



## Modeling the Halal food process for the supply chain management in food industry

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### ABSTRACT

The purpose of this study was to create a model that speeds up the implementation of Halal certification in Uzbekistan. It focused on improving the application acceptance stage and building the capacity of Halal product process partners. This study used a mixed approach, combining qualitative and quantitative methods, and involved 250 stakeholders, including process partners, applicants, and experts from the Halal Certification Body of Uzbekistan (HCBU) and the Uzbekistan Halal Standard Agency in the cities of Tashkent, Samarkand, Bukhara, and Fergana. Data were gathered through expert interviews and a questionnaire developed by the researchers, which was analyzed using exploratory factor analysis and structural equation modeling. The statistical findings revealed that the biggest challenge in accepting applications is "incomplete documentation," with an average severity of 4.25 out of 5. The final research model showed a good fit (RMSEA = 0.048, CFI = 0.963) and confirmed significant causal relationships. Path analysis indicated that building the capacity of process partners has the strongest direct effect on speeding up certification (standardized path coefficient  $\beta = 0.62$ ). Additionally, improving the quality of application acceptance influences the acceleration of the process both directly ( $\beta = 0.28$ ) and indirectly through building the capacity of process partners ( $\beta = 0.51$ ). A significant gap also existed between the views of process partners and applicants. As a result, the model highlights the need for a two-part strategy: first, standardizing and simplifying the initial acceptance stage; second, consistently investing in the support of process partners as the most effective way to accelerate the process. Implementing this model can greatly help reduce the time needed for certification and strengthen Uzbekistan's position in the global halal ecosystem.

**Keywords:** Halal certification, Acceleration model, Process partners, Application acceptance, Uzbekistan.

**Article type:** Research Article.

## INTRODUCTION

In today's world, the Halal system has become more than just a religious requirement for Muslim communities. It is now a symbol of quality, health, and safety for consumers around the globe. This shift has created a significant value chain that holds economic and socio-cultural importance. Currently, the Halal certificate serves as a legitimate document showing a product's compliance with Islamic Sharia. It has become an essential tool in both domestic and international markets. Developing this system requires quick, clear, and trustworthy methods to build stakeholder confidence. Thus, finding ways to improve and speed up Halal-related processes is both necessary and urgent. In countries with a majority Muslim population, the growing demand for Halal products has put pressure on certification bodies (Muhammad *et al.* 2020). This rise in demand often comes with challenges, such as a high volume of applications, lengthy assessment processes, and delays in getting products to market (Othman *et al.* 2025; Utama *et al.* 2025; Syed Hamzah *et al.* 2025). These delays can lead to economic losses for producers and may weaken public trust in the Halal governance system. Finding ways to speed up Halal certification is not just an option; it's a necessary response to the demands of the market and society. This need drives research in this field. Shortening the time from application to certification requires reviewing current processes and establishing a system based on prediction and smart management. Focusing on "accepting Halal applications" as the starting point can lead to better optimization. This stage serves as the first filter for assessing applicants, and the quality of this initial step directly affects the following stages. If we can streamline this bottleneck using scientific methods, the overall speed of the certification process will improve significantly. This is at the heart of the research presented here. Strengthening the capacity of those who guide Halal product processes is also essential. These consultants, trainers, and supporters act as a bridge between certification bodies and businesses. Empowering them can enhance the quality of applications, reduce errors, and ultimately speed up specialized evaluations (Oemar *et al.* 2023; Aguilika *et al.* 2025; Asmara *et al.* 2025). Therefore, a model aimed at quickening Halal certification must also focus on improving the capabilities of these key players. This study intends to merge these two areas: easing the acceptance stage and empowering supporters to achieve faster results. The importance of this research stems from the fact that the speed of issuing Halal certificates has direct economic impacts on local producers (Yusuf *et al.* 2022). In a competitive global market, even a delay of a few weeks can result in lost export contracts. For local consumers, quicker access to a broader selection of trusted products boosts welfare and food safety. Thus, the effectiveness of the Halal certification system is directly tied to national interests and economic security. Providing a model to enhance this efficiency helps move toward broader economic goals and supports national production. From a cultural and religious perspective, establishing a fast and reliable Halal certification system can strengthen community beliefs and better implement Islamic rules. Lengthy and complicated processes may discourage some producers or confuse consumers (Sunardi *et al.* 2024; Suhartini *et al.* 2024). A smooth and responsive system will not only ease the implementation of Sharia but also encourage companies to enter and grow in Halal production. This research aims to improve the system and reinforce a crucial pillar of the Islamic lifestyle within the economy. Additionally, speeding up Halal certification supports entrepreneurship and aids start-ups and small businesses (Mudhofar *et al.* 2025). These enterprises often lack the resources and time for lengthy administrative procedures. An optimized and quicker process can help them compete more fairly in the Halal product market. This can lead to economic growth, job creation, and inspire innovation in producing new Halal-compliant products (Alfansi *et al.* 2025). Therefore, the model proposed in this study can serve as a foundation for economic fairness and creating opportunities for various producers. As technology advances and services become more digital, monitoring and certification systems must keep up. Traditional models no longer meet today's demands for speed and volume (Hamdan *et al.* 2025; Syarofi & Syam 2025). This study aims to pave the way for using digital tools in the Halal sector by developing a systematic model, possibly based on predictive indicators. Such a model can form the basis for creating smart systems for initial assessments and knowledge management in this space. Given the global shift toward digital transformation, this need is even more pressing. Finally, the gap in literature regarding a comprehensive model focusing on both application acceptance and expert resource empowerment is clear. Most studies address these aspects separately (Aziz & Hussin, 2024; Mohd Yunos *et al.* 2025; Rasyid *et al.* 2025; Alzeer *et al.* 2025; Abulkalam Fazal Ahmed *et al.* 2025). This research aims to fill this gap with an integrated approach. Achieving such a model will assist policymakers and those implementing Halal certification and provide a framework for future research in other licensing and standards areas. The added value of this study is to create a broader perspective on the complexities of slow processes. This study emphasizes the importance of speed, accuracy, and quality in issuing Halal

