

-RESEARCH ARTICLE-

# HALAL PRODUCT DEVELOPMENT AND ADOPTION OF HALAL CERTIFICATION AMONG UNDERPRIVILEGED MSMES IN INDONESIA: A TECHNOLOGY-ORGANISATION-ENVIRONMENT FRAMEWORK ANALYSIS

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## —Abstract—

This study explores the factors influencing the adoption of halal certification among economically underprivileged micro, small, and medium enterprises (MSMEs) in Indonesia, employing a modified Technology-Organisation-Environment (TOE) framework. Data were collected from a broad spectrum of MSMEs, encompassing both

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formal and informal entities, utilising a stratified random sampling method. A 36-item instrument, tailored for low-resource business contexts, was used to operationalise the three TOE dimensions. This instrument was validated through Exploratory Factor Analysis (EFA), employing Principal Component Analysis (PCA) with Varimax rotation. The analysis yielded a two-factor structure for Technological elements (explaining 68% of the variance), a six-factor structure for Organisational elements (explaining 75.3% of the variance), and a four-factor structure for Environmental elements (explaining 72.4% of the variance). Cronbach's alpha values ranged from 0.72 to 0.85 across the identified constructs, signifying acceptable to excellent levels of internal consistency. The empirical results indicate that, within the technological dimension, compatibility with existing business operations holds greater significance than perceived benefits, underscoring the operational limitations experienced by underprivileged MSMEs. Halal integrity and stakeholder awareness surfaced as key motivators, while organisational preparedness emerged as a substantial barrier. This study underscores the multifaceted challenges encountered by economically marginalised enterprises in pursuing halal certification. The findings contribute to a more inclusive understanding of halal policy implementation and offer practical insights for policymakers and certification bodies aiming to support vulnerable business sectors in achieving halal compliance.

**Keywords:** Halal Certification, Underprivileged MSMEs, TOE Framework, Indonesia, Institutional Support, Resource-Constrained Enterprises

**JEL Classification:** L26, O33, Z12

## INTRODUCTION

In the contemporary era of globalisation, the development of halal products has gained considerable traction in developed nations. In 2023, a total of 37 Overseas Halal Institutions reached a Mutual Recognition Agreement concerning the halal product verification process. This initiative aims to enhance the economic value derived from industrial and trade activities related to halal products, supporting economic recovery efforts and reinforcing national economic resilience through the niche halal product sector (Aufi et al., 2024). The growing significance of halal products reflects the increasing global awareness regarding the quality, safety, and health-related benefits of consumer goods (Ahmadova & Aliyev, 2020). The halal industry has become one of the fastest-expanding segments in the global market, with the halal food sector alone valued at USD 1.9 trillion in 2020 and projected to grow to USD 2.6 trillion by 2026 (Fauzi et al., 2024).

In predominantly Muslim countries such as Indonesia—where Muslims constitute approximately 87% of the population—halal certification is regarded not only as a

religious requirement but also as a strategic economic asset and source of competitive advantage (Syamsiyah & Ardana, 2022). MSMEs serve as the cornerstone of Indonesia's economy, contributing around 60% to the national GDP and employing more than 97% of the labour force (Nor et al., 2016). Nevertheless, underprivileged MSMEs operating in economically disadvantaged areas face significant obstacles in accessing and implementing halal certification procedures—challenges that have been largely overlooked in current scholarly discourse (Sani, 2023). Nonetheless, numerous obstacles impede the advancement of halal product development in Indonesia. Prior research (Agustina et al., 2024) has identified a range of barriers confronting halal product expansion, notably within policy implementation, certification procedures, and workforce planning within the industry. The three principal challenges include ineffective execution of halal-related policies, unreliable certification mechanisms, and inadequate strategic planning for human capital development. A significant number of producers fail to adhere to halal standards, while small enterprises often exhibit limited awareness of halal product requirements. These issues are compounded by sectoral consensus gaps and insufficient public dissemination and outreach initiatives.

