



Advancing Halal Compliance in the Food Industry Through AI and Digital Innovation

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Organization: Ministry of Agriculture, Fisheries Wealth and Water Resources (MAFWR), & Atyab International Service (AIS)

مؤتمر عمان الدولي لسلامة وجودة الغذاء
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معاً لغذاء آمن

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Outline



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Challenges in Current Halal Certification Systems



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The AI and Blockchain Potential



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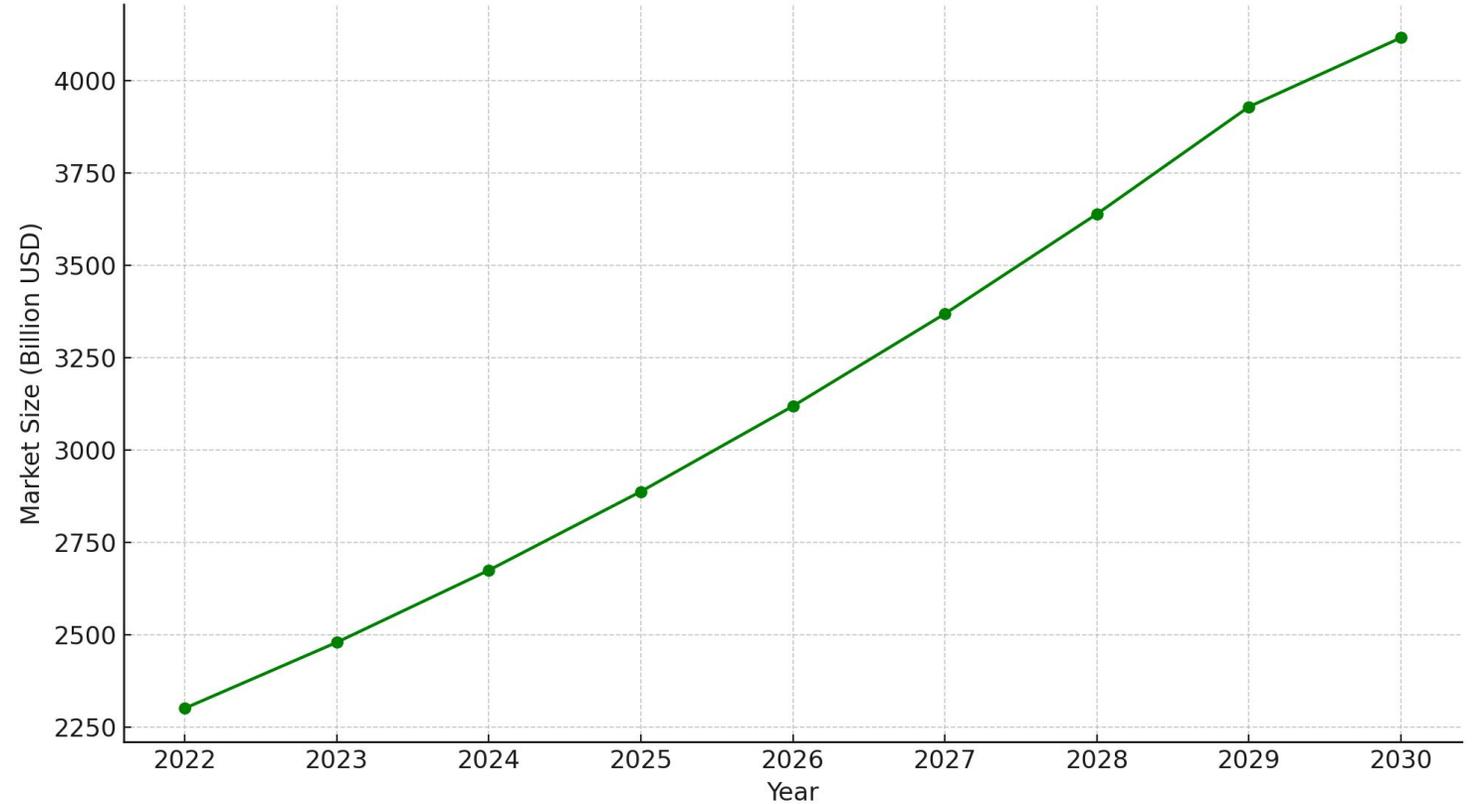
Introduction – The Growing Importance of Halal Certification