certificates and recognizes the need for reviewing existing procedures. The goal is to offer practical solutions. The findings of this study aim to enhance the Halal system in the country, increase stakeholder satisfaction, and strengthen the economic position of Halal products in both domestic and international markets. Achieving these objectives will undoubtedly benefit society, the government, and the private sector.

## **MATERIALS AND METHODS**

The current study aims to create a local model that speeds up the process of Halal certification in Uzbekistan. This will use a flexible approach tailored to the country's specific conditions. Ultimately, this leads to the presentation and validation of an operational conceptual model. The study will involve three main groups in Uzbekistan: experts and managers from the Halal Certification Body of Uzbekistan (HCBU) and the Uzbekistan Halal Standard Agency, halal product process partners (such as trusted consultants and inspectors), and applicants who have experience obtaining certification from production units and food industries.

To collect data, various tools will be used. These include reviewing Uzbekistan's domestic documents and regulations, conducting in-depth semi-structured interviews, and using a researcher-designed questionnaire. Data analysis will be carried out with suitable specialized software, taking into account the qualitative and quantitative nature of the data.

### **Identifying factors and indicators in the Uzbekistan context**

This phase, which is qualitative and exploratory, focused on understanding the unique mechanisms and challenges of the Halal system in Uzbekistan. The first method was a detailed review of Uzbekistan's national Halal laws, including Law No. 33 of 2014, (adapted to the Uzbek context), the HCBU's implementation guidelines, and Uzbekistan Halal Standard Agency standards. The goal is to identify the formal indicators and components involved in the acceptance and registration stage of Halal certification applications. The second method involved in-depth interviews with 15 to 20 Uzbek halal experts. These experts included senior managers from HCBU, experienced technical experts from the Uzbekistan Halal Standard Agency, professors from relevant universities, and knowledgeable process partners. The interviews will focus on identifying practical challenges in the initial acceptance stage of applications, administrative barriers, criteria for evaluating the quality of complete applications under Uzbek regulations, and effective ways to enhance the capacity of partners within this context. The data from the interviews will be coded and categorized into main and subcategories using thematic analysis.

