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Digital Traceability and Halal Supply Chain Assurance: Building Consumer Trust in Islamic Tourism and Hospitality

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ABSTRACT

Halal tourism and hospitality depend on more than the availability of Muslim-friendly facilities: consumers must be able to trust that food, ingredients, handling practices, accommodation services, and related experiences conform to the standards they expect. Digital traceability technologies—including blockchain-enabled records, QR-linked product information, Internet of Things (IoT) sensors, digital certification registries, and interoperable data platforms—can make supply-chain evidence more accessible and strengthen assurance across fragmented service networks. Yet technology does not automatically produce trustworthy halal outcomes. Inaccurate source data, weak governance, inconsistent certification, privacy concerns, and poor consumer-facing communication can undermine the credibility of digital systems. The analysis proposes that traceability affects trust primarily through perceived transparency and assurance credibility, with certification governance and platform interoperability shaping the strength of these relationships. The article also identifies risks associated with "technology-washing," fragmented standards, and the mistaken assumption that immutable records guarantee truthful inputs. It concludes with a set of testable hypotheses, an empirical research design, and strategic implications for destination managers, hospitality firms, halal certifiers, technology providers, and Islamic finance stakeholders.

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1. INTRODUCTION

Islamic tourism and halal hospitality have developed into strategically important areas at the intersection of tourism management, consumer services, ethical consumption, and the wider halal economy. Muslim travelers may evaluate destinations not only through conventional criteria such as price, location, service quality, and attractions, but also through the availability and reliability of halal food, prayer facilities, privacy-sensitive services, and information that helps them make decisions consistent with their religious commitments. The importance of these considerations varies across travelers, destinations, and trip purposes; Muslim consumers should not be treated as a homogeneous segment. Nevertheless, confidence in halal-related claims can influence destination choice, dining decisions, accommodation evaluation, and willingness to recommend a service (Mastercard-CrescentRating, 2024; DinarStandard, 2023).

A central challenge is that many halal attributes are difficult for visitors to verify directly. A traveler may see a halal logo on a restaurant menu but have little visibility into the origin of ingredients, the status of a supplier's certification, the handling of products during transport, or the controls used to prevent cross-contact. Similar uncertainty can arise in hotel kitchens, catering operations, packaged food sold at attractions, and multi-vendor tourism packages. The service is experienced at the destination, while important assurance activities occur upstream across suppliers, logistics providers, certifiers, and regulators. This creates information asymmetry: operators and suppliers typically possess more detailed information about sourcing and processes than consumers do. When the evidence is difficult to access, travelers may rely on reputation, staff assurances, peer recommendations, or familiar certification marks, each of which can be helpful but imperfect (Ali et al., 2021; Hidayat & Fang, 2026).

Digital traceability offers a possible response. A traceability system links an item, batch, ingredient, or service input to records about its origin, movement, handling, certification, and status. Technologies vary from centralized databases and QR-linked records to IoT-enabled monitoring and distributed ledgers. A QR

code can make relevant information accessible at the point of decision; a shared digital registry can help operators check certificates; sensor data can record temperature or storage conditions; and a blockchain can create a tamper-evident log of events among participating organizations. These tools can reduce the time required to retrieve evidence, make responsibility more visible, and support faster investigation when a discrepancy occurs (Casino et al., 2021; Fang, 2026; Kouhizadeh et al., 2021).

However, traceability and assurance are not synonymous. A digital record can show that an event was entered into a system without proving that the event was described accurately. A blockchain can preserve an incorrect supplier declaration as effectively as a correct one. Sensors can record temperature or location but cannot independently establish the religious permissibility of an ingredient. A QR code may lead to outdated certification data, and a well-designed application may still be built on a weak audit process. Consequently, digital traceability can improve the visibility of evidence, but halal assurance continues to depend on standards, qualified verification, reliable source data, governance, and corrective action. The managerial problem is therefore not simply whether to adopt a technology, but how to integrate it into an assurance system that consumers and institutions can reasonably trust (Kouhizadeh et al., 2021; Queiroz et al., 2021).

The research gap has three dimensions. First, traceability research often emphasizes operational efficiency, food safety, or product provenance, while halal tourism research frequently focuses on destination attributes, religiosity, satisfaction, and revisit intention. Less attention is given to the mechanism that connects supply-chain evidence to consumer trust across a tourism service journey. Second, studies can treat blockchain or digitalization as if adoption itself were the outcome of interest, without distinguishing technical functionality from the credibility of halal assurance. Third, consumer trust is sometimes modeled as a single perception even though it may refer to the technology, the supplier, the certifier, the destination, or the institutional system. These are related but distinct trust objects, and a failure at one level can undermine the whole service experience (Rejeb et al., 2021; Mastercard-CrescentRating, 2024).

This article develops an integrative framework for explaining how digital traceability can support consumer trust in Islamic tourism and hospitality. It asks: how does digital traceability influence perceived halal assurance and trust? Which roles are played by information accessibility, data integrity, certification credibility, and perceived transparency? Under what conditions can technology fail to generate trust or even intensify skepticism? What strategic and governance choices allow hospitality firms and destinations to convert traceability capabilities into credible market value? The article contributes by linking supply-chain processes to consumer-facing trust mechanisms, distinguishing traceability from verification, and outlining a research design for empirical testing. Its emphasis is strategic marketing and Islamic business, rather than technology implementation in isolation (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Mastercard-CrescentRating, 2024).

2. LITERATURE REVIEW

This article uses a structured integrative review to connect research streams that are often considered separately: halal supply-chain management, digital traceability, blockchain and IoT applications, halal tourism and hospitality, consumer trust, and strategic marketing. An integrative approach is suitable because the focal problem spans technical, organizational, institutional, and behavioral dimensions. The synthesis prioritizes literature and reports published from 2021 onward, while established theoretical concepts are used to explain mechanisms that remain relevant across publication periods. The evidence base includes peer-reviewed studies, systematic reviews, policy and standards documents, and industry reports on Muslim travel and the halal economy (Dwivedi et al., 2021; Rejeb et al., 2021).

The purpose is conceptual integration, not a claim of exhaustive systematic coverage. No invented database search counts, screening totals, or pooled effect sizes are reported. The studies are assessed in terms of their relevance to the relationship between digital evidence and consumer trust, the level of analysis, the type of traceability technology, and the conditions under which findings may transfer to tourism and hospitality. Evidence from food and pharmaceutical supply chains is used cautiously: these sectors offer insights into provenance, data integrity, and coordination, but tourism services introduce additional factors such as human interaction, destination image, service recovery, and time pressure during travel (Alamsyah et al., 2022; Jannah & Al-Banna, 2021; Rejeb et al., 2021).