Rising Global Demand:



- **Growing Muslim Population**
– Halal food demand has **increased with the expanding Muslim population.**

Global Halal Food Market Growth (2022-2030)



"Here's the chart showing the projected global halal food market growth from 2022 to 2030, based on the Zion Market Research data."

Source: Zion Market Research (2023). Global Halal Food Market Size, Share, Trends & Forecast 2030.

Introduction – The Growing Importance of Halal Certification

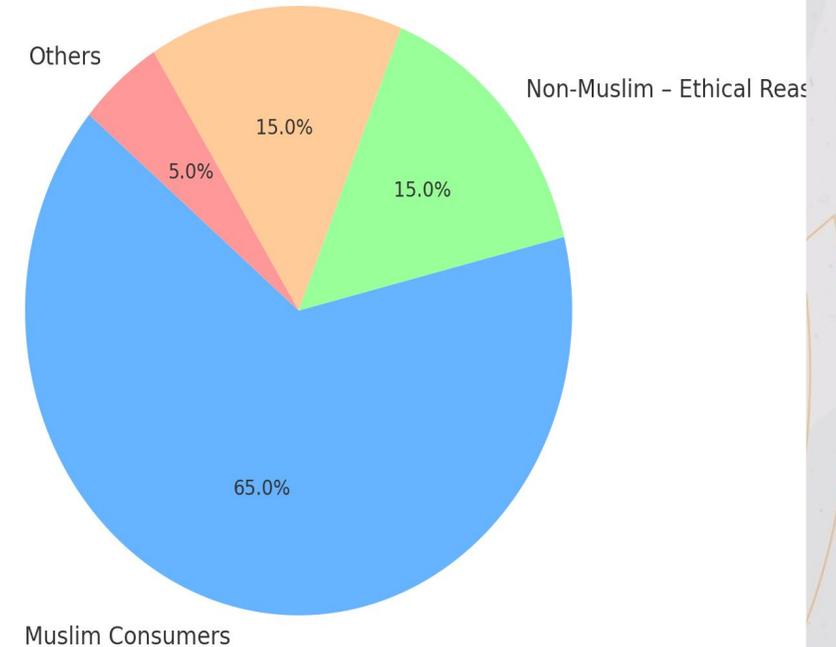
• Increased Non-Muslim Awareness

Non-Muslim consumers are increasingly aware of:

- ✓ The ethical,
- ✓ Quality,
- ✓ and safety standards

associated with halal certification (Riaz & Chaudry, 2018).

Global Consumer Segments Interested in Halal Products
Non-Muslim - Health Reasons



Source: Adapted from Nasirudin et al. (2020), Katadata (2022), and PBGPH (2023)

"The pie chart shows global consumer segments interested in halal products in 2023 (Adapted from Nasirudin et al., 2020; Katadata, 2022; and PBGPH, 2023)



Inefficiencies & Limited Transparency – Current halal certification systems suffer from

- * **inefficiencies,**
- * **lack of automation,**
- * **and limited traceability.**