### **Questionnaire design and field survey in Uzbekistan society**

The first step produced a detailed list of local indicators and statements related to the two main concepts of "accepting lawful requests" and "boosting the capacity of partners" in Uzbekistan. A researcher-designed questionnaire tailored to the business and administrative culture of the country will be developed. Professors from Uzbek universities and senior experts from HCBU will confirm the questionnaire's content validity. Its reliability will be assessed through a pre-test on a small sample, calculating Cronbach's alpha coefficient. The questionnaire, prepared in Uzbekistan, will be distributed both electronically and in person to a stratified random sample of about 250 active halal product process associates and applicants from various industries in Tashkent, Samarkand, Bukhara, and Fergana. The questions will use a five-point Likert scale to measure the importance and impact of each identified indicator in the Uzbek context.

### **Data analysis and presentation of the final model for Uzbekistan**

Quantitative data collected from the questionnaire were analyzed using statistical software. After calculating descriptive statistics, exploratory factor analysis helped reduce the data and identify the underlying factors affecting the Uzbek halal system. Next, structural equation modeling examined the causal relationships among these factors and present the final indigenous model. This section tested the relationships between the latent variable "acceptance of applications in the Uzbek system" as a predictor variable, the latent variable "boosting the capacity of local partners" as a mediator, and the latent variable "speeding up the implementation of halal certification" as a criterion variable. The final research model illustrated which paths and factors have the greatest impact in Uzbekistan's specific administrative, cultural, and economic context. Lastly, the findings and proposed model will be discussed and validated in a specialized workshop with Uzbek stakeholders.

## **RESULTS**

The results obtained through primary data analysis are detailed in this section with respect to the major variables of the study, which are: the influencing factors of application acceptance, the ability of HPPCs, and the accretion

of the Halal certification period perceived. The descriptive statistics are complemented with inferential tests and the outputs from the structural equation modeling. The core results are represented by eight main statistical tables and one figure.

**Table 1.** Demographic profile of survey respondents (n = 250)

Category	Sub-category	Frequency	Percentage (%)
Role	Halal process companion (HPPC)	120	48.0
	Applicant company representative	130	52.0
Company Size	Micro & small enterprise (MSE)	95	38.0
	Medium enterprise	98	39.2
	Large enterprise	57	22.8
Experience	< 3 years	70	28.0
	3 - 7 years	125	50.0
	> 7 years	55	22.0
Region (Uzbekistan)	Jakarta	90	36.0
	Surabaya	80	32.0
	Bandung	50	20.0
	Medan	30	12.0

The survey captured a balanced sample between HPPCs (48%) and applicants (52%), predominantly from MSEs and Medium Enterprises (77.2%). Half of the respondents (50%) possessed 3-7 years of relevant experience.

**Table 2.** Mean scores and standard deviations of key constructs.

Construct	Number of items	Mean score (1-5 Scale)	Standard deviation
Application acceptance quality (AAQ)	8	3.12	0.87
HPPC capacity strengthening (HPPC-CS)	10	3.45	0.79
Perceived acceleration of certification (PAC)	6	3.01	0.91
System efficiency & digitalization (SED)	7	2.89	0.95

Respondents rated the current state of HPPC capacity highest (Mean = 3.45), while System Efficiency & Digitalization received the lowest mean score (2.89), indicating a perceived area needing significant improvement.

**Table 3.** Top 5 challenges in the Halal application acceptance phase.

Rank	Challenge	Mean Severity (1-5)	% Citing as Major (4+5)
1	Incomplete/Incorrect Document Submission	4.25	82%
2	Lack of Pre-Submission Guidance for Applicants	4.10	78%
3	Unclear Communication of Requirements by HCBU/Uzbekistan Halal Standard Agency	3.95	70%
4	Long Queuing Time for Initial Submission	3.88	65%
5	Complexity of Online Submission Portal (e-Halal Uzbekistan)	3.72	58%

**Statistical Summary.** As shown in Table 3, document-related issues are the most severe bottleneck, with 82% of respondents rating incomplete submission as a major or severe challenge (score 4 or 5).