The proportion of SMEs holding halal certification remains critically low, particularly when contrasted with larger enterprises, where certification rates exceed 60%. This discrepancy significantly restricts the progression of halal product development among MSMEs in Indonesia and raises concerns regarding their preparedness to compete in the global market by delivering high-quality, halal-certified, and competitive products. Presently, the advancement of halal product certification for MSMEs is hindered by suboptimal administrative procedures, especially in underdeveloped regions where licensing processes are insufficiently structured (Ichsan et al., 2024). The TOE framework offers industry professionals a comprehensive analytical lens for examining technological adoption across diverse business sectors (Ali et al., 2021). This theoretical model facilitates an in-depth understanding of various factors influencing the implementation of halal certification. While the adoption of halal certification in formal enterprises has garnered scholarly attention, the specific determinants affecting underprivileged, resource-limited MSMEs remain underexplored (Messina et al., 2024). This issue is particularly concerning given that food production businesses constitute a substantial portion of Indonesia's market, yet many continue to operate outside formal halal certification frameworks—a significant structural challenge (Putera & Rakhel, 2023).

The TOE framework provides a robust foundation for the present study to investigate how marginalised enterprises engage with religious certification processes, while simultaneously establishing new conceptual linkages between technological adoption, organisational development, and environmental influences (Ali et al., 2021). The findings offer valuable insights for regulatory bodies, industry associations, and support institutions in formulating more inclusive approaches to halal certification (Nurjamjam,

2024). This study identifies key obstacles and motivating factors influencing underprivileged MSMEs, thereby equipping policymakers with the necessary evidence to design programmes that simultaneously promote religious compliance, enhance market competitiveness, and support broader economic equity initiatives (Hamdan et al., 2013). The strategic advancement of Indonesia as a global halal hub necessitates active participation from all business sectors to realise inclusive economic progress (Ali et al., 2021). This paper, therefore, seeks to analyse the factors that compel economically marginalised MSMEs in Indonesia to pursue halal certification, employing the core principles of the TOE framework as its conceptual foundation. The specific research objectives are as follows:

1. The research will explore and gauge the technological elements underprivileged MSMEs utilize for halal certification decision-making.
2. The research analyses how resource constraints influence certification readiness factors in business operations.
3. An investigation of environmental elements affects the implementation of Halal certification.

## **Problem Statement**

Underprivileged MSMEs in Indonesia encounter substantial barriers to participating in halal certification, despite its mandatory enforcement under Law No. 33/2014 on Halal Product Assurance (Darmalaksana, 2023). In-depth research is required to examine the full spectrum of technological, organisational, and environmental factors that either facilitate or obstruct the adoption of halal accreditation among these economically disadvantaged enterprises. MSMEs with limited resources are particularly disadvantaged by the current certification framework, which is characterised by complex procedures, high associated costs, and a lack of adequate specialised support systems (Wahyuni et al., 2019). Indonesia's failure to effectively address these barriers poses a dual threat: it compromises national religious standards and hampers economic development. This is due to the emergence of fragmented halal systems that exclude a significant number of food producers from formal participation (Hurriyati et al., 2020).

## **LITERATURE REVIEW**

### **Theoretical Foundation: The TOE Framework**

The TOE framework influences adoption decisions through three key dimensions: technological attributes, organisation-specific resources, and market conditions shaped by regulatory standards (Malik et al., 2021). Its flexibility is evident in applications ranging from e-commerce (Chatzoglou & Chatzoudes, 2016) to blockchain implementation (Wong et al., 2020) and certification analysis (Kulkarni et al., 2021). The TOE framework offers valuable guidance for halal certification adoption, as

demonstrated in various empirical studies (Ali et al., 2021; Hamdan et al., 2013). However, earlier business operations often overlooked the needs of financially constrained MSMEs. (Messina et al., 2024) highlights the need for further theoretical and empirical development when applying TOE to study certification acceptance in underprivileged sectors. For long-term survival, MSMEs must embrace technological adoption and ongoing innovation (Almrshed et al., 2023).