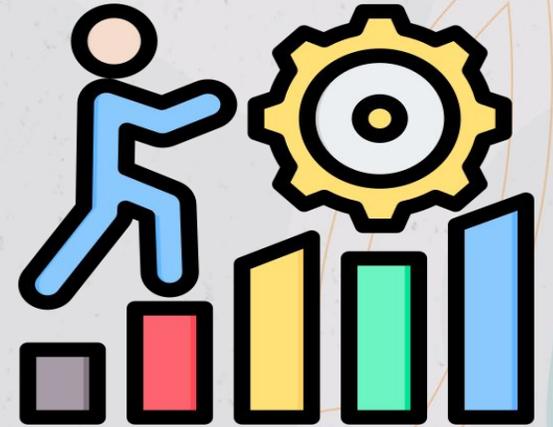


Supply Chain Fraud Risks –
Fraud risks

- * **diminish consumer trust**
- * **and undermine the integrity of halal-certified products**

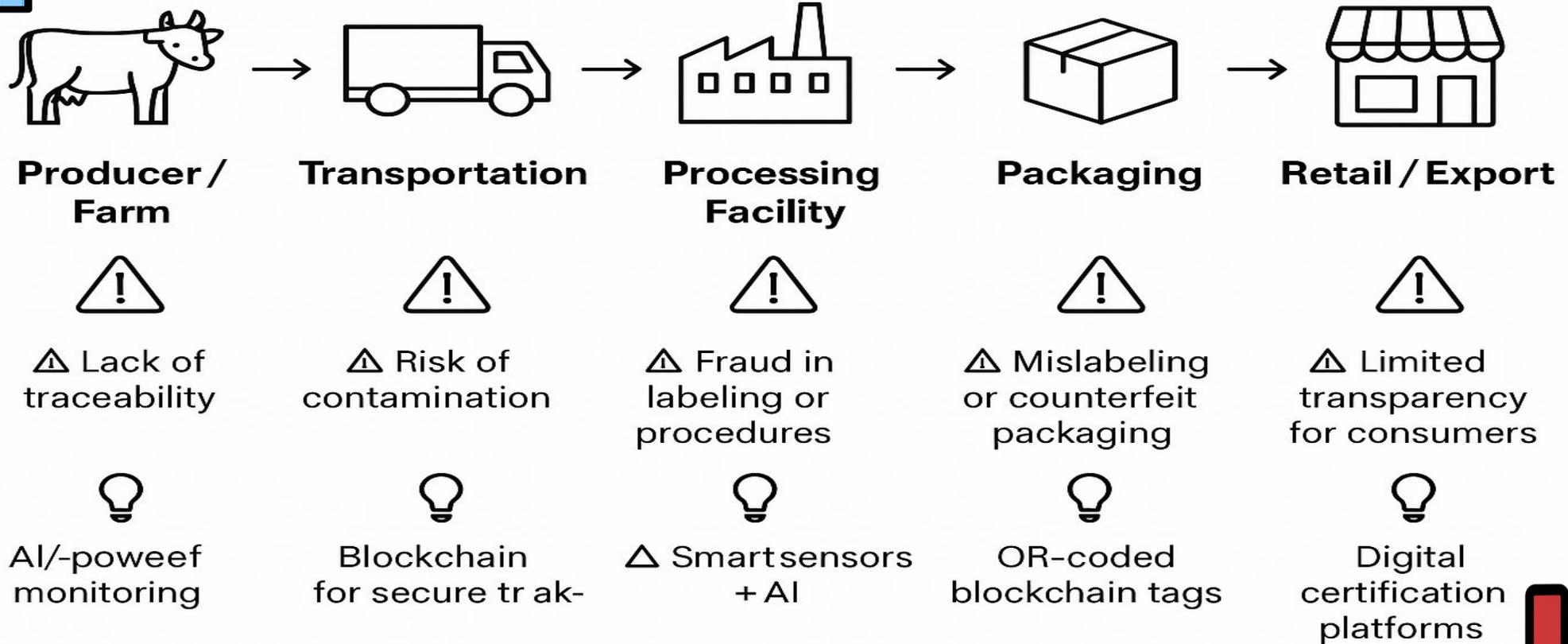
(Shahnawaz et al., 2022; Tan et al., 2022).

