



Discoverable Agentic AI for Shariah Compliance

Re-Architecting Islamic Finance Through Transparent, Deterministic, and Auditable Intelligence Systems

Agentic in Intelligence Systems

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Shariah Compliant
Institutional Portfolio



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Real-time
Governance



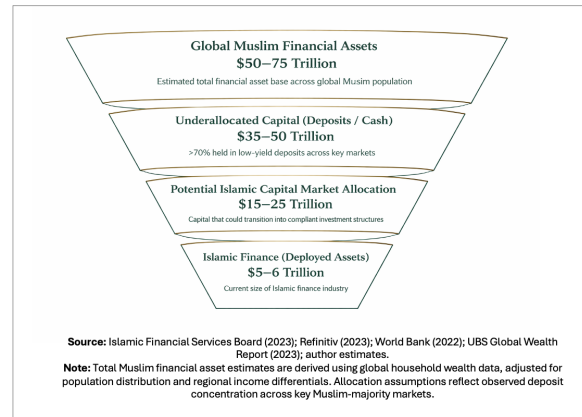
AI Predictive
Tracking

Abstract

Islamic finance is structurally constrained—not by demand, but by infrastructure.

While the industry has reached USD 5–6 trillion in deployed assets, this represents only a fraction of its true addressable market. A substantially larger pool of capital extending into the tens of trillions of dollars remains concentrated in low-yield deposits and underutilized financial assets across global Muslim populations. The limitation is not capital availability, but the absence of scalable mechanisms to deploy it into compliant investment structures.

At the core of this constraint is Shariah compliance itself. In its current form, compliance is fragmented, non-standardized, and operationally non-scalable. Divergent frameworks, manual interpretation, and point-in-time assessments prevent interoperability across jurisdictions and inhibit institutional participation. Critically, compliance decisions are often difficult to reconstruct, verify, and audit at the level required by global capital markets.



This paper argues that Islamic finance requires a new foundational layer: a Compliance Infrastructure Layer (CIL) that enables standardized, machine-readable, and auditable compliance at scale.

To address this, we introduce Discoverable Agentic AI a governance-aligned system architecture designed for deterministic, traceable, and reproducible decision-making. Unlike conventional AI systems, which rely on probabilistic inference and post-hoc explanation, Discoverable Agentic AI embeds transparency and auditability directly into the execution process. Every compliance outcome is fully decomposable into inputs, rules, calculations, and outputs, enabling complete reconstruction of decision pathways.

This approach transforms compliance from an interpretive function into a programmable infrastructure layer, capable of supporting real-time monitoring, cross-jurisdictional interoperability, and institutional-grade governance.

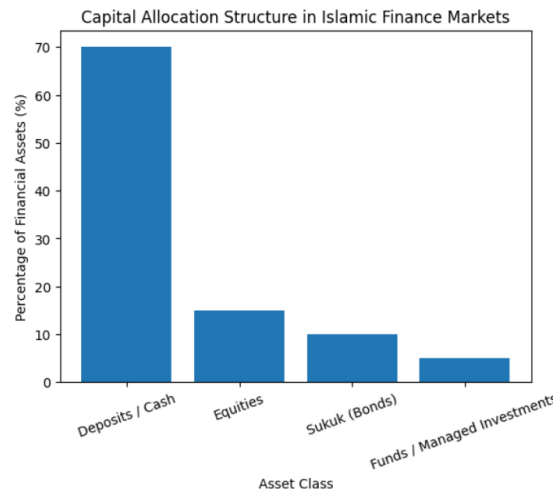
HalalCheck operationalizes this architecture as the first institutional implementation of a Compliance Infrastructure Layer for Islamic capital markets. By embedding compliance directly into financial systems as a persistent, verifiable capability, it establishes the conditions required to unlock large-scale capital allocation and enable the next phase of growth in Islamic finance.

1. Market Size, Growth Dynamics, and Structural Capital Inefficiency

Islamic finance has reached material scale within the global financial system. Total assets exceeded USD 3.2 trillion in 2023, with projections indicating expansion to between USD 5.9 trillion and USD 6.7 trillion by 2027–2030 (Islamic Financial Services Board, 2023; Islamic Corporation for the Development of the Private Sector–Refinitiv, 2023). The composition of the market remains concentrated, with Islamic banking accounting for approximately 70% of total assets, sukuk approximately 25%, and the remainder distributed across funds and takaful.