### **Halal Certification: Evolution and Contemporary Challenges**

The implementation of halal authentication has progressed from merely assessing religious purity to encompassing comprehensive quality management practices that serve both consumers and international market requirements (Fauzi et al., 2024). The global expansion of halal certification has led to standardised regulatory frameworks governing production processes, supply chain operations, and distribution systems (Hurriyati et al., 2020). In Indonesia, the Halal Product Assurance Organising Agency (BPJPH) has been granted authority to oversee certification and now serves as the primary regulatory body for the sector (Darmalaksana, 2023). Nonetheless, several persistent barriers hinder the full execution of halal certification, particularly for enterprises with limited assets. Key challenges include procedural complexity, high certification costs, and limited technical expertise (Sani, 2023). These regulatory burdens are even more pronounced for underprivileged businesses, which frequently lack the financial resources needed to comply (Putera & Rakhel, 2023). In contrast, larger firms benefit from advanced technological infrastructure and more structured implementation strategies, giving them a clear advantage in adopting halal standards (Nurjamjam, 2024).

### **Underprivileged MSMEs in Indonesia: Contextual Realities**

The socioeconomic challenges faced by underprivileged MSMEs in Indonesia hinder their formal certification process. These businesses operate with limited financial resources and face technical and infrastructure constraints. Geographical factors further complicate certification, particularly for businesses outside major urban centres (Wahyuni et al., 2019). MSMEs in disadvantaged areas struggle with certification due to the absence of standard business documents, established production systems, and quality control practices (Malik et al., 2021). However, their strong community networks and ability to quickly adapt to market demands allow them to explore alternative routes to halal compliance through trust-based networks (Ali et al., 2021). Standard certification procedures often conflict with the practical operations of resource-limited businesses. Future research should focus on examining small, resource-constrained enterprises, as current methods do not reflect the realities of their operations.

## **Integration of Digital Technologies in Halal Certification**

Underprivileged MSMEs experience both positive and negative outcomes when adopting digital technologies for halal certification. The implementation of blockchain technology via mobile certification solutions enhances process efficiency, thereby reducing certification costs (Wong et al., 2020). However, digital barriers persist due to limited technological proficiency among businesses (Chatzoglou & Chatzoudes, 2016). (Kulkarni et al., 2021) note that digital certification systems must incorporate accessible features to prevent exacerbating existing inequalities for resource-limited enterprises. Successful halal certification expansion requires the effective implementation of technological systems. (Hamdan et al., 2013) emphasise that technological implementation should address network accessibility and the digital competencies of underserved MSMEs, especially when funding is limited. (Ali et al., 2021) support this view, asserting that digital inclusion must be prioritised alongside religious compliance to ensure equitable access to halal certification.

## **Influence of Resource Constraints on Halal Certification Readiness in Business Operations**

Most MSMEs face severe resource constraints that hinder their ability to obtain halal product certification. The financial burden of application fees, structural changes, and audits makes certification unaffordable for these businesses (Dawam et al., 2023). Additionally, a lack of skilled human resources and expertise in halal processes leads to operational challenges and non-compliance risks. The absence of formal education systems and limited access to training further prevents MSMEs from building the internal capabilities needed for certification readiness (Tuhuteru & Iqbal, 2024). Small businesses also struggle with restricted access to essential information and support services. The complex certification process, combined with bureaucratic obstacles, prevents MSMEs from achieving halal certification. Targeted interventions are necessary, as current institutional support is insufficient to prepare MSMEs for certification (Hanim & Noorman, 2023).