The synthesis distinguishes four analytical levels. The technical level concerns data capture, linkage, interoperability, and auditability. The organizational level concerns supplier participation, internal controls, capability, and response to discrepancies. The institutional level concerns certification rules, oversight, standards, and dispute resolution. The consumer level concerns perceived transparency, confidence, uncertainty, and trust. This multilevel structure prevents the analysis from assuming that a technically functioning system automatically produces an organizationally reliable or consumer-trusted service (Alamsyah et al., 2022; Jannah & Al-Banna, 2021; Rejeb et al., 2021).

2.1 Signaling theory

Halal status often includes attributes that consumers cannot observe before purchase and may not be able to verify after consumption. In such circumstances, consumers use signals to infer quality and conformity. A recognizable certification mark, a verified digital record, or a transparent supplier profile can signal that a claim has passed a relevant process. Yet signals vary in credibility. A self-issued green or halal badge is inexpensive to imitate; a certificate issued by a competent body and linked to a current registry is harder to misrepresent. Digital traceability can strengthen signaling when it connects claims to verifiable evidence and identifies who is accountable for each record. It adds less value when it merely creates an attractive interface around unverifiable statements (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

The signaling perspective also explains why more information does not always create more trust. Consumers may interpret complex technical data as confusing, or they may infer that the operator is trying to overwhelm them with detail. The signal must be comprehensible and relevant to the decision. For a traveler choosing a restaurant, the most useful information may be the certifier, certificate status, scope, validity period, and the outlet covered by the certificate. A long list of blockchain transactions may not improve the decision unless the platform explains what those records establish. The practical objective is not maximal disclosure but decision-useful disclosure that can be checked and understood (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

2.2 Trust and certification credibility

Trust in halal services is partly interpersonal and partly institutional. A consumer may trust a restaurant manager, but that trust can be strengthened or weakened by the credibility of the certifier, the consistency of regulatory enforcement, and the availability of complaint mechanisms. Institutional trust becomes particularly important when a service involves several organizations that the consumer never meets. Digital systems can make institutional evidence more accessible, but they do not replace the institutions that define, audit, and enforce standards. If certification criteria are inconsistent or the status of a certificate cannot be confirmed, a technically sophisticated platform may expose the inconsistency rather than solve it (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

Certification credibility has at least four components: competence, independence, transparency, and accountability. Competence concerns whether the certifier has the expertise and procedures required to assess the relevant claim. Independence concerns conflicts of interest. Transparency concerns whether the scope and criteria are understandable. Accountability concerns whether errors can be challenged and corrected. Digital registries can support each component by publishing current status, identifying the issuing body, recording updates, and providing an audit trail. But the quality of the institutional process remains decisive. A digital record of a weak certification decision does not make the decision stronger (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

2.3 Resource-based view and dynamic capabilities

From a strategic perspective, traceability can be understood as a capability rather than a stand-alone asset. Hardware, software, and blockchain access are increasingly purchasable. Competitive advantage depends more on how an organization integrates these tools with supplier relationships, staff routines, data governance, service recovery, and customer communication. The resource-based view directs attention to the combination of technological and organizational resources; dynamic capabilities explain how firms reconfigure those resources as standards, technologies, and consumer expectations evolve. A hotel that links procurement records to kitchen controls and frontline communication may generate greater assurance value

than a hotel that merely displays a QR code without changing its operating practices (Alamsyah et al., 2022; Jannah & Al-Banna, 2021; Phattanaviroj & Pattaradej, 2025).

Capability development also has a collective dimension. A destination may include small restaurants, independent guides, transport providers, food producers, and accommodation operators with unequal financial and technical resources. If a traceability scheme is too costly or complicated for small suppliers, participation may remain limited to larger firms and the resulting record may not cover the whole visitor journey. A credible strategy must therefore include onboarding, training, support, common data standards, and proportionate verification. In Islamic business settings, the value proposition should connect operational capability with amanah, accountability, and responsible stewardship without treating religious values as marketing decoration (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

2.4 Service-dominant logic and the tourism experience

Tourism value is co-created through interactions among travelers, service employees, suppliers, destination organizations, digital platforms, and local institutions. Halal assurance is not experienced only as a product attribute; it becomes part of the service journey, including booking, arrival, dining, accommodation, and problem resolution. Digital traceability can support value co-creation by allowing consumers to access relevant information and make more informed choices. However, its effect depends on the surrounding service. An application that verifies a food ingredient but leaves staff unable to answer questions may create a mismatch between digital promise and human interaction. The technology must therefore be embedded in service design, not treated as a substitute for trained staff or respectful communication (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

2.5 Technology acceptance, perceived usefulness, and perceived risk

Consumers are more likely to use a traceability feature when it is easy to access and helps them make a meaningful decision. A QR-linked certificate that loads slowly, uses technical language, or requires unnecessary personal data may be ignored even if its underlying database is reliable. Perceived usefulness and ease of use can affect whether consumers consult the information, while perceived risk can influence whether they rely on it. Privacy risk is relevant if the system tracks location or links travel choices to identifiable profiles. Information overload is also a risk: the interface should prioritize relevant assurance details and allow users to explore additional evidence when they wish (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

2.6 Islamic business ethics and the meaning of assurance

Halal assurance is rooted in religious and institutional interpretations of permissibility, but its operational expression also depends on transparency, responsibility, and fair dealing. Concepts such as amanah (trustworthiness), sidq (truthfulness), and maslahah (public benefit) offer an ethical lens for evaluating how digital claims are produced and communicated. These concepts should not be used as substitutes for empirical analysis or as claims that all Muslim consumers hold identical preferences. Rather, they help articulate why misleading certification information is more than a conventional service failure: it may violate a consumer's expectation that a provider will handle a religiously significant commitment with care. In practice, ethical assurance requires accurate records, honest communication, effective correction, and respect for consumer choice (Jannah & Al-Banna, 2021; Alamsyah et al., 2022; Dwivedi et al., 2021).