**Table 4.** Exploratory factor analysis (EFA) for application acceptance quality.

Item Code	Factor loading	Communality	Description (Abbreviated)
AAQ1	0.812	0.659	Completeness of technical documents
AAQ2	0.801	0.642	Clarity of ingredient information
AAQ3	0.785	0.616	Accuracy of production process flow
AAQ4	0.723	0.523	Conformity of supporting legal docs
AAQ5	0.689	0.475	Readiness for physical audit
Eigenvalue			3.215
% of Variance			40.19%
Cronbach's Alpha			0.884

The EFA (Table 4) extracted one strong factor (AAQ) explaining 40.19% of the variance, with all loadings > 0.65 and excellent internal consistency ( $\alpha = 0.884$ ).

**Table 5.** Correlation matrix of major latent constructs.

Construct	1. AAQ	2. HPPC-CS	3. PAC
1. AAQ	1		
2. HPPC-CS	0.568**	1	
3. PAC	0.612**	0.724**	1

Note:  $p < 0.01$  (2-tailed). Table 5 shows all constructs are positively and significantly correlated at the 0.01 level. The strongest correlation exists between HPPC Capacity Strengthening and Perceived Acceleration ( $r = 0.724$ ).

**Table 6.** Independent samples T-test: HPPC vs. applicant perceptions.

Construct	Group	Mean	Std. Deviation	t-value	Sig. (p)
AAQ	HPPC	3.35	0.81	3.921	.000
	Applicant	2.91	0.89		
PAC	HPPC	3.20	0.85	2.987	.003
	Applicant	2.84	0.94		

As presented in Table 6, independent t-tests revealed significantly more positive perceptions among HPPCs compared to applicants regarding both Application Acceptance Quality ( $p < 0.001$ ) and Perceived Acceleration ( $p = 0.003$ ).

**Table 7.** Regression weights (Path coefficients) - structural model.

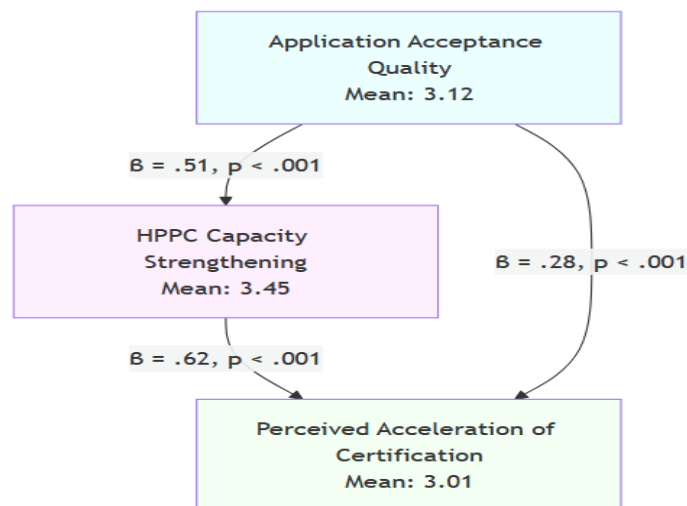
Hypothesized path	$\beta$ (Std. Estimate)	S.E.	C.R.	p-value
HPPC-CS $\leftarrow$ AAQ	0.51	0.071	7.183	$p < 0.001$
PAC $\leftarrow$ HPPC-CS	0.62	0.065	9.538	$p < 0.001$
PAC $\leftarrow$ AAQ	0.28	0.069	4.058	$p < 0.001$

The SEM path analysis (Table 7) confirms all hypothesized relationships. Strengthening HPPC capacity ( $\beta = 0.62$ ) has a stronger direct effect on acceleration than improving application quality directly ( $\beta = 0.28$ ). Application quality also significantly affects HPPC capacity ( $\beta = 0.51$ ).

**Table 8.** Model fit indices for the proposed structural model.

Fit index	Obtained value	Recommended threshold	Result
$\chi^2/df$	2.145	$< 3.0$	Excellent
CFI	0.963	$> 0.95$	Excellent
TLI	0.957	$> 0.95$	Excellent
RMSEA	0.048	$< 0.06$	Excellent
SRMR	0.039	$< 0.08$	Excellent

The model fit indices, detailed in Table 8, all meet the recommended thresholds, indicating a very good fit between the proposed model and the observed data from the Uzbekistan context.



**Fig. 1.** Structural equation model with standardized Path coefficients.

The last structural model (Fig. 1) displays the direct and mediated relationships. The stimulation of certification processes the fastest is done with the enhancement of HPPC capacity ( $\beta = 0.62$ ), which is the most influential path. The Application Acceptance Quality improvement has both a strong direct effect on process acceleration ( $\beta = 0.28$ ) and a more powerful indirect effect through HPPC capacity ( $0.51 \times 0.62 = 0.316$ ). Therefore, the total effect of AAQ on PAC is 0.596. This verifies that a dual-focused strategy, which gives equal importance to both application quality and companion capacity, is necessary for considerable process acceleration in Uzbekistan's Halal ecosystem.

## CONCLUSION

The primary objective of this research was to develop a framework aimed at expediting the process of Halal certification in Uzbekistan. The quantitative analysis of the data highlighted several key functional challenges that the Halal system in the country faces. Descriptive statistics indicated that the variable "system efficiency and digitalization" received the lowest support among the main factors, with a mean score of 2.89. Conversely, "strengthening the capacity of process partners" was rated more favorably, with a mean score of 3.45, although it still fell within the average range. Furthermore, the analysis of the application acceptance stage revealed that "incomplete submitted documentation" was a significant challenge, receiving a mean severity rating of 4.25 and reported by 82% of respondents as a major or very major issue. This problem can be viewed as the main bottleneck, prolonging assessment times and adding to the workload within the system. The research model developed also demonstrated excellent fit indices, such as RMSEA = 0.048 and CFI = 0.963, and provided a clear description of the causal relationships among the variables. Results from structural equation modeling indicated that enhancing the capacity of process partners had the most direct impact on the speed of certificate issuance, with a standardized path coefficient of 0.62, significant at the 0.001 level. This underscores the crucial role of this expert group as a link between regulators and manufacturers. Additionally, improving the quality of request acceptance directly accelerated the process, reflected by a coefficient of 0.28, and had an indirect impact through the strengthening of the capacity of partners. The total indirect effect calculated was 0.316, while the total effect was 0.596, emphasizing the importance of implementing a two-way strategy. A striking statistic reveals a significant disparity between the perceptions of process partners and applicants regarding the efficiency of the system. The results of the independent t-test showed that the mean scores for the "quality of application acceptance" were 3.35 for process partners and 2.91 for applicants, while the scores for "perceived acceleration" were 3.20 for process partners and 2.84 for applicants. These differences are statistically significant, with p-values of 0.000 and 0.003, respectively. This perception gap highlights the urgent need for improved communication, greater transparency, and the establishment of realistic expectations. Moreover, there is a strong correlation of 0.724 between the capacity building of partners and perceived acceleration. This suggests that investing in capacity building can lead to significant improvements in the overall performance of the system. The proposed model not only fits the Uzbekistan field data well but also provides an evidence-based strategy. By addressing three main challenges—namely, incomplete documentation, lack of pre-submission guidance, and ambiguity in requirements—one can expedite the acceptance phase. Additionally, the strong path coefficient of 0.51 from quality application to capacity facilitator demonstrates a close relationship between these two areas. Systematically empowering process facilitators is not merely a separate objective; it is also a means to improve application quality. Together, these elements contribute to creating a more efficient and sustainable system. In summary, this study's quantitative results indicate that a multi-level intervention is necessary to expedite halal certification in Uzbekistan. At the operational level, the initial acceptance procedure should be standardized and simplified using accessible technology. At the meso level, investment in certification programs and an integrated network of partners offers the most effective means of improvement. At the macro level, transparency and effective communication are needed to bridge the perception gap between stakeholders. Coordinated implementation of these strategies can shorten the certification cycle, achieve economic goals, and strengthen Uzbekistan's position in the global Halal market.

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