digital Transformation): Firms employing digital reporting tools achieved better solvency and compliance, consistent with RegTech evidence from Singapore and the EU (Arner et al., 2024; MAS, 2023; EBA, 2022).
- H5 (Governance): Stronger audit oversight and independent boards enhanced solvency performance, supporting OECD (2024) governance principles and ISA-based oversight (Hassan et al., 2020; Kirkpatrick, 2021).

These outcomes collectively demonstrate that solvency stability depends on the simultaneous enforcement of capital, liquidity, provisioning, digital, and governance dimensions, rather than any single reform pillar (Vives, 2021).

8.3. Capital Adequacy and Financial Stability

Capital adequacy represents the cornerstone of solvency supervision. FRA Decree 137/2025 raised the minimum CAR to 12%, aligning partially with Basel III; however, empirical evidence revealed that smaller MFIs and consumer finance firms remain structurally undercapitalised. Their limited equity bases and high leverage magnify vulnerability during credit downturns (BCBS, 2023; Ahmed & El-Sayed, 2022; Borio, 2021).

Comparatively, India's NBFC reforms after 2019 and South Africa's SAM implementation show that tiered capital regimes and counter-cyclical buffers enhance resilience (Ghosh, 2021; Barth et al., 2020; IMF, 2022). Egypt's experience supports the view that solvency reform must be phased, sector-specific, and risk-sensitive. FRA should adopt progressive CAR increments, link them to firm-size

categories, and disclose capital ratios publicly to strengthen market discipline (World Bank, 2023).

The findings also confirm the risk-absorption gap predicted by Basel III theory: weak capital undermines shock absorption, intensifies credit cycles, and elevates systemic risk (BIS, 2024; Adrian et al., 2020). Therefore, capital regulation should be reinforced through mandatory buffers and governance-linked equity policies.

8.4. Liquidity and Risk Resilience

Liquidity mismatches emerged as a structural solvency weakness across factoring, microfinance, and consumer-finance sectors. Average LCRs between 85% - 95% and NSFRs below 90% signify that many institutions could not sustain funding under stress scenarios (IMF, 2024; Gorton & Metrick, 2020). Similar liquidity fragility precipitated India's 2018-2019 NBFC crisis and pre-reform failures in South Africa (Ghosh, 2021; World Bank, 2023).

From a theoretical perspective, the results validate the liquidity-risk propagation model: short-term wholesale funding without stable deposits leads to contagion and loss of confidence (BIS, 2024; Brunnermeier & Oehmke, 2021). Egypt's regulatory challenge thus lies not in rule-setting but in implementation and stress testing. FRA should enforce forward-looking liquidity audits, diversify funding instruments (such as securitisation and bonds), and create a liquidity-support facility analogous to a central-bank lender-of-last-resort (OECD, 2024; BCBS, 2023).

Ultimately, liquidity resilience complements capital adequacy. Without consistent funding buffers, even solvent firms face rapid collapse—a pattern confirmed across emerging markets.

8.5. Provisioning, Risk Management, and IFRS 9

Provisioning for credit losses is fundamental to solvency and financial sustainability. Under FRA Decree 137/2025, all non-bank financial institutions (NBFIs) must apply IFRS 9 Expected Credit Loss (ECL) models. However, empirical evidence confirmed chronic under-provisioning, particularly in microfinance and consumer finance firms, validating H3. Weak provisioning practices mask real credit risk and inflate short-term profitability (El-Masry & Abdelsalam, 2021; Abad & Suárez, 2020).

Internationally, the European Union has adopted real-time provisioning through digital stress testing, while Kenya's regulators integrate ECL scoring into digital credit models (World Bank, 2023; IMF, 2024). Theoretically, these practices support a forward-looking risk recognition framework, shifting provisioning from reactive to preventive (IASB, 2021). For Egypt, this means embedding automated provisioning analytics within supervisory RegTech platforms and linking ECL adequacy to solvency ratios.

Policy implications are clear: FRA should establish a digital provisioning validation system, require auditor certification of ECL models, and impose financial penalties for under-provisioning. In practice, this will enhance capital quality, re-

duce contagion risks, and improve investor confidence (PwC, 2024; BCBS, 2023).

8.6. Digital Transformation and Smart Regulation

Digital transformation is now a decisive factor in achieving solvency resilience. The study confirmed H4: institutions adopting digital reporting and monitoring tools display higher compliance with CAR, LCR, and ECL benchmarks. Digital adoption improves transparency, timeliness, and early warning capacity (Arner et al., 2024; Frost et al., 2022).

