

Fig. 1 Use Case Diagram of HSCMT as an embedded service of an authorized payment gateway

Next, the prototype HSCMT analytics system receives all transaction data and associated documents, and it then analyses and stores the data in its associated database. Finally,

micro MHSOs may utilize the prototype HSCMT analytics dashboard, as shown in Fig. 2, to overview their current transactions and make HSCMT analytics-based decisions.

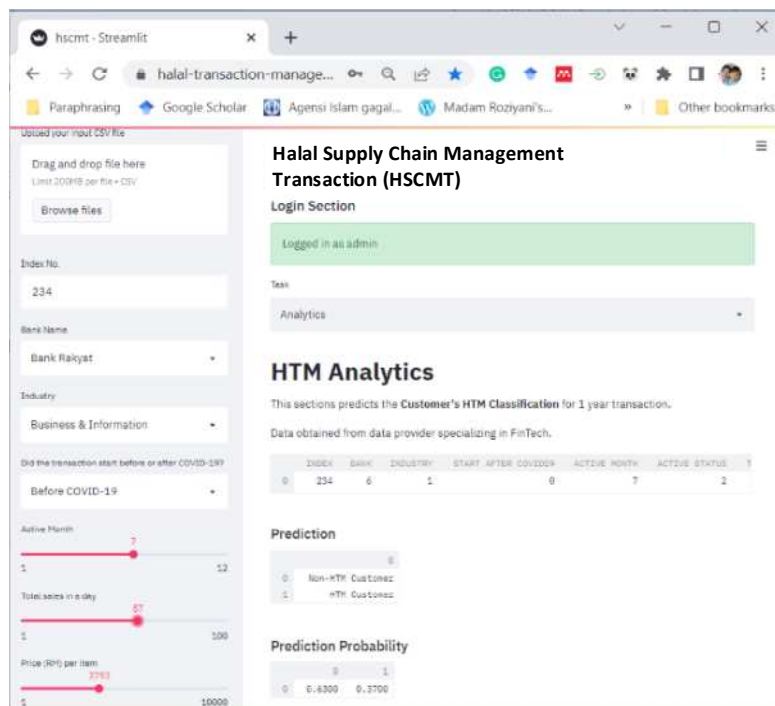


Fig. 2 HSCMT Analytics Dashboard

#### D. Expert and User Roundtable Verification Session

In the last phase, the conceptual framework, model, and prototype simulation were presented and validated through an online expert roundtable. The session was held for four days online, using the Google Meet platform. The roundtable discussion comprised 14 experts to assess the model's efficacy in improving transactional value and assisting MHSO in making choices via prediction categorization. The thoughts of the experts who participated in the roundtable discussion on the prototype's usability and expert consensus were documented. The usability questions were scored using a Likert scale.

The survey concluded with two open-ended questions on their thoughts on the proposed system and recommendations for improvement. First, the assessment determines the usability and efficacy of the results and the degree of agreeability of each expert. A usability score of 80 or more is considered good, while an agreeability score of at least 4 out of 5 is considered good [25].

The architectural methodology for this research's experimental activities was summarized in Fig.3 referred to phases from Cross-Industry Standard Process for Data Mining (CRISP-DM) process as the most comprehensive data mining method for industrial projects.