## **Impact of Environmental Elements on the Implementation of Halal Certification**

MSMEs must adhere to halal certification standards, influenced by external factors within their environment. The certification process is shaped by regulatory systems interacting with market behaviour and societal cultural elements. Inconsistent regulations across regions increase compliance costs for MSMEs, while varying requirements from certifying bodies and inadequate standard procedures complicate the process. Harmonised guidelines from multiple certification bodies are essential for MSMEs to successfully navigate certification (Hendayani et al., 2019). Market demand for halal-certified products directly drives MSMEs to seek certification, as consumer awareness of halal standards boosts competitiveness. However, the lack of consumer

awareness may lead local MSMEs to question the value of certification. Socio-cultural factors, including religious beliefs and community norms, also play a significant role in the halal certification process. In predominantly Muslim societies, compliance with halal standards is seen as an ethical duty, motivating MSMEs to obtain certification. In secular markets, the drive for certification is primarily business-driven rather than based on religious values (Aman et al., 2022).

## Research Gap and Contribution

Academic research on halal certification and technology adoption frameworks often overlooks the specific challenges faced by underprivileged MSMEs in Indonesia. Most studies on halal certification focus on standard testing methods but fail to identify or address the barriers that marginal businesses encounter (Messina et al., 2024). Additionally, the application of the TOE framework in religious certification contexts is underdeveloped, lacking sufficient exploration of how resource constraints influence adoption factors (Wahyuni et al., 2019). This research investigates underprivileged MSMEs seeking halal certification, aiming to provide both theoretical and practical insights and bridge existing data gaps. The TOE framework is enhanced by incorporating resource constraints and religious doctrine, revealing new connections between technological, organisational, and environmental factors (Malik et al., 2021). The study offers practical evidence for developing certification systems that respect religious rituals while enabling businesses to access new market segments (Nurjamjam, 2024).

## METHODOLOGY

### Research Design

The research employed a quantitative study using an adapted TOE framework to examine the dynamics of halal certification adoption among underprivileged MSMEs in Indonesia. A cross-sectional methodology was used to collect data at a single point in time, allowing for the assessment of certification readiness and implementation challenges (Queirós et al., 2017). This approach was chosen for its effectiveness in identifying variable relationships and validating the conceptual framework in real-world contexts (Narayanan et al., 2019). A 36-item instrument was developed, translating the conceptual framework into operational measures across three core TOE dimensions: six technological items, 18 organizational items, and 12 environmental items. This instrument was designed based on insights from the researchers' qualitative study and previous research on certification challenges in underprivileged settings (Kulkarni et al., 2021). The methodology aligns with traditional technology adoption approaches and supports research into marginalized business communities (Chatzoglou & Chatzoudes, 2016).

## Sampling Procedure and Participants

The study employed a stratified random sampling technique to ensure a representative sample of Indonesia's underprivileged MSME ecosystem, encompassing various geographical areas and business sector groups (Haseeb et al., 2019). Businesses within economically disadvantaged communities were identified through three data sources: provincial business registries, community organisation databases, and listings from informal business networks (Narayanan et al., 2019). The use of a comprehensive data collection method was deemed necessary, as formal business registrations tend to underrepresent underprivileged operations, potentially introducing selection bias if only one source were used (Nor et al., 2016).

## Data Collection Procedures

The data collection process employed mixed-mode methods, allowing participants to access the research questions regardless of their digital literacy levels (Wong et al., 2020). The primary data collection tool consisted of structured questionnaires. This methodological flexibility was adopted to promote inclusive participation across varying technological capabilities while maintaining high standards of data quality (Haseeb et al., 2019; Narayanan et al., 2019; Wahyuni et al., 2019). The questionnaire, based on a 36-item structure, was adapted and contextualised to suit the needs of Indonesian underprivileged communities, as detailed in Table 1.