Challenges in Current Halal Systems:



Challenges in Current Halal Systems:

Halal Supply Chain: Challenges & Opportunities

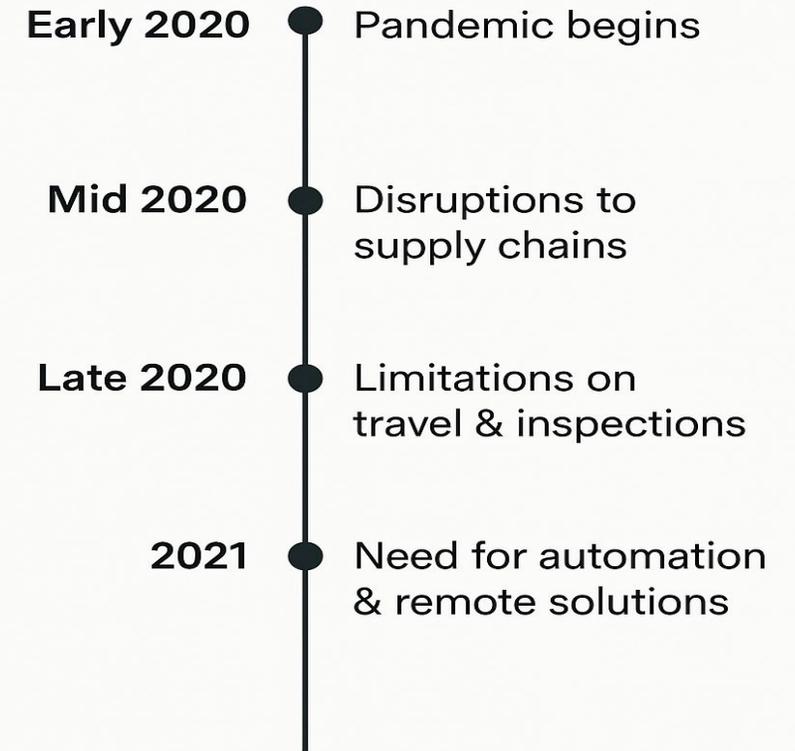


COVID-19 Impact:

Vulnerabilities Exposed – The pandemic revealed **weaknesses in global supply chains** (Katadata, 2022).

Accelerated Digital Transition – **Increased digitalization, especially among SMEs**, in response to the pandemic (BPJPH, 2023).

COVID-19 Impact on Halal Certification



Acceleration of Digital Transformation



The AI and Blockchain Potential

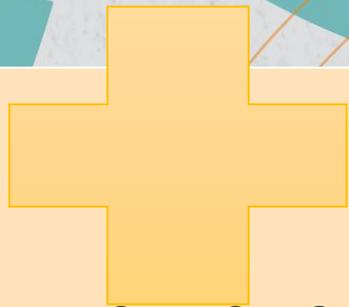
AI in Halal Certification:

Improves Accuracy – AI can

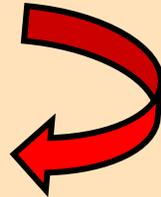
- * **automate error detection**,
- * **improving accuracy** and
- * **reducing human mistakes**
(Ahmad Ridho, 2025).

Enhances

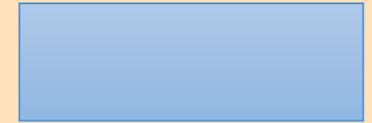
Decision-Making – AI algorithms optimize decision-making and certifications.