2.7 Digital traceability in halal tourism and hospitality

Digital traceability refers to the ability to follow a product, batch, ingredient, or relevant service input through specified stages and to retrieve records about its identity, origin, status, and movement. Its architecture may include centralized databases, QR codes, radio-frequency identification, IoT sensors, cloud platforms, application programming interfaces, and distributed ledgers. These tools are complementary rather than interchangeable. QR codes are a consumer-facing access mechanism; IoT devices capture selected physical conditions; a database stores structured records; a distributed ledger can coordinate records among organizations that do not fully trust one another. Technology selection should begin with the assurance problem, not with a presumption that blockchain is always the best solution (GS1, 2023; Rejeb et al., 2021).

In a hotel kitchen, for example, digital traceability could connect a supplier lot to a delivery note, ingredient record, certificate status, storage event, and internal receiving check. The consumer-facing interface could summarize whether the relevant ingredient or menu item is covered by a valid assurance process. A restaurant could use a similar system to verify the current status of a supplier certificate before accepting a shipment. For a destination management organization, a registry could help travelers identify verified halal dining options and understand what each verification covers. In a tourism package involving multiple vendors, the system could make it easier to identify which components have been checked and which are based on operator declarations (Alamsyah et al., 2022; Sidarto & Hamka, 2021; GS1, 2023).

Traceability must be designed around clear units of identification. If the record identifies only a supplier but not the relevant product, batch, location, or time period, it may not provide sufficient evidence for a consumer's question. If a certificate applies to a production facility but not to every outlet or product sold under the same brand, the interface must not imply broader coverage. Data models should preserve the relationship between product, batch, supplier, certificate, certifier, location, and validity period. The scope of a claim should be visible to consumers and auditable by the organization responsible for it (GS1, 2023; Hastig & Sodhi, 2021).

Blockchain is useful in some multi-party environments because it can make changes to shared records detectable and preserve a time-ordered history. It may reduce disputes about whether a record was altered after entry and can improve coordination when participants use a common protocol. However, blockchain does not guarantee that source data are true, that every relevant event is recorded, or that all suppliers participate. Governance questions remain: who may write records, who validates them, how corrections are handled, who pays, what data remain private, and which authority resolves disagreements. A permissioned ledger may be appropriate where participating organizations need controlled access; a conventional database may be more economical where a trusted operator already governs the records (Casino et al., 2021; Kouhizadeh et al., 2021).

IoT sensors can capture operational conditions such as temperature, location, and storage duration. Such data may be valuable for food quality and handling assurance, but their interpretation must remain specific. A temperature record cannot establish halal status by itself, and sensor accuracy depends on calibration, placement, maintenance, and data linkage. The system should disclose what is measured, what is inferred, and what remains subject to human verification. Likewise, automated alerts should trigger an accountable process: someone must assess the anomaly, quarantine the affected item where necessary, document the decision, and communicate relevant information. Traceability becomes assurance only when records inform controls and corrective action (Hasan & Saiyed, 2026; UNCTAD, 2024).

2.8 Halal assurance and consumer trust

Consumer trust in halal tourism can be understood as willingness to rely on a provider's claim that relevant products and services meet stated halal requirements despite incomplete direct observation. This trust may concern the restaurant, hotel, destination, certifier, platform, or the overall regulatory system. A consumer can trust the platform's payment protection while doubting the accuracy of a restaurant's halal claim. Conversely, a consumer may trust a certifier but find the digital interface confusing. Research should measure these trust objects separately and avoid treating trust as a single undifferentiated attitude (Mastercard-CrescentRating, 2024; Olya et al., 2021).

Perceived halal assurance is the consumer's judgment that credible procedures exist to protect conformity across relevant stages. It is related to trust but conceptually distinct. Assurance refers to the perceived strength and adequacy of controls and evidence; trust refers to the willingness to rely on the provider or system. A consumer may see a detailed traceability record and conclude that controls are strong, yet remain reluctant to trust a company because of a previous service failure. Alternatively, a consumer may trust a familiar family-owned restaurant despite having little digital evidence. The framework proposes that traceability influences trust partly through perceived assurance and transparency, while prior experience and institutional credibility may affect the translation of assurance into trust (Jannah & Al-Banna, 2021; Mastercard-CrescentRating, 2024).

Transparency should be understood as the availability and intelligibility of relevant information, not as the publication of every internal record. Excessive disclosure can expose commercially sensitive information or overwhelm consumers. A well-designed system provides enough evidence to answer reasonable questions and makes deeper documentation available to auditors or authorized parties. Consumers should be able to identify the certifier, the scope of certification, validity status, and the date of the last relevant update without navigating a complex technical interface. If information is unavailable or a certificate has expired, the system should state that clearly rather than continue to display a reassuring but outdated symbol (Jannah & Al-Banna, 2021; Mastercard-CrescentRating, 2024).

Trust is also dynamic. It can be strengthened when digital records match the actual service and staff respond competently to questions. It can be damaged quickly by a discrepancy between the displayed status and the item served. A single incident may have spillover effects, leading travelers to question other providers or the destination's broader halal reputation. For this reason, assurance systems should include incident reporting, escalation pathways, timely correction, and a clear distinction between a technical error and a substantive conformity failure. Communication should be accurate and prompt without prematurely declaring that a problem is resolved (Jannah & Al-Banna, 2021; Mastercard-CrescentRating, 2024).

2.9 Conceptual framework and hypothesis development

The proposed framework treats digital traceability capability as an antecedent of perceived halal assurance and consumer trust. Its influence is expected to operate through several mechanisms: accessibility of information, perceived transparency, confidence in data integrity, and credibility of certification. The framework also includes organizational and institutional conditions that can strengthen or weaken these pathways. The central outcome is consumer trust in halal tourism and hospitality providers, with related outcomes including willingness to use a traceability feature, booking intention, satisfaction, recommendation intention, and perceived destination reliability. These outcomes should be measured separately rather than assumed to be equivalent (Alamsyah et al., 2022; Jannah & Al-Banna, 2021; Sidarto & Hamka, 2021).

H1: Digital traceability capability is positively associated with perceived halal assurance. The logic is that linked records make it easier to verify the origin, status, and handling history of relevant inputs. The effect should be strongest when the traceability system covers the stages that matter to the specific consumer decision. A system that tracks delivery location but omits certificate scope may improve logistics visibility without materially improving halal assurance. Thus, traceability coverage and relevance are likely to matter as much as technical sophistication.

H2: Perceived halal assurance is positively associated with consumer trust in halal tourism and hospitality providers. Consumers are more likely to rely on a provider when they believe that clear procedures and credible evidence support its halal claims. This relationship may depend on prior experience and the reputation of the relevant institution. Assurance may be less persuasive if consumers believe that audits are superficial or that complaints are rarely addressed. The hypothesis therefore concerns perceived assurance quality, not the mere presence of a certificate icon.