Notwithstanding this growth, the current size of Islamic finance represents only a partial reflection of its addressable base. The global Muslim population exceeds 1.9 billion individuals, representing approximately one-quarter of the world’s population, and is disproportionately concentrated in regions with high savings rates and expanding middle-class wealth (World Bank, 2022). However, the allocation of financial assets within these markets remains heavily skewed toward deposits and low-yield instruments.

Across many Muslim-majority economies, more than 70% of household financial assets are held in bank deposits or cash equivalents, with limited participation in equities, fixed income securities, or managed investment products (World Bank, 2022; Islamic Corporation for the Development of the Private Sector–Refinitiv, 2023). This results in a significant divergence between the stock of financial wealth and the proportion actively deployed into capital markets.



From a market sizing perspective, this divergence implies that the effective Total Addressable Market (TAM) for Islamic finance extends materially beyond the currently reported asset base. Rather than being defined by the USD 3–6 trillion of existing Shariah-compliant assets, the addressable base is more appropriately anchored to the broader pool of financial assets held by Muslim populations globally. Given the scale of savings and deposit concentrations across key markets, this base is widely understood to extend into the tens of trillions of dollars of financial wealth, the majority of which remains outside capital market instruments.

The resulting structural inefficiency is characterized by a persistent gap between available capital and invested capital, with large volumes of savings remaining in low-productivity financial forms. This gap manifests at system level through reduced market depth, limited liquidity in Shariah-compliant instruments, and underrepresentation of Islamic assets within global investment allocations.

Accordingly, while Islamic finance is often characterized as a multi-trillion-dollar market, this framing understates its true scale. The current asset base represents only the deployed segment of a substantially larger financial ecosystem, within which a significant proportion of capital remains unallocated to investment markets. This divergence defines a structurally large and underpenetrated Total Addressable Market, positioned well beyond the current boundaries of the Islamic financial system.

2. Structural Constraint: Fragmentation of Shariah Compliance

Shariah compliance within Islamic finance is governed by a diverse and non-harmonized set of standards, reflecting both global index methodologies and jurisdiction-specific regulatory frameworks. Prominent global standards include those issued by Accounting and Auditing Organization for Islamic Financial Institutions, as well as index-based methodologies developed by MSCI Islamic, FTSE Russell Shariah, and the S&P Dow Jones Indices Islamic Market series. These are complemented by national and regional regulatory frameworks, including those issued by Otoritas Jasa Keuangan (OJK) in conjunction with DSN-MUI in Indonesia, and the Securities Commission Malaysia, among others.

At a high level, these frameworks are aligned in principle, reflecting shared prohibitions on *riba* (interest), *gharar* (excessive uncertainty), and involvement in non-permissible activities such as alcohol, gambling, and conventional financial services. However, this alignment at the level of principles masks substantial divergence in implementation.

These divergences manifest across several key dimensions. Financial ratio thresholds such as debt-to-asset, liquidity, and non-permissible income ratios vary across standards, with differing denominators, calculation methodologies, and acceptable limits (AAOIFI, 2021; MSCI, 2023; FTSE Russell, 2023). Sector classification methodologies also differ, with index providers applying proprietary taxonomies and revenue segmentation techniques to determine exposure to prohibited activities. In addition, the

treatment of incidental non-permissible income varies, including differences in purification thresholds, aggregation rules, and materiality interpretations (S&P Dow Jones Indices, 2023; Securities Commission Malaysia, 2022).

As a result, identical underlying assets may yield divergent compliance outcomes depending on the framework applied.

Empirical analyses of Shariah indices have demonstrated non-trivial differences in constituent inclusion across major providers, despite operating over the same investable universe (Derigs & Marzban, 2008; Hoepner et al., 2011). For institutional investors, this introduces a layer of structural complexity not present in conventional financial markets.

Portfolio construction becomes inherently jurisdiction dependent. Asset eligibility must be assessed relative to the specific standard governing a fund, mandate, or listing venue. Cross-border investment strategies require reconciliation across multiple frameworks, each with distinct rules and interpretations. This results in duplicated compliance workflows, inconsistent portfolio compositions, and increased operational overhead.