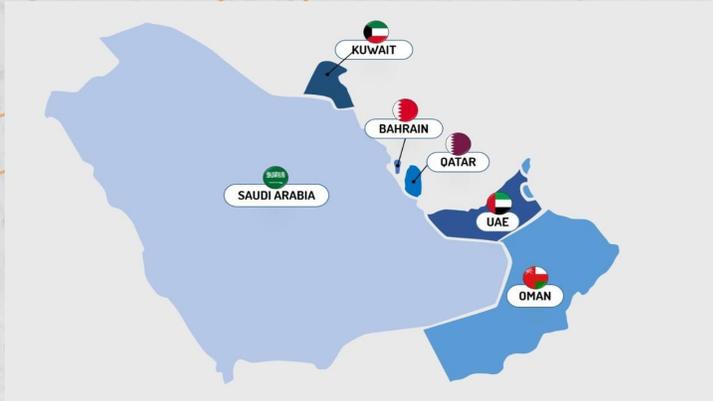
Blockchain in Halal Certification:



- Ensures Transparency and Traceability
– Blockchain technology offers:
 - ✓ An immutable,
 - ✓ Decentralized system  to ensure transparency, traceability, and consumer trust (Sharma et al., 2022).



The AI and Blockchain Potential



Global Relevance:



GCC Region – The Gulf Cooperation Council (GCC) region plays a critical role in the global halal trade.

Indonesia's BPJPH – Indonesia is a pioneer in adopting digital certification technology (BPJPH, 2023).

The AI and Blockchain Potential

Research Aim:



- Explore the **integration of AI and blockchain** to
-  **improve halal certification systems,**
-  ensuring they align with **Islamic Ethical Principles (honesty, fairness, responsibility)** (Darmawati, 2013).



Introduction – The Challenge

Halal Certification Challenges:



Inefficiencies in Inspections – Manual inspections and documentation slow down the certification process.

Limited Transparency in Supply Chains – Lack of visibility across the entire halal supply chain compromises accountability.

Risk of Fraud – The global sourcing of halal products increases the potential for fraudulent activities.



Introduction – The Challenge



Impact:



Reduced Consumer Trust –



Lack of Trust

Lack of Trust

These issues compromise the integrity of halal-certified products and decrease consumer confidence in the halal market.



Introduction – The Opportunity

Pandemic-Driven Shift:

- Global Supply Chain Vulnerabilities Exposed –
- **COVID-19** ➔ highlighted the fragility of traditional supply chains, emphasizing the need for more robust, transparent systems.
- **Accelerated Digital Transition for SMEs** – As businesses increasingly move online, there is an opportunity to ➔
- integrate AI and blockchain for more effective halal certification.



Innovation Opportunity:

Growing Reliance on Digital Platforms

– SMEs are using digital platforms for:

certification,

marketing,

and sales,

making this an ideal time to implement technological solutions.

Perfect Moment for Technological Innovation

– Digital tools like

AI and blockchain

can **address the challenges** faced by the halal certification process

and help **drive the industry forward.**

Methods – Research Approach

Quantitative Research Design:

This study uses a quantitative & qualitative approach combining a thorough literature review with the collection of primary data through surveys and interviews.



Data Collection:

Interviews:

Discussions with key industry stakeholders (e.g., halal certification bodies, regulatory authorities, food producers, technology developers) to gather insights on AI and blockchain implementation challenges and benefits.

Surveys

Surveys: structured questionnaires were distributed to halal industry professionals, especially SMEs, using the Likert Scale Method (1–5) to assess:

Perceived effectiveness of AI and blockchain in improving accuracy, transparency, and efficiency.

Readiness for adoption.

Impact on consumer trust and regulatory compliance.

Methods – Data Collection and Analysis

Interview Insights:

- **Participants:** Key stakeholders from halal certification bodies, regulatory authorities, food producers, and tech developers.
- **Focus Areas:**
 - Barriers to AI and blockchain integration.
 - Expected benefits and concerns.

Survey Insights:

- **Survey Recipients:** A broader group of halal industry professionals (in food production and distribution).

Focus Areas:

- Effectiveness of AI and blockchain for certification.
- Readiness to adopt new technologies.
- Trust and transparency benefits.

Analysis Method:

- Both qualitative (interviews) and quantitative (survey) data were analyzed to **provide a comprehensive view of the current state and future opportunities of AI and blockchain in halal certification.**

Results – Interview Insights

Key Findings from Industry Interviews:

• Challenges Identified:

- Inefficiencies in manual inspections and documentation.
- Limited traceability across the supply chain.
- Fraud risks affecting halal certification credibility.