H3: Perceived transparency mediates the relationship between digital traceability capability and perceived halal assurance. Traceability may be technically robust but have little consumer impact if the relevant information is not accessible or understandable. A transparent interface allows users to see what is covered, who verified the claim, and whether the evidence is current. Transparency is expected to translate technical capability into a more intelligible judgment about assurance.

H4: Data integrity strengthens the positive relationship between digital traceability capability and perceived halal assurance. Traceability relies on accurate, complete, timely, and properly linked records. Where source data are unreliable or records are not updated after supplier changes, the existence of a digital trail may create false confidence. Data integrity includes validation at entry, role-based permissions, audit trails, exception handling, and documented corrections. A tamper-evident ledger can contribute to integrity, but it cannot replace these controls.

H5: Certification credibility strengthens the positive relationship between perceived transparency and consumer trust. Transparent information is more persuasive when it comes from a competent and accountable certification process. Consumers may not understand the technical details of a traceability

system, but they may understand who issued the certificate and whether its scope and validity can be checked. If the certifier is unfamiliar or perceived as conflicted, the same information may have a weaker effect. Future research should measure perceived certifier competence and independence rather than using a binary halal-logo indicator alone.

H6: Perceived usefulness of digital traceability information is positively associated with trust in the provider. Consumers are more likely to value the feature when it answers a practical question relevant to their trip, such as whether a restaurant is covered by a valid certification or whether a menu item falls within the stated scope. Technical novelty alone is unlikely to sustain use. The interface should be fast, accessible, multilingual where appropriate, and compatible with the traveler's device and connectivity constraints.

H7: Perceived privacy risk is negatively associated with willingness to use digital traceability features. A consumer may hesitate to scan a code or create an account if the process requires unnecessary personal details, location tracking, or marketing permissions. Traceability should not become a pretext for collecting excessive visitor data. Systems can often provide certificate verification without identifying the consumer, and privacy-preserving design can improve acceptance while reducing compliance exposure.

H8: Organizational halal assurance capability strengthens the relationship between digital traceability and perceived assurance. Technology generates value when procurement, receiving, storage, preparation, service, and incident response routines use the records consistently. If frontline employees cannot interpret the data or managers do not act on exceptions, the system may become a compliance display rather than an operational control. Training, accountability, supplier onboarding, and internal audit are therefore likely to moderate the effect.

H9: Perceived greenwashing or technology-washing is negatively associated with consumer trust. Technology-washing occurs when a provider presents digital features as proof of integrity without demonstrating that the underlying process is reliable. A blockchain label may create an impression of certainty that exceeds what the system can substantiate. If consumers perceive a mismatch between technological claims and actual practice, trust may decline more sharply than if the firm had made a narrower claim. Accurate communication about system scope and limitations is therefore essential.

H10: Destination reputation mediates part of the relationship between consumer trust in individual providers and intention to recommend the destination. A visitor's evaluation of one restaurant or hotel may influence perceptions of the wider destination, especially where the destination markets itself as halal-friendly. Consistent assurance across providers can support destination credibility; repeated inconsistencies can create reputational spillovers. This hypothesis encourages researchers to examine the destination ecosystem rather than focus exclusively on a single firm.

3. METHOD

The present article is a conceptual integrative synthesis. Because no primary survey, transaction records, or experimental observations were supplied, this section proposes a research design for testing the framework rather than reporting a completed empirical study. A multi-method design would be especially useful because the research question involves technical capabilities, institutional practices, and consumer perceptions. The first phase could involve interviews with hotel procurement managers, restaurant operators, halal certifiers, destination organizations, and technology providers to map how traceability evidence is produced and used. The second phase could test consumer-level relationships using a survey or randomized information experiment. This design would connect the actual content of assurance systems with how travelers interpret the information (Dwivedi et al., 2021; Rejeb et al., 2021).

The empirical context should be specified carefully. One option is to study Muslim travelers evaluating halal restaurants and hotels in a destination that offers a mix of certified, self-declared, and digitally traceable services. Another is to focus on a defined group of hospitality providers that have implemented a traceability feature. The sampling frame should document the destination, traveler profile, language, travel purpose, and prior familiarity with digital halal information. Muslim identity should not be used as a proxy for uniform levels of religiosity or identical service expectations. Researchers can measure the importance respondents

attach to halal assurance directly and treat it as a potential moderator (Dwivedi et al., 2021; Rejeb et al., 2021).

A consumer survey should distinguish digital traceability capability as experienced by the respondent from objective system capability. Perceived capability can be measured through the clarity, completeness, accessibility, and apparent verifiability of the information shown. Objective capability should be assessed separately through system documentation, certificate registry checks, audit coverage, data update procedures, or interviews with operators. Combining these perspectives can help identify whether a technically strong system is poorly communicated or whether a persuasive interface masks weak controls (Dwivedi et al., 2021; Rejeb et al., 2021).

Perceived halal assurance can be measured through items concerning confidence in supplier verification, certificate validity, handling controls, and the ability to identify the scope of a claim. Perceived transparency should capture whether information is accessible, understandable, and specific enough to support a decision. Trust should be measured separately for the provider, certifier, digital platform, and destination. Outcomes may include intention to choose the provider, willingness to pay for a service with verified assurance, intention to revisit, and recommendation intention. These should not be combined without evidence that they form a coherent construct (Dwivedi et al., 2021; Rejeb et al., 2021).

Potential control variables include prior destination experience, familiarity with halal certification, travel purpose, age, income, digital literacy, language proficiency, perceived religiosity or importance of halal compliance, and the type of service being evaluated. Controls should be theoretically justified rather than added indiscriminately. Product or service category may be particularly important because consumers may need different levels of evidence for packaged food, restaurant meals, spa services, accommodation amenities, and tour packages. Cross-country comparisons require careful translation, cultural adaptation, and measurement-invariance testing (Dwivedi et al., 2021; Rejeb et al., 2021).

For quantitative analysis, covariance-based structural equation modeling may be appropriate when the aim is to test a theory-driven latent-variable model and assess model fit. Partial least squares SEM may be suitable when the study emphasizes prediction and a complex model with formative composites, provided that the choice is justified. Researchers should conduct power analysis, assess measurement reliability and validity, test discriminant validity, and report confidence intervals and effect sizes. Mediation should be tested with bootstrapped indirect effects; moderation should include interaction terms and conditional effects. If the sample is clustered within hotels, restaurants, or destinations, the analysis should account for the clustering rather than assume every response is independent (Dwivedi et al., 2021; Rejeb et al., 2021).