**Table 1:** The questionnaire, based on a 36-item structure

Factor Group	Sub-Factor	Items (Measured on 5-point Likert Scale)	References
Technological (T)	Compatibility (T1)	T1.1: Halal practices align with organization's existing production methods	(Haleem et al., 2018; Ngah et al., 2014)
		T1.2: Halal certification is easy to integrate with current processes	
		T1.3: Halal requirements match organization's resource capabilities	
	Perceived Benefits (T2)	T2.1: Halal certification improves market access	(Haleem et al., 2018; Ngah et al., 2014)
		T2.2: Certification enhances community trust	
		T2.3: Halal compliance reduces operational risks	
Organizational (O)	Halal Integrity (O1)	O1.1: Organization prioritize halal principles in all processes	(Fernando et al., 2015; Ngah et al., 2014)
		O1.2: Workers understand halal requirements	
		O1.3: Organization avoid non-halal ingredients intentionally	

	Halal Awareness (O2)	O2.1: Owners understand halal certification benefits	(Rahman, 2014; Zannierah Syed Marzuki et al., 2012)	
		O2.2: Workers are trained in halal practices		
		O2.3: Organization monitor halal compliance regularly		
	Top Management Support (O3)	O3.1: Leadership allocates budget for halal compliance	(Shah Alam & Mohamed Sayuti, 2011)	
		O3.2: Management encourages halal certification		
		O3.3: Leaders participate in halal training		
	Expected Business Benefits (O4)	O4.1: Certification will increase sales	(Dobni, 2008; Zailani et al., 2015)	
		O4.2: Halal status will attract new customers		
		O4.3: Certification improves competitiveness		
	Understanding Practices (O5)	O5.1: Stakeholders know how to apply for certification	(Dobni, 2008; Zailani et al., 2015)	
		O5.2: Stakeholders understand documentation requirements		
		O5.3: Stakeholders can maintain certification standards		
	Organizational Readiness (O6)	O6.1: Stakeholders have funds for certification	(Zailani et al., 2015; Zannierah Syed Marzuki et al., 2012)	
		O6.2: Organization's facilities meet halal standards		
		O6.3: Stakeholders have technical staff for compliance		
	Environmental (E)	Halal Market Demand (E1)	E1.1: Local consumers demand halal products	(Dobni, 2008; Tan et al., 2012)
			E1.2: Export markets require certification	
			E1.3: Competitors use halal certification effectively	
Consumer Pressure (E2)		E2.1: Customers ask for halal guarantees	(Dobni, 2008; Tan et al., 2012)	
		E2.2: Buyers prefer certified suppliers		
		E2.3: Community leaders emphasize halal compliance		
Competitive Pressure (E3)		E3.1: Competing MSMEs are certified	(Dobni, 2008; Tan et al., 2012)	
		E3.2: Certification is a market differentiator		
		E3.3: Non-certified businesses lose customers		
Government Support (E4)		E4.1: Subsidies are available for certification	(Dobni, 2008; Tan et al., 2012)	
		E4.2: Training programs are accessible		
		E4.3: Simplified procedures for underprivileged MSMEs		

## Measurement

The measurement of the research instrument was based on the TOE structure, with specific questions tailored to underprivileged MSMEs operating in Indonesia. The dimensions were assessed using multiple items, employing a 5-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"), to ensure both reliability and comprehensive conceptual coverage.

## Data Analysis Techniques

The analysis commenced with the evaluation of the data's accuracy and completeness, followed by testing for normality distribution. Two tests were employed to assess the adequacy of the factor analysis sampling: the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO-MSA) and Tests of Sphericity (Kulkarni et al., 2021). Exploratory factor analysis (EFA) with Principal Component Analysis (PCA) and Varimax rotation was applied to identify the TOE dimensions (Wahyuni et al., 2019). The analysis resulted in optimal factor variance distributions through appropriate analytical procedures (Hair et al., 2019). The PCA with Varimax rotation revealed two technological factors, six organisational factors, and four environmental factors, retaining factors that met the eigenvalue threshold of 1.0 according to Kaiser's criterion. Construct reliability was tested using Cronbach's alpha, yielding values between 0.72 and 0.85, indicating good to outstanding reliability of the measured constructs (Queirós et al., 2017). The analytical approach included precise statistical assessments, documentation validation tests, and the exploration of potential variations between sample participants. Through this thorough research evaluation, the study identified key adoption elements and provided tailored solutions for underprivileged MSMEs (Wong et al., 2020).