• AI Benefits:

- Automates verification processes.
- Reduces human error.
- Enhances decision-making accuracy.

Results – Interview Insights

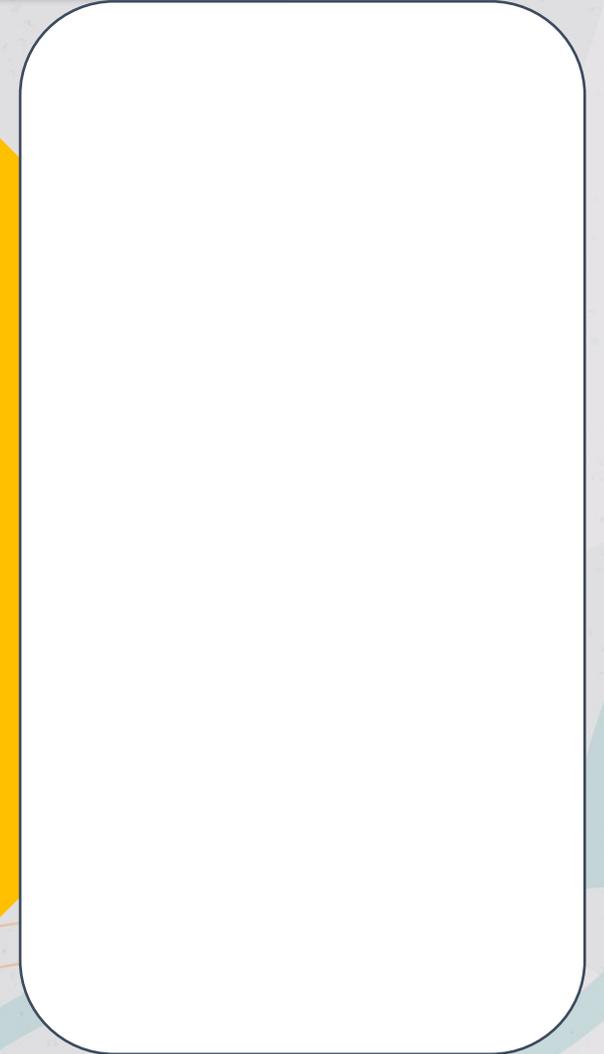
•Blockchain Benefits:

- Ensures data integrity and prevents tampering.
- Provides end-to-end traceability and transparency.
- Builds consumer and regulatory trust.

•Concerns Highlighted:

- High implementation and maintenance costs.
- Lack of digital infrastructure, especially for SMEs.
- Uncertainty regarding regulatory frameworks.