From an audit and governance perspective, the fragmentation of standards leads to similarly fragmented verification processes. Compliance cannot be assessed through a single unified framework; rather, it must be re-established independently for each applicable standard. This limits comparability across portfolios and reduces transparency for both regulators and institutional allocators.

The operational characteristics of current compliance processes further compound this fragmentation. Screening is frequently conducted through a combination of manual scholar review, rule interpretation, and spreadsheet-based analysis. Reporting is typically periodic rather than continuous, resulting in point-in-time assessments rather than persistent compliance monitoring. These approaches are inherently non-scalable and introduce variability into decision-making processes, particularly where interpretation is required.



Collectively, these factors result in a structural lack of standardization at both the methodological and operational levels. Unlike conventional asset classes where accounting standards, disclosure requirements, and regulatory frameworks are broadly harmonized Islamic finance operates across a patchwork of partially aligned but independently implemented compliance systems.

The absence of a unified, machine-readable, and interoperable compliance layer constrains the scalability of Islamic capital markets. It limits the ability of global institutional investors to deploy capital efficiently across jurisdictions, reduces liquidity through segmentation of investable universes, and inhibits the integration of Islamic financial assets into mainstream global indices and portfolio strategies.

3. Limitations of Conventional Artificial Intelligence

Artificial intelligence has become a foundational component of modern financial systems, enabling automation across trading, credit risk modelling, fraud detection, anti-money laundering (AML), and regulatory compliance. Global investment in AI within financial services is projected to exceed USD 100 billion annually by 2030, with leading institutions embedding machine learning models across core decision-making processes (McKinsey & Company, 2023; PwC, 2022). These systems have demonstrated significant efficiency gains, including reductions in fraud losses, improved credit scoring accuracy, and real-time transaction monitoring.

However, the dominant paradigms underpinning these systems particularly black-box machine learning models and probabilistic inference frameworks are fundamentally misaligned with the epistemological and governance requirements of Shariah compliance.

Black-box models, including deep neural networks and ensemble learning techniques, are characterized by limited interpretability, where decision pathways cannot be readily inspected or reconstructed. In financial contexts, this has already raised material regulatory concerns. Studies indicate that over 60% of financial institutions identify model explainability as a primary barrier to AI adoption in regulated functions (Deloitte, 2023). Regulatory bodies globally have similarly emphasized the risks associated with opaque decision-making systems, particularly in areas requiring accountability and auditability.

In parallel, probabilistic AI systems introduce inherent variability into decision-making. Outputs are often expressed as likelihoods or confidence scores rather than deterministic outcomes. While this is acceptable in domains such as fraud detection or marketing optimization, it is incompatible with compliance environments that require binary, rule-based determinations namely, whether an asset is compliant or non-compliant under a defined Shariah standard.

These limitations are increasingly reflected in regulatory developments. The European Union Artificial Intelligence Act classifies many financial AI applications as “high-risk,” imposing strict requirements for transparency, traceability, and human oversight. Similarly, guidance from the Bank for International Settlements and the Financial Stability Board emphasizes the need for explainable and auditable AI systems in financial markets (BIS, 2023; FSB, 2022).

However, the prevailing approach to explainable AI (XAI) remains insufficient in this context. Most XAI techniques are post-hoc, meaning they attempt to interpret or approximate the reasoning of a model after a decision has been made. Techniques such as SHAP values, LIME, and feature attribution provide insights into model behavior but do not offer a complete, deterministic reconstruction of the decision process.

This distinction is critical. In Shariah compliance, it is not sufficient to understand which variables influenced a decision; it is necessary to demonstrate how the decision was derived, step-by-step, including the precise application of rules, thresholds, and classifications. This requirement reflects the



underlying governance model of Islamic finance, which is based on jurisprudential reasoning, evidentiary traceability, and scholarly accountability.

Consequently, Shariah compliance imposes a higher standard than conventional regulatory explainability. It requires what may be termed discoverability: the ability to fully reconstruct and audit every stage of a decision, including inputs, transformations, rule applications, intermediate calculations, and final outputs. This level of transparency must be intrinsic to the system architecture, rather than layered on retrospectively.