RegTech and SupTech innovations, such as automated solvency dashboards and API-based data interfaces, are transforming supervisory ecosystems (MAS, 2023). These digital tools enable continuous monitoring, predictive analytics, and real-time interventions (IMF, 2024; Auer et al., 2021). Singapore's Monetary Authority (MAS) and the European Insurance and Occupational Pensions Authority (EIOPA) have demonstrated the success of these systems in strengthening prudential control (World Bank, 2023).

For Egypt, digital readiness remains a constraint, but FRA's roadmap can prioritise phased adoption—beginning with high-impact areas like solvency dashboards and automated liquidity reporting. RegTech implementation is not merely technological; it reshapes governance, accountability, and institutional trust (OECD, 2024).

Digitalisation thus represents both a compliance accelerator and a resilience enhancer, aligning Egypt's regulatory infrastructure with the global shift toward smart supervision.

8.7. Governance, Audit Oversight, and Institutional Trust

Governance and audit oversight determine the behavioural and ethical foundations of solvency regulation. The empirical results validated H5: firms with strong governance and independent audit committees recorded superior solvency and provisioning performance (Hassan et al., 2020; IAASB, 2023). This aligns with agency theory, which argues that governance mitigates opportunistic risk-taking and promotes stakeholder protection (OECD, 2024; World Economic Forum, 2022).

Audit quality is equally critical. Effective implementation of ISA 315, 540 and 570 enhances solvency verification, particularly in provisioning and going-concern evaluations (IAASB, 2023). Comparative evidence shows that countries like South Africa and India incorporated governance modules into solvency regulations post-crisis, strengthening investor confidence (Barth et al., 2020; Ghosh, 2021).

For Egypt, governance reform should move beyond formal compliance toward functional independence. FRA should enforce minimum independence ratios (≥50% of directors), mandatory audit committees, and public disclosure of governance practices. Transparent oversight will consolidate institutional trust and international credibility.

8.8. Alignment with International Literature

To contextualise the findings, this section contrasts the study's outcomes with prior literature on solvency, risk, and digital transformation. The comparison reveals convergence with most international frameworks, confirming that Egypt's experience mirrors broader emerging-market dynamics (IMF, 2024; OECD, 2024) as shown in Table 17.

Table 17. Alignment of results with international literature.

Theme	Findings of This Study	Agreement with Literature	Contradiction with Literature
Capital Adequacy (H1)	Undercapitalisation in MFIs and consumer finance	Matches Ghosh (2021); Barth et al. (2020)	Insurers stronger than peers, weaker than Solvency II
Liquidity (H2)	Systemic mismatches	Aligns with IMF (2024); BIS (2024)	Leasing firms show better resilience
Provisioning (H3)	Weak IFRS 9 implementation	Confirms IASB (2021); World Bank (2023)	IFRS 17 compliance stronger in insurance
Digital Adoption (H4)	Higher solvency via digital tools	Consistent with Arner et al. (2024); MAS (2023)	Lag in digital maturity
Governance (H5)	Strong boards improve solvency	OECD (2024); Hassan et al. (2020)	FRA enforcement incomplete

Agreements:

- Undercapitalisation in MFIs and consumer finance aligns with India's NBFC patterns (Ghosh, 2021).
- Liquidity mismatches replicate vulnerabilities documented by BIS (2024) and IMF (2024).
- Weak IFRS 9 implementation echoes EU transitional difficulties (IASB, 2021).
- RegTech adoption effects support Arner et al. (2024) on efficiency and compliance.
- Governance–solvency relationships match OECD (2024) and Hassan et al. (2020).

Contradictions:

- Egyptian insurers outperform many African peers but remain below Solvency II levels (World Bank, 2023).
- FRA's governance enforcement remains weaker than OECD benchmarks.
- Digital maturity lags behind Singapore and EU standards (MAS, 2023).

8.9. Theoretical Contributions

The present research contributes substantially to advancing solvency regulation, accounting, and auditing theory within emerging financial systems.

First, it extends solvency regulation theory beyond banking by adapting Basel III and Solvency II concepts to non-bank financial institutions (NBFIs). Prior

studies (BCBS, 2023; Barth et al., 2020) emphasised bank-centric solvency tools, whereas this research demonstrates the feasibility of a multi-sectoral solvency model applicable to mixed economies such as Egypt's.

Second, the study integrates digital accounting and RegTech within solvency theory, showing that digitalisation not only enhances efficiency but reshapes regulatory accountability (Arner et al., 2024; MAS, 2023). The theoretical novelty lies in conceptualising digital reporting as a determinant of solvency performance rather than a mere compliance tool.

Third, it establishes a theoretical bridge between provisioning standards (IFRS 9 and IFRS 17) and solvency resilience. While provisioning has traditionally been treated as an accounting adjustment, this research redefines it as a strategic instrument for financial stability (IASB, 2021; PwC, 2024).