Results – Survey Findings



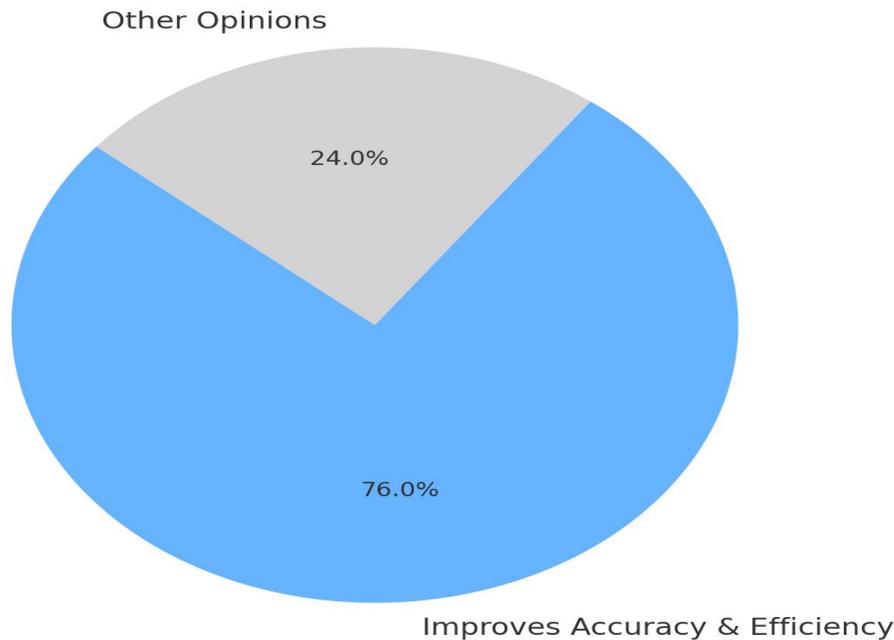
Results – Survey Findings

Commonly Cited Challenges:

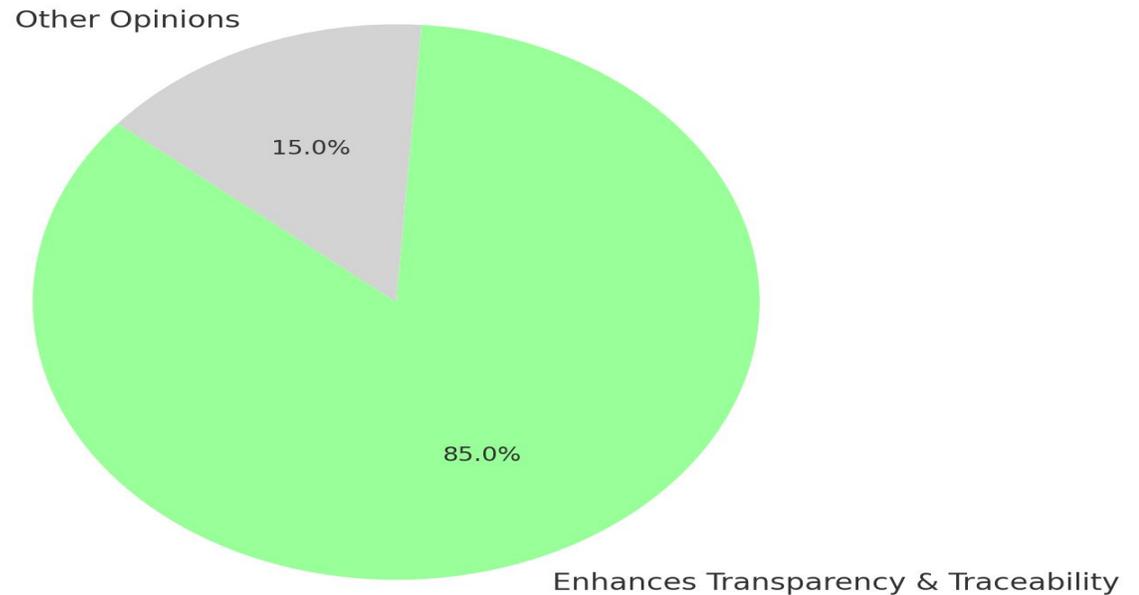
- ❑ Limited technical knowledge in the industry.
- ❑ Financial barriers to adoption.
- ❑ Absence of clear guidelines or support from authorities.