The implications for system design are significant. AI systems used in Islamic finance cannot rely on opaque or probabilistic models as primary decision engines. Instead, they must be structured around deterministic, rule-governed, and traceable processes, within which any use of machine learning is constrained, contextualized, and fully auditable.

The absence of deterministic, auditable compliance infrastructure is not a passive limitation it is an active risk.

As capital flows increase and cross-border allocations accelerate, the probability of misclassification, regulatory divergence, and post-investment non-compliance rises materially.

A single misalignment between applied standards and governing jurisdiction can result in:

Forced asset divestment

- Retrospective portfolio non-compliance
- Regulatory scrutiny and reputational damage
- Loss of institutional investor confidence

In this context, reliance on manual, interpretive, or probabilistic systems is no longer operationally viable.

The question is no longer whether compliance infrastructure should be modernized, but whether institutions can afford the consequences

Accordingly, while conventional AI has delivered substantial value across financial services, its prevailing architectures are not directly transferable to Shariah compliance. The requirements of determinism, traceability, and evidentiary justification fundamentally alter the design space, necessitating a new class of AI systems aligned with governance-first principles.

4. Discoverable Agentic AI: A Governance-Aligned Paradigm

Discoverable Agentic AI represents an emerging class of artificial intelligence systems designed specifically for governance-critical domains, where determinism, traceability, and auditability are non-negotiable requirements. Unlike conventional AI architectures, which prioritize predictive performance and probabilistic optimization, this paradigm is structured to ensure that every decision is reproducible, inspectable, and evidentially grounded.

The need for such systems is increasingly reinforced by global regulatory developments. The Bank for International Settlements (2023) highlights the growing requirement for financial institutions to demonstrate end-to-end traceability of automated decision systems, particularly in areas affecting risk, compliance, and market integrity. Similarly, the European Union Artificial Intelligence Act mandates that high-risk AI systems provide comprehensive logging, auditability, and human oversight. These developments signal a structural shift: transparency must be embedded within system design, not retrofitted through post-hoc explanation.

Within this context, Discoverable Agentic AI can be understood as a deterministic orchestration paradigm. Rather than relying on opaque models to infer outcomes, the system decomposes complex decisions into a sequence of governed, rule-bound operations executed by specialized agents. Each agent performs a narrowly



defined task—such as financial ratio calculation, business activity classification, or non-permissible income assessment—ensuring that outputs are derived through explicit logic rather than probabilistic inference.

A defining characteristic of this paradigm is decision decomposability. Every output generated by the system can be broken down into its constituent components:

- Inputs (financial data, disclosures, classifications)
- Rules (Shariah standards, thresholds, methodologies)
- Calculations (ratios, aggregations, classifications)
- Outputs (compliance status, scores, flags)

This structured decomposition ensures that decisions are not only explainable, but reconstructable in full. Each transformation within the decision pathway is explicitly defined, enabling complete visibility into how outcomes are derived.

Importantly, this paradigm does not replace human governance—it formalizes and scales it. Scholars, compliance officers, and regulators retain authority overrule definition, interpretation, and exception handling. The system, in turn, ensures consistent, repeatable execution of these rules across large datasets and portfolios. This reflects broader industry consensus that human-in-the-loop oversight remains essential in regulated environments, particularly where interpretive judgment is required (PwC, 2023).

From an operational perspective, Discoverable Agentic AI enables a transition from static, point-in-time compliance assessments to continuous, real-time evaluation. As underlying data changes through updated financial disclosures, market movements, or corporate actions compliance status can be dynamically re-evaluated. This addresses a key limitation in current industry practice, where compliance is often assessed periodically rather than persistently (Deloitte, 2023).

More fundamentally, this paradigm establishes a new foundation for institutional trust. Transparency, auditability, and reproducibility are not ancillary features, but core system properties. For institutional investors, these attributes are increasingly prerequisites for capital allocation, particularly in emerging or structurally complex asset classes (McKinsey & Company, 2023).

Accordingly, Discoverable Agentic AI should be understood not merely as a technological advancement, but as a governance-aligned architecture for compliance execution. It enables compliance to be embedded directly into financial systems as a persistent, verifiable capability—aligning technological processes with regulatory expectations and jurisprudential requirements.

This paradigm defines the governing principles of the system. Its practical implementation, however, requires a structured architecture capable of enforcing these properties at scale.