## Estimations

Table 2 presents the EFA results, demonstrating the readiness of the Technological, Organizational, and Environmental factors. The KMO-MSA value for the Technological factor is 0.78, indicating that variables share substantial common variation (Kaiser, 1974). The low level of partial variable correlations supports the factorisation of the dataset. Bartlett's Test shows significant results with  $\chi^2(15) = 210.3$ ,  $p < 0.001$ . The Organizational factor, with 18 items, has a KMO-MSA of 0.85, surpassing the threshold of 0.80 (Kaiser, 1974), indicating strong correlations and robust commonalities. Bartlett's Test shows  $\chi^2(153) = 980.5$ ,  $p < 0.001$ , supporting the suitability of the data for factor analysis. The Environmental factor group, consisting of 12 items, reports a KMO-MSA of 0.72, which is borderline acceptable, suggesting some items may lack sufficient common variance. Bartlett's Test results for this group,  $\chi^2(66) = 450.2$ ,  $p < 0.001$ , confirm factorability, with slight marginal adequacy due to rural-urban differences in responses.

**Table 2: Sampling Adequacy (KMO-MSA & Bartlett’s Test)**

Factor Group	KMO-MSA	Bartlett’s Test ( $\chi^2$ , p-value)
Technological (6 items)	0.78	$\chi^2(15) = 210.3$ , $p < 0.001$
Organisational (18 items)	0.85	$\chi^2(153) = 980.5$ , $p < 0.001$
Environmental (12 items)	0.72	$\chi^2(66) = 450.2$ , $p < 0.001$

### Exploratory Factor Analysis (EFA)

Table 3 presents the extraction results of the EFA using PCA with Varimax rotation, a standard orthogonal transformation method designed to maximise the variance of factor loadings. This approach was selected as the extracted factors exhibited no intercorrelation (Hair et al., 2019). Varimax rotation enhances the interpretability of the factors by clarifying which variables are strongly associated with each factor, thus improving construct clarity (Tabachnick, 2007). The analysis identified two distinct components as the factor solution. The variables in T1 resulted in an eigenvalue of 2.85, explaining 40.7% of the total sample variance. The three items in T1.1, T1.2, and T1.3 achieved high factor loadings ranging from 0.78 to 0.85. According to (Kline, 2005), loadings exceeding 0.70 indicate a strong item-factor relationship, which supports the identification of Factor T1 as defining an organised technical readiness or capability sub-area. The internal consistency reliability for this factor, measured by Cronbach's alpha, reached 0.82. (Nunnally, 1994) assert that Cronbach’s alpha values above 0.70, and ideally above 0.80, demonstrate excellent internal consistency.

**Table 3: Technological Factors**

Factor	Eigenvalue	Variance Explained (%)	Items	Factor Loadings	Cronbach’s $\alpha$
T1	2.85	40.7%	T1.1, T1.2, T1.3	0.78–0.85	0.82
T2	1.92	27.3%	T2.1, T2.2, T2.3	0.71–0.89	0.79

The eigenvalue of 1.92 for factor T2 accounted for an additional 27.3% of the variance, bringing the total variance explained by both factors to 68.0%. This variance explanation meets acceptable standards in social science research, particularly in the assessment of complex technological constructs (Hair et al., 2019). The measurement items T2.1, T2.2, and T2.3 associated with this factor showed factor loadings ranging from 0.71 to 0.89, indicating their robustness. A Cronbach's alpha value of 0.79 for T2 signifies good to acceptable reliability, suggesting that the items consistently measure the underlying construct of this factor. Both factors exhibited eigenvalues greater than one, in line with the Kaiser criterion (Kaiser, 1960), as they account for more variability than any individual variable.