Finally, it contributes to governance and institutional trust theory, empirically validating that board independence and audit oversight directly enhance solvency outcomes (OECD, 2024; Hassan et al., 2020). These theoretical advancements collectively underpin a new conceptual construct—the Smart Resilient Solvency Framework (SRSF)—which integrates risk-based regulation, digital supervision, and governance ethics into a coherent model for emerging economies.

8.10. Practical and Policy Contributions

Beyond theory, this research offers actionable implications for regulators, auditors, and NBFI executives. FRA Decree 137/2025 can become a transformative milestone if supported by operational alignment, digital enforcement, and capacity building as shown in **Table 18**.

Table 18. Practical and policy contributions.

Stakeholder	Practical Contribution	Policy Contribution	International Benchmark
FRA Regulators	Implement digital solvency dashboards; monthly stress testing	Tiered CAR and liquidity buffers	Basel III; Solvency II; SAM
Auditors	Verify CAR, LCR, and provisioning ratios using AI tools	Enforce IFRS 9/17 validation through ISA 540	IAASB (2023); PwC (2024)
NBFI Managers	Build internal liquidity and equity buffers	Integrate governance into decision systems	OECD (2024); Arner et al. (2024)

These contributions highlight that solvency reform in Egypt requires regulatory coordination, audit modernization, and digital adoption to achieve sustainable compliance and investor trust (World Bank, 2024).

8.11. Policy and Practical Recommendations

The findings support both macro-policy adjustments and micro-level institutional

reforms.

Regulators should adopt a phased digital solvency strategy combining capital, liquidity, provisioning, and governance enforcement. FRA must also establish a RegTech innovation hub linking academia, industry, and international partners (World Bank, 2023) as shown in **Table 19**.

Table 19. Summary of policy and practical recommendations.

Level	Recommendation	Expected Impact	Reference
FRA	Amend Decree 137/2025 to include RegTech reporting	Modernised supervision	OECD (2024)
FRA	Phased Basel III implementation for NBFIs	Stronger capital and liquidity	BCBS (2023)
FRA	Mandatory IFRS 9 & 17 compliance	Accurate provisioning and valuation	IASB (2021)
NBFIs	Adopt API-based solvency reporting	Real-time risk detection	MAS (2023)
NBFIs	Strengthen governance and audit independence	Enhanced solvency trust	Hassan et al. (2020)

9. Conclusion, Limitations, and Future Directions

9.1. Conclusion

This study critically evaluated the financial solvency framework for Egyptian non-bank financial institutions (NBFIs) in light of FRA Decree No. 137/2025, which unified solvency standards across sectors. By integrating international benchmarks such as Basel III, Solvency II, and IFRS 9/17, the research developed a smart digital accounting framework for solvency and financial evaluation.

The findings revealed that, while Decree 137/2025 represented a milestone in regulatory reform, gaps remain in practice. Case studies showed that microfinance institutions face challenges in provisioning, leasing and factoring companies in liquidity management, and insurance firms in actuarial valuation and governance. Empirical results confirmed that solvency ratios are often below global thresholds and that digital adoption is limited.

The proposed framework emphasizes:

1) Digitalization of solvency monitoring through RegTech and SupTech.

2) Integration of intangible assets valuation into solvency assessments.

3) Adoption of international standards (Basel III, IFRS 9/17, Solvency II).

4) Strengthening governance structures across NBFIs.

Overall, the study provides a roadmap for Egypt to modernize its regulatory framework, enhance resilience, and align with international best practices (OECD, 2021; World Bank, 2022).

9.2. Limitations of the Study

Several limitations must be acknowledged:

- Sample coverage: The analysis focused on 30 institutions, which, while representative, does not capture all Egyptian NBFIs.
- Timeframe: The study used financial data from 2019-2023, which may not fully reflect post-2025 developments.
- Self-reported data: Interviews and surveys may involve bias.
- Dynamic regulations: Financial frameworks evolve rapidly; thus, recommendations must be continuously updated (Cihak & Suss, 2020).

Despite these limitations, the methodology ensured validity through triangulation of qualitative and quantitative data.

9.3. Directions for Future Research

Future studies could expand and refine this research in several ways:

1) Broader coverage by including more NBFIs and cross-border comparative cases.

2) Longitudinal studies assessing solvency trends beyond 2025.

3) Advanced digital tools such as AI-driven stress-testing, blockchain-based solvency reporting, and digital twins (Chen et al., 2021).

4) Behavioral dimensions exploring how governance culture and management practices affect solvency.

5) Policy experimentation with sandbox environments to test new solvency models.

By pursuing these directions, researchers and policymakers can continuously strengthen Egypt's solvency framework, ensuring resilience, competitiveness, and international alignment.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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