An experiment could provide stronger causal evidence. Participants could be randomly assigned to view a hospitality listing with (a) a conventional halal logo, (b) a QR-linked certificate record, or (c) a traceability interface that identifies the certifier, certificate scope, date, and handling evidence. The study could measure perceived transparency, assurance, trust, choice intention, and recall of the claim's limitations. A second manipulation could vary whether the evidence is independently verified or merely self-declared. Such a design would help determine whether trust comes from the technology label itself or from the quality and source of the evidence made available through the technology (Dwivedi et al., 2021; Rejeb et al., 2021).

Qualitative analysis should examine how consumers interpret assurance information in their own terms. Interview questions can explore what evidence they expect, which claims they regard as meaningful, how they react to conflicting certification information, and whether they see digital traceability as a convenience, a reassurance, or a surveillance risk. Coding should distinguish trust in technology from trust in institutions and providers. Researchers should retain negative cases, such as consumers who distrust digital records despite trusting conventional certification, because these cases can reveal boundary conditions that a survey might miss (Dwivedi et al., 2021; Rejeb et al., 2021).

Ethics and data governance are central. Researchers should obtain informed consent, collect only necessary data, and avoid storing identifiable travel histories unless essential and properly protected. Digital traceability systems should not expose confidential supplier information or personal data merely to create a public appearance of transparency. The study should disclose funding or industry involvement, particularly if the research evaluates a system supplied by a commercial technology provider. These practices are

important both for research integrity and for the credibility of the proposed assurance model (Dwivedi et al., 2021; Rejeb et al., 2021).

4. RESULTS AND DISCUSSION

A visitor's assurance needs change as the trip progresses. During trip planning, the traveler may need to identify suitable destinations, understand certification terminology, and compare available services. During booking, the concern may shift toward whether the selected hotel or package provides the promised facilities. At the destination, the traveler may need to verify a specific restaurant, ingredient, or service at short notice. After a service incident, the traveler needs a clear way to report the concern and understand the response. A traceability architecture designed only for procurement teams may fail at the moments when consumer trust is most vulnerable. It should therefore connect back-office records with practical touchpoints across discovery, booking, on-site service, and complaint resolution (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

The visitor journey also implies that not every data field should be shown to every user. Procurement staff may need lot codes, supplier contracts, audit results, and exception records. Frontline employees may need a clear status and escalation contact. Travelers may need a concise explanation of certification scope and the date of verification. A layered access model can make information usable without exposing commercially sensitive or personally identifiable data. The design principle is selective transparency: show each stakeholder the evidence needed for a legitimate decision, while retaining auditability and accountability across the system (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

The journey perspective also highlights the importance of continuity. A traveler may see a verified restaurant listing online, but the outlet may change supplier or menu after the listing is updated. The system should therefore define update responsibilities and service-level expectations. Certificate expiry alerts, supplier-change notifications, periodic reconciliation, and clear timestamps can reduce the risk of stale information. Where real-time updates are not possible, the interface should state the last verification date and avoid suggesting that the status has been continuously monitored (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

A common implementation mistake is to measure progress by counting the number of QR codes, registered suppliers, blockchain transactions, or app downloads. These indicators describe deployment, not assurance quality. A more useful scorecard would assess the proportion of relevant inputs covered by traceability, the proportion of certificates with current status, the rate of unresolved data discrepancies, the time required to investigate a claim, the accuracy of public listings, and consumer comprehension of the information. Operational measures should be combined with consumer measures because a technically complete system can still fail to communicate its value (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Metrics should also distinguish leading indicators from outcomes. Supplier onboarding, staff training, data-validation rules, and certificate-update processes are leading indicators of system readiness. Complaint resolution, consumer trust, repeat usage, and reduced uncertainty are outcome indicators. A program may need time to affect trust, especially where travelers have little prior familiarity with digital assurance. Managers should therefore avoid declaring success solely from early adoption figures. They should compare outcomes with a baseline and, where feasible, with similar providers that have not yet implemented the system (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Evaluation should include negative and unintended outcomes. For example, a traceability system might improve confidence among highly digitally literate travelers while creating confusion among others. A platform might improve certificate visibility but increase administrative workload for small suppliers. A high-visibility badge might increase initial selection but lead to disappointment if staff cannot answer follow-up questions. These effects should be captured rather than treated as implementation noise. A mature assurance strategy learns from discrepancies and revises the system accordingly (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Interoperability is a strategic condition because halal tourism services rarely operate within a single firm. A hotel may source ingredients from multiple distributors, use external catering services, and refer guests to independent restaurants. A destination platform may rely on certifiers and municipal agencies for

status information. If each participant uses a different data structure or identification convention, the system may require costly manual reconciliation and create gaps at organizational boundaries. Common identifiers, standardized fields, open interfaces, and clear data-sharing agreements can reduce these frictions (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Interoperability is not merely a technical issue. Participants must agree on who is responsible for data quality, who may correct records, which certificate statuses are recognized, and how disputes are escalated. A technically compatible interface cannot resolve disagreement over the meaning of a standard or the legitimacy of a certifier. Ecosystem governance should therefore define decision rights and accountability before connecting systems. This is particularly important in cross-border tourism, where legal rules and certification recognition may differ (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

A destination-wide platform may create network effects as more providers join, because travelers can compare more options and providers can rely on a common information infrastructure. However, network effects can be undermined by inconsistent verification. If inclusion is easy but evidence standards are weak, the platform may expand rapidly while losing credibility. If requirements are too burdensome, participation may remain limited and the platform may fail to represent the destination. Governance must balance accessibility with credible minimum standards and offer support that allows smaller businesses to comply (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Halal assurance and environmental sustainability can complement one another, but they should not be collapsed into a single claim. A halal-certified product is not automatically low-carbon, and an environmentally sustainable product is not automatically halal. Consumers may value both attributes, but the evidence and standards supporting them differ. Digital systems can present separate, clearly scoped information about halal certification, sourcing, packaging, food waste, or environmental performance. This avoids implying that one certification proves another quality dimension and enables consumers to make decisions according to their own priorities (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Traceability can support responsible consumption by improving stock rotation, reducing avoidable food waste, identifying supplier problems, and helping operators manage inventory. Yet such operational benefits should be measured rather than assumed. The system may generate additional hardware, energy use, data storage, or administrative activity. For many small hospitality businesses, a lightweight shared registry may deliver more net benefit than a complex architecture. Technology selection should therefore consider the environmental and economic costs of the system itself, along with the assurance value it creates (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