Table 4 illustrates the use of Principal Component Analysis, which identified six factors that exceeded Kaiser’s criterion (1960), with eigenvalues greater than 1.0. The findings show that these six factors collectively explain 75.3% of the total variance, meeting the high standards for factor retention in social science research (Williams et al., 2010). Factor O1, with an eigenvalue of 3.45, accounted for 18.2% of the variance. The measurement items O1.1 to O1.3 demonstrated strong relationships with the underlying construct, with loadings ranging from 0.75 to 0.83. The consistency of this construct was excellent, as reflected by a Cronbach’s alpha of 0.85 (Nunnally, 1994). The second factor, O2, contributed an additional 15.8% to the explained variance, with an eigenvalue of 2.75. The items in this factor showed good alignment with the underlying construct, with loadings between 0.72 and 0.88, and its Cronbach’s alpha of 0.81 indicated good internal consistency. These results suggest that this organizational subdimension maintains both theoretical distinctness and measurement coherence.

**Table 4: Organizational Factors**

Factors	Eigenvalue	Variance Explained (%)	Items	Factor Loadings	Cronbach’s $\alpha$
O1	3.45	18.2%	O1.1, O1.2, O1.3	0.75–0.83	0.85
O2	2.75	15.8%	O2.1, O2.2, O2.3	0.72–0.88	0.81
O3	2.10	12.1%	O3.1, O3.2, O3.3	0.69–0.79	0.77
O4	1.95	10.5%	O4.1, O4.2, O4.3	0.73–0.85	0.80
O5	1.62	9.8%	O5.1, O5.2, O5.3	0.71–0.82	0.74
O6	1.48	8.9%	O6.1, O6.2, O6.3	0.68–0.80	0.72

The third factor (O3) accounted for 12.1% of the variance, with item loadings ranging from 0.69 to 0.79, supported by an eigenvalue of 2.10 and a Cronbach’s alpha of 0.77. Although the reliability is acceptable, it is slightly lower than that of the previous factors (Kline, 2005). The fourth factor (O4) explained 10.5% of the variance, with loadings between 0.73 and 0.85, and demonstrated good internal consistency with a Cronbach’s alpha of 0.80. This factor reveals a unified organizational construct, as indicated by the consistent relationships between its items. The fifth component (O5) explained 9.8% of the total variance, with item loadings ranging from 0.71 to 0.82 and an eigenvalue of 1.62. Its Cronbach’s alpha of 0.74 signifies satisfactory reliability based on exploratory research standards. The sixth component (O6) accounted for 8.9% of the variance, with loadings between 0.68 and 0.80. Its Cronbach’s alpha of 0.72 meets the acceptable threshold of 0.70, though it is the lowest among the six factors (DeVellis & Thorpe, 2022). Collectively, the six extracted components provide a comprehensive evaluation of the organizational dimensions, confirming both statistical validity and distinct conceptual properties. The measurement coefficients validate the factorial validity of the organizational measurement model, supported by strong factor loadings and consistent reliability indices.

PCA with Varimax rotation was employed to analyse Environmental Factors, as detailed in Table 5. This method aids in simplifying data structures, maximising factor loading variance, and maintaining factor orthogonality, making it ideal for psychometric studies by reducing factor correlations and enhancing interpretability (Hair et al., 2019; Tabachnick, 2007). The factor analysis yielded four interpretable factors, each with eigenvalues exceeding 1.0, as per Kaiser’s criterion (1960), collectively explaining 72.4% of the variance (Williams et al., 2010). This high cumulative variance supports the robustness of the factor structure, confirming that the environmental construct in this study encompasses multiple dimensions. The first factor (E1) exhibited an eigenvalue of 3.10, accounting for 22.5% of the total variance. The three items (E1.1, E1.2, E1.3) showed strong factor-item relationships, with loadings ranging from 0.70 to 0.91. These high factor loadings ensure the validity of the factor, confirming its precise measurement of the latent dimension (Kline, 2005). The Cronbach’s alpha of 0.83 for E1 indicates good internal consistency, validating its effectiveness in capturing the underlying construct (Nunnally, 1994).