5. System Architecture and Operational Model

Building on the governance-aligned paradigm described above, Discoverable Agentic AI systems are implemented as a multi-layered execution architecture designed to ensure determinism, traceability, and auditability at every stage of the decision process.

At the foundation of this architecture is the Data Layer, responsible for the ingestion, normalization, and validation of structured financial data. This includes company financial statements, market data feeds, sector classifications, and corporate disclosures. All data inputs are version-controlled, timestamped, and linked to their original sources, ensuring full data provenance and enabling reconstruction of the input state at any point in time.

Above this sits the Agent Layer, composed of specialized, task-oriented agents operating within tightly defined domains. Each agent performs a discrete function—such as financial ratio computation, business activity classification, or income screening—allowing complex workflows to be decomposed into auditable micro-tasks. This modular design enhances transparency, maintainability, and governance control, while ensuring that identical inputs and rules produce consistent outputs.

The Rule Engine forms the core of the system’s compliance logic. Shariah standards—including those defined by AAOIFI, MSCI Islamic, FTSE Shariah, and regional regulatory bodies—are encoded in a machine-readable, version-controlled format. This ensures that rule application is consistent, reproducible, and independent of manual interpretation at the point of execution. Changes to standards are tracked over time, enabling historical comparison and auditability.

The Reasoning Layer executes these rules against the underlying data, generating both compliance outcomes and structured explanations. Each decision is expressed as a sequence of rule applications and calculations, providing native transparency without reliance on post-hoc interpretability techniques. This aligns with regulatory expectations for explainability in high-risk automated systems.

The Evidence Layer provides the linkage between outputs and their underlying inputs, rules, and intermediate transformations. For every decision, the system maintains explicit references to source data, applied methodologies, and calculation steps, forming a complete evidentiary chain. This enables independent verification and supports regulatory audit requirements for data lineage and traceability.

At the highest level, the Audit Layer maintains immutable records of all system activity. This includes input states, rule versions, agent executions, and final outputs. Logs are structured to support both internal governance processes and external supervisory review, ensuring that decisions can be reconstructed, validated, and defended.

Collectively, these layers form an integrated architecture in which every stage of the decision process is explicitly defined and tightly linked. Unlike conventional systems—where data, logic, and outputs are often loosely coupled—this model enforces end-to-end traceability, ensuring that no decision exists without a verifiable lineage.

Operationally, this architecture enables continuous, real-time compliance monitoring. As underlying data changes, the system dynamically re-evaluates compliance status, maintaining an up-to-date and auditable view of asset and portfolio eligibility. This represents a shift from periodic compliance assessments to persistent, system-driven verification.

This architecture provides the operational foundation required for institutional adoption. By embedding governance, transparency, and auditability directly into system design, it ensures that compliance is not merely asserted, but demonstrably proven—supporting scalability across jurisdictions, asset classes, and regulatory environments.

6. Conclusion: Strategic Learnings and Implications for Islamic Capital Markets

Islamic finance does not face a demand constraint. With USD 5–6 trillion in deployed assets and an addressable market extending into the tens of trillions, the underlying capacity for growth is substantial. The constraint is structural: the absence of standardized, auditable, and scalable compliance infrastructure.

First, the market is significantly underpenetrated. A large share of financial assets remains concentrated in deposits rather than invested instruments, indicating a persistent gap between available capital and deployed capital.

Second, fragmentation limits capital efficiency. Divergent standards, jurisdictional inconsistencies, and manual processes restrict interoperability, constrain liquidity, and inhibit institutional allocation.

Third, trust is the gating factor for scale. Institutional participation depends on transparency, auditability, and consistency. Without the ability to verify how compliance decisions are derived and maintained, capital cannot scale.

Within this context, Discoverable Agentic AI represents a structural inflection point. It transforms compliance from an interpretive process into a deterministic, auditable infrastructure layer.

This shift has three effects:

- Expands trust through fully traceable and verifiable decision-making
- Expands reach through standardized, interoperable compliance frameworks
- Expands scale through continuous, system-driven monitoring

Islamic finance does not require reinvention it requires infrastructure.

The systems that embed governance, transparency, and auditability at their core will define the next phase of growth.

Discoverable Agentic AI provides that foundation.



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