From a strategic-marketing standpoint, responsible communication requires firms to avoid bundling halal, ethical, local, organic, and low-carbon claims into an undifferentiated “good” label. Each claim has a different basis and may require separate evidence. Consumers should be able to see which attribute is certified, who verifies it, and what the scope covers. This precision helps prevent both consumer confusion and reputational damage when one dimension is verified but another is not (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Digital assurance projects often underperform when they are treated as an IT installation rather than an organizational change. Procurement teams may need to revise supplier onboarding; kitchen staff may need new receiving checks; managers may need to review exception dashboards; customer-service teams may need scripts for explaining certification scope. If these changes are not assigned to specific roles, records may be entered inconsistently and alerts may be ignored. Implementation plans should identify process owners, define training requirements, and establish a schedule for reviewing data quality and consumer feedback (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Frontline adoption depends on whether the system fits the realities of service work. Staff in busy kitchens or reception areas may not have time to navigate multiple screens or enter long records. A usable system minimizes unnecessary steps, integrates with existing workflows, and clarifies when human judgment is required. It should also avoid penalizing staff for raising legitimate concerns or reporting inconsistencies. If employees fear blame, they may bypass the system or conceal errors, undermining the very assurance it is intended to provide (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Leadership must communicate that the objective is accurate assurance rather than the appearance of technological sophistication. Managers should reward timely reporting, careful verification, and constructive correction. This culture is especially important when an incident reveals a gap in the system. Organizations that treat discrepancies as opportunities to improve controls may build more durable trust than those that focus on maintaining an unblemished digital dashboard (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

Table 1. Digital traceability components and assurance contribution

Component	Potential contribution	Key limitation	Governance requirement
QR-linked records	Makes certificate and product information accessible at point of decision	Code may link to stale or incomplete information	Current status, scope, update ownership, clear source
Shared digital registry	Supports certificate lookup and consistent status across providers	Depends on data quality and institutional recognition	Authorized issuers, correction process, audit trail
Blockchain / distributed ledger	Makes record history tamper-evident across multiple parties	Cannot guarantee truthful source data or complete participation	Identity controls, validation, correction governance, clear use case
IoT sensors	Captures selected conditions such as temperature or location	Does not independently establish halal status	Calibration, maintenance, event linkage, exception handling
Consumer-facing platform	Supports comparison, transparency, and informed choice	May oversimplify evidence or exclude less digitally confident users	Usability testing, multilingual access, privacy-by-design

Source: Authors' elaboration.

Table 2. Proposed hypotheses for empirical testing

Code	Hypothesis
H1	Digital traceability capability is positively associated with perceived halal assurance.
H2	Perceived halal assurance is positively associated with consumer trust in halal tourism and hospitality providers.
H3	Perceived transparency mediates the relationship between digital traceability capability and perceived halal assurance.
H4	Data integrity strengthens the positive relationship between digital traceability capability and perceived halal assurance.
H5	Certification credibility strengthens the positive relationship between perceived transparency and consumer trust.
H6	Perceived usefulness of digital traceability information is positively associated with trust in the provider.
H7	Perceived privacy risk is negatively associated with willingness to use digital traceability features.
H8	Organizational halal assurance capability strengthens the relationship between digital traceability and perceived assurance.
H9	Perceived technology-washing is negatively associated with consumer trust.
H10	Destination reputation mediates part of the relationship between trust in individual providers and intention to recommend the destination.

Source: Authors' elaboration.

The synthesis suggests that digital traceability is best understood as an enabling capability whose effect on consumer trust depends on the quality of the surrounding assurance system. Its most direct contribution is to make selected evidence easier to retrieve, connect, and check. The consumer benefit arises when that evidence reduces uncertainty about a meaningful attribute. A traceability platform that records product movement but does not clarify certification status may improve logistics management while providing limited reassurance about halal compliance. Conversely, a modest digital registry that makes the current certificate, its scope, and the issuing authority easy to verify may have substantial consumer value even without a blockchain architecture. This distinction cautions against equating technical complexity with assurance effectiveness (Rejeb et al., 2021; Kouhizadeh et al., 2021).

The first analytical insight is that data availability is necessary but insufficient. A record becomes useful only when it has a clear referent, a reliable source, an understandable meaning, and a process for addressing exceptions. In hospitality, the relevant referent may be a supplier lot, ingredient, kitchen, outlet, or menu item. If the record is not linked to the item actually served, it may create an illusion of traceability. Firms should therefore define the claims their system is designed to support and test whether a consumer or

auditor can follow the evidence from the claim back to the relevant source (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

A second insight concerns the difference between a complete digital trail and a complete supply-chain trail. Digital systems can only represent events that participating organizations capture. If a small supplier does not enter data, if a delivery is substituted without updating the record, or if an outlet operates outside the registry, the chain is incomplete even when the interface appears polished. The system should visibly distinguish verified events from missing data and should not imply continuous coverage where gaps remain. Such candor may appear less persuasive in the short term, but it protects credibility and supports meaningful corrective action (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Certification is a critical interpretive layer between technical data and religiously meaningful assurance. Consumers are not expected to independently evaluate every ingredient or audit procedure. They rely on institutions to define criteria, assess conformity, and communicate status. Digital tools can reduce the cost of checking whether a certificate is current and applicable, but the certifier's competence and accountability remain essential. A registry should identify the issuer, scope, validity period, and status, and should make suspension or withdrawal visible. If a certificate is disputed, the interface should communicate the status accurately rather than display an ambiguous badge (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

The role of certification also reveals a potential governance tension. Hospitality firms may prefer a single standardized signal for ease of communication, while consumers and jurisdictions may encounter different certification bodies and recognition arrangements. A destination-wide platform should not silently treat all credentials as equivalent unless a legitimate recognition framework supports that decision. Where standards differ, the platform can disclose the issuing body and explain the basis for recognition. This is particularly important in cross-border tourism, where visitors may be unfamiliar with local institutions and may interpret a logo through assumptions formed in another market (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Digital assurance can reduce repetitive verification work and make information available outside business hours, but it cannot fully replace knowledgeable staff. Travelers may ask questions that do not map neatly onto a database field, such as whether a particular dish can be modified or whether a facility's service arrangement meets their needs. Staff must know how to interpret the system and when to escalate a question to a manager or certifier. Training should include not only how to scan a code but also how to communicate uncertainty and avoid making claims beyond the evidence. In this sense, digital traceability should improve the quality of human service rather than displace it (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