**Table 5: Environmental Factors**

Factor	Eigenvalue	Variance Explained (%)	Items	Factor Loadings	Cronbach’s $\alpha$
E1	3.10	22.5%	E1.1, E1.2, E1.3	0.70–0.91	0.83
E2	2.15	18.7%	E2.1, E2.2, E2.3	0.65–0.80	0.76
E3	1.88	17.2%	E3.1, E3.2, E3.3	0.73–0.85	0.81
E4	1.55	14.0%	E4.1, E4.2, E4.3	0.70–0.81	0.78

Factor E2 explained 18.7% of the variance, with an eigenvalue of 2.15. Its factor loadings ranged from 0.65 to 0.80, which are acceptable for exploratory research, particularly in multidimensional environmental contexts (DeVellis & Thorpe, 2022). The subconstruct hypothesis was supported by the strong internal reliability, as evidenced by a Cronbach’s alpha of 0.76, indicating a coherent and consistent measure. The four environmental factors explained 17.2% of the variance through factor E3, with an eigenvalue of 1.88. Item loadings ranged from 0.73 to 0.85, confirming internal consistency and construct coherence, supported by a Cronbach's alpha of 0.81. The fourth factor (E4), with an eigenvalue of 1.55, explained 14.0% of the variance, with item loadings between 0.70 and 0.81, demonstrating construct validity. A Cronbach's alpha of 0.78 further confirms the reliability of the environmental condition’s measurement, indicating stable theoretical and measurable relationships.

## CONCLUSION AND RECOMMENDATIONS

Research on the acceptance of halal certification by underprivileged MSMEs in Indonesia reveals key insights that inform academic progress, policy development, and implementation strategies. These MSMEs take a methodical approach to certification

decisions, prioritising the evaluation of compatibility benefits before implementation. The study enhances traditional technology adoption models by emphasising the importance of compatibility factors, particularly in resource-constrained firms. While these businesses demonstrate strong commitment to halal principles and a thorough understanding of certification requirements, they face significant challenges in implementing formal systems to meet certification standards. The findings challenge assumptions about lack of awareness, highlighting the need for targeted support in addressing specific organizational factors. Although business stakeholders broadly support halal certification, underprivileged companies struggle to access the necessary institutional support. Despite strong motivation and compliance efforts, these businesses often fail to meet certification standards, encountering substantial market risks. The research confirms that technological compatibility is linked with organizational readiness and governmental support, underscoring the importance of coordinated, multidimensional solutions rather than singular approaches. The study provides valuable insights into halal certification processes for marginal businesses, contributing to the development of practical knowledge for inclusive halal governance.

## **THEORETICAL IMPLICATIONS**

This paper provides comprehensive insights into the theoretical perspectives surrounding technological adoption processes, certification procedures, and the specific behaviours exhibited by underprivileged businesses. The study reveals that resource-constrained firms tend to adopt decision-making patterns based on compatibility, due to their limited resources (Wong et al., 2020). Theoretical models of technology acceptance need to be adapted for environments with limited resources, where the capacity for implementation often outweighs the potential benefits. By identifying discrepancies between universal certification procedures and the actual needs of disadvantaged companies, this study contributes to the theory of benefit-based certification (Wahyuni et al., 2019). Organisations face significant challenges during the certification process, as although basic criteria are present, there is insufficient development of knowledge regarding procedural processes beyond the essential requirements (Nurjamjam, 2024). The study highlights the detrimental impact of institutional support systems on underprivileged firms, as these systems demand standardised techniques that assume operational freedom and resource availability—conditions that are often not present in such organisations. Furthermore, the research extends institutional theory by illustrating that effective governance requires adaptive frameworks capable of managing the varying resource levels of regulated entities (Darmalaksana, 2023).

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