Survey Results – AI & Blockchain Perception

Perception of AI in Halal Certification

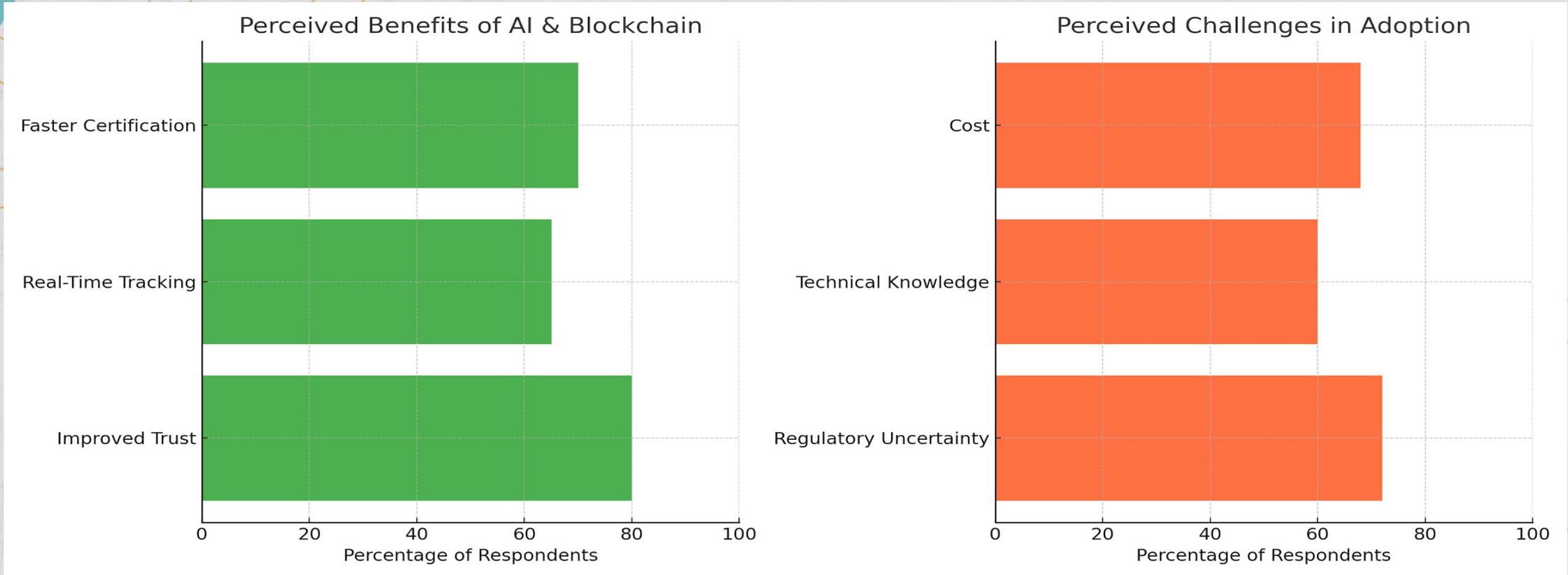


Perception of Blockchain in Halal Certification



- The first chart shows that **76% of respondents believe AI improves accuracy and efficiency** in halal certification.
- The second chart shows that **85% believe blockchain enhances transparency and traceability**.

Survey Results – Benefits & Challenges



•**Left:** Key benefits like faster certification, real-time tracking, and improved trust were highly valued.

•**Right:** Main challenges include cost, lack of technical knowledge, and regulatory uncertainty.



Discussion – Key Insights

AI Benefits:

- Automates verification and reduces human error (Ridho, 2025; Mohd et al., 2021)
- Enhances compliance and decision-making processes

Blockchain Benefits:

- Creates tamper-proof, transparent records (Sharma et al., 2022; Tian, 2016)
- Improves traceability and prevents fraud
- Boosts consumer confidence



Discussion – Key Insights

Stakeholder Views:

- Strong support, but concerns about:
 - High implementation costs
 - Technical capacity, especially for SMEs
 - Regulatory ambiguity (Tan et al., 2022; Lim et al., 2021)

Islamic Ethical Alignment:

- Supports honesty, fairness, and transparency in trade (Darmawati, 2013; Nasruddin et al., 2020)



Conclusion – Embracing Digital Transformation

- AI and blockchain are transformative tools for halal certification
- They **address current inefficiencies** and **strengthen trust**
- Stakeholders are optimistic but face **practical and policy-related challenges**
- **GCC countries** and global leaders can play a key role in driving adoption
- Tech adoption should remain aligned with **Islamic ethical values**



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