The human interface matters especially when a problem occurs. If a traveler discovers a mismatch between a digital certificate and a menu claim, the provider's response may influence trust as much as the original error. A defensive response or unexplained technical excuse can suggest that the system is designed for promotion rather than accountability. A responsible response acknowledges the concern, checks the record, explains what is known, takes proportionate action, and communicates the outcome. Incident response is therefore part of assurance design and should be included in audits and staff training (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Distributed ledgers are often promoted because they make stored records difficult to alter unnoticed. That property is relevant where parties may dispute the history of a transaction, but it addresses only one part of data integrity. It does not establish that the original input was accurate, that the person entering the data was authorized to attest to it, or that all relevant events were captured. Strong governance requires validation at the point of entry, identity and access controls, periodic reconciliation, audit procedures, and a correction mechanism that preserves the history of changes. The record should be tamper-evident, not treated as infallible (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

This limitation has practical consequences for investment decisions. A firm should not select blockchain simply because halal claims are sensitive or because consumers may find the technology reassuring. The business case should compare expected benefits with implementation and maintenance costs, integration

requirements, supplier readiness, and the availability of trusted alternatives. A centralized registry may be more appropriate when one competent institution is responsible for updates and other parties accept its authority. A distributed ledger may be more useful when several organizations need shared records and no single party can credibly control the database. Technology choice should follow governance and use-case analysis (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

A traceability system can contain extensive operational data, but a traveler usually needs a concise answer to a practical question. The interface should present the status, scope, issuer, and date of the relevant assurance evidence first, with access to deeper documentation for users who want more detail. Language should avoid unexplained technical terms and should be available in languages relevant to the destination's visitor base. Visual symbols can support rapid interpretation, but the symbol should link to evidence rather than stand alone. If a system is unavailable, the interface should say so and provide a reliable alternative rather than silently displaying cached information as current (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

The quality of information design can influence trust independently of the underlying technology. A technically reliable database may appear unreliable if pages are broken, certificate dates are hidden, or different screens contradict one another. Conversely, an attractive interface can create excessive confidence in a weak system. Organizations should therefore test both the back-end assurance process and the consumer-facing presentation. Usability testing should include people with varying levels of digital literacy, language proficiency, and familiarity with halal certification. Accessibility is not a cosmetic issue: a system that excludes some travelers cannot fully serve the assurance purpose it claims to support (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Credible traceability can support differentiation when it reduces uncertainty that matters to a target segment. For hotels and restaurants, it can reinforce a promise of dependable halal service. For destination managers, it can make the destination's information ecosystem easier to navigate and reduce the effort travelers spend verifying basic claims. Yet traceability should not be marketed as an absolute guarantee unless the assurance system can substantiate that scope. A more defensible promise is that the destination makes certification status and relevant supply-chain evidence easier to check, with clear information about what is and is not covered (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Strategic value is likely to emerge from consistency across the service ecosystem rather than from isolated adoption. If only a few flagship hotels use traceability while restaurants, transport providers, and attractions offer inconsistent information, travelers may continue to face high search costs. Destination-level coordination can establish common data fields, minimum disclosure practices, onboarding support, and a process for updating provider status. Small businesses need accessible tools and proportionate requirements; otherwise, digital assurance could widen the gap between well-resourced operators and local enterprises. A credible destination strategy should balance consistency with inclusion (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Technology-washing occurs when a firm uses a digital tool as a reputational symbol without integrating it into substantive controls. In halal hospitality, a QR code may be promoted as evidence of complete assurance even if it links only to a supplier's self-declaration. A blockchain logo may suggest independent verification when the records are written by a single commercial actor. These practices can create short-term attention but increase long-term reputational exposure. Firms should state what the technology does, what it does not establish, who verifies the underlying claims, and how problems are handled. Precision in communication is a strategic strength because it reduces the gap between promise and performance (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Technology-washing is also a risk for consumers who interpret digital sophistication as institutional legitimacy. Interfaces often use visual cues—verified icons, dashboards, chain diagrams, and timestamps—that can look authoritative. Without clear explanations, these cues may substitute for scrutiny rather than support it. Consumer education can help, but the burden should not fall entirely on the traveler. Providers and platforms should design claims so that the evidence is accessible and the limits are visible. Regulators and certifiers can contribute by defining how digital verification marks may be used and by preventing

misleading representations of the assurance process (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Traceability often requires information exchange among suppliers, hospitality firms, certifiers, and technology providers. Not all data should be public. Supplier prices, commercially sensitive contracts, employee details, and personal information may need access restrictions. The system should disclose the minimum information needed to support a consumer claim while allowing authorized auditors to examine more detailed records. Privacy-by-design principles, access control, encryption, retention limits, and incident-response procedures are relevant to both security and trust. If consumers believe that scanning a halal information code will trigger unnecessary tracking or marketing, they may avoid the feature even if they value the assurance itself (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Security incidents can also damage institutional trust beyond the immediate technology provider. A compromised account or altered record may lead users to question the entire certification ecosystem. Organizations should define responsibility for access management, software updates, incident disclosure, and recovery. A system's resilience should be tested through realistic scenarios, including supplier substitution, expired certificates, incorrect data entry, connectivity failure, and unauthorized access. These scenarios are especially relevant in tourism because users may need information while traveling, often under time pressure and with inconsistent connectivity (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

A digital-first assurance strategy can unintentionally exclude travelers who have limited connectivity, older devices, visual impairments, or low familiarity with QR codes and online registries. Printed certificates, clear signage, trained staff, and offline access to essential information may remain necessary. Multilingual presentation is important because a visitor may not understand the local certification terminology. Digital traceability should widen access to assurance rather than make it conditional on owning a particular device or knowing how to navigate an unfamiliar platform. An inclusive system offers multiple ways to obtain the same core information while maintaining consistency in the underlying records (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Small hospitality businesses face a related participation challenge. They may lack procurement software, staff time, or resources to integrate multiple supplier systems. If a destination requires sophisticated technology without support, small operators may withdraw or remain invisible in the official registry. This can reduce the diversity of local businesses available to visitors and undermine the destination's inclusive development goals. Shared platforms, low-cost mobile tools, training, and standardized onboarding can lower the barrier to participation. Financial support may be justified where the public benefit of reliable destination-wide assurance exceeds the private benefit captured by any single firm (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Digital traceability can also intersect with Islamic finance where financing, procurement, and service delivery are linked. Financial institutions may support technology investment by hospitality firms or suppliers when the project has a clear governance model and measurable operational benefits. Shariah-compliant financing does not itself validate a supplier's halal claim, and a traceability record does not establish that a financing structure is Shariah-compliant; these are distinct assurance questions. Nevertheless, responsible financing can support the infrastructure, training, and audit capability needed for trustworthy supply chains. Investment appraisal should consider lifecycle costs, data governance, supplier adoption, and the distribution of benefits rather than treat technology acquisition as an end in itself (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

Business models may include shared destination registries, subscription-based traceability services, certification-linked digital verification, or consortium platforms. The choice raises questions about who controls the data, who pays for maintenance, and whether smaller operators can afford participation. A model that depends on a commercial platform should provide clear rules for portability and continuity if the provider exits the market. Public-private partnerships may support common infrastructure, but governance must protect independence and avoid allowing promotional interests to determine certification status. These issues connect technology strategy with the principles of accountability and fair dealing that are important in Islamic business contexts (Alamsyah et al., 2022; Sidarto & Hamka, 2021; Kouhizadeh et al., 2021).

5. IMPLICATIONS

For hospitality managers, implementation should begin with a map of the assurance problem. Firms should identify the claims consumers need to verify, the records required to support those claims, the parties responsible for creating and updating the records, and the procedures used when information conflicts. Only then should they select a technology. A small restaurant may need a reliable supplier-certificate registry and clear menu-level disclosure rather than a complex blockchain solution. A hotel group with many suppliers may benefit from integrated procurement and audit trails. A destination network may require a shared registry and common standards so that visitors can compare providers fairly (GS1, 2023; UNCTAD, 2024).

For halal certifiers and regulators, digitalization should improve the timeliness and accessibility of status information. Registries should identify the issuing authority, scope, validity, and any suspension or withdrawal. Procedures should specify how errors are corrected and how disputes are handled. Where different certification systems are recognized, the basis for recognition should be communicated clearly. The goal is to make assurance evidence more usable without implying that a digital record replaces inspection, professional judgment, or enforcement (GS1, 2023; UNCTAD, 2024; Alamsyah et al., 2022).

For destination management organizations, traceability can be positioned as a trust infrastructure that complements transport information, accessibility information, prayer facilities, food listings, and other visitor services. Common disclosure fields can reduce confusion across providers. Destination managers should establish onboarding support for small businesses and an independent process for handling complaints. Performance indicators should include the proportion of claims that are current, the time required to resolve discrepancies, consumer comprehension, supplier participation, and the incidence of inaccurate listings—not simply the number of QR codes deployed (GS1, 2023; UNCTAD, 2024; Alamsyah et al., 2022).

For technology providers, the product should be designed around assurance workflows and user needs. Systems should support role-based access, audit trails, version history, certificate expiry alerts, data portability, and clear exception handling. Vendors should avoid overstating what blockchain, IoT, or artificial intelligence can prove. They should also explain who controls the system, how data are stored, and what happens if the vendor ceases operation. A traceability service is part of a trust-sensitive infrastructure and should be evaluated on reliability, governance, and interoperability rather than interface novelty alone (GS1, 2023; UNCTAD, 2024; Alamsyah et al., 2022).

For Islamic financial institutions and investors, due diligence can assess whether proposed traceability projects have realistic adoption plans, credible governance, and measurable outcomes. Financing can support common infrastructure or supplier onboarding where benefits are shared across a destination. Yet technology projects should not be funded solely because they carry a sustainability or halal label. Appraisal should consider operating costs, data ownership, maintenance, cybersecurity, user adoption, and whether the system improves the underlying assurance process. Clear separation between Shariah compliance of financing and halal conformity of goods and services is essential (GS1, 2023; UNCTAD, 2024; Alamsyah et al., 2022).

For researchers, the agenda should move beyond binary comparisons between blockchain and non-blockchain systems. More informative questions concern the conditions under which specific traceability features reduce uncertainty, improve assurance, and change consumer choices. Research should distinguish perceived transparency from objective data quality, trust in the provider from trust in the certifier, and stated intention from actual service selection. Comparative studies can examine destinations with different certification institutions, levels of digital infrastructure, and visitor profiles. Longitudinal work can determine whether trust persists after a service incident or whether digital assurance is mainly an initial reassurance cue (GS1, 2023; UNCTAD, 2024; Alamsyah et al., 2022).

6. CONCLUSION

Digital traceability can help build consumer trust in Islamic tourism and hospitality, but only when it is integrated into a credible halal assurance system. Its primary contribution is to make relevant records more accessible, link claims to evidence, and improve coordination across suppliers, hospitality operators,

certifiers, and destination organizations. The resulting value depends on data integrity, certificate credibility, organizational capability, interface quality, and effective response to discrepancies. Technology is therefore an enabler of assurance, not a substitute for it (Alamsyah et al., 2022; Sidarto & Hamka, 2021).

This article has limitations. The meaning of halal assurance can vary with certification arrangements, consumer expectations, and the nature of the service being evaluated. (Jannah & Al-Banna, 2021; Rejeb et al., 2021). Future research should test the framework in specific tourism contexts and measure both perceived and objective assurance. A field study could compare consumer responses before and after a destination introduces a verified digital certificate registry. An experiment could vary the source and specificity of the evidence presented on a restaurant listing. A multi-level study could examine whether organizational capability and certification credibility moderate the relationship between digital traceability and consumer trust. Researchers should also assess unintended effects, including privacy concerns, exclusion of small suppliers, overconfidence in digital badges, and the possibility that consumers rely on technology without understanding its limitations (Jannah & Al-Banna, 2021; Rejeb et al., 2021).

A further research direction concerns the economic value of trust. Studies could examine whether traceability is associated with booking conversion, willingness to recommend, complaint resolution, or reduced verification costs. These outcomes should be assessed against implementation costs and the distribution of benefits across large and small providers. Research could also explore whether shared destination platforms create network effects: the value of the registry may increase as more verified providers join, but only if data quality and governance remain consistent. This would connect consumer behavior with strategic investment and platform economics (Jannah & Al-Banna, 2021; Rejeb et al., 2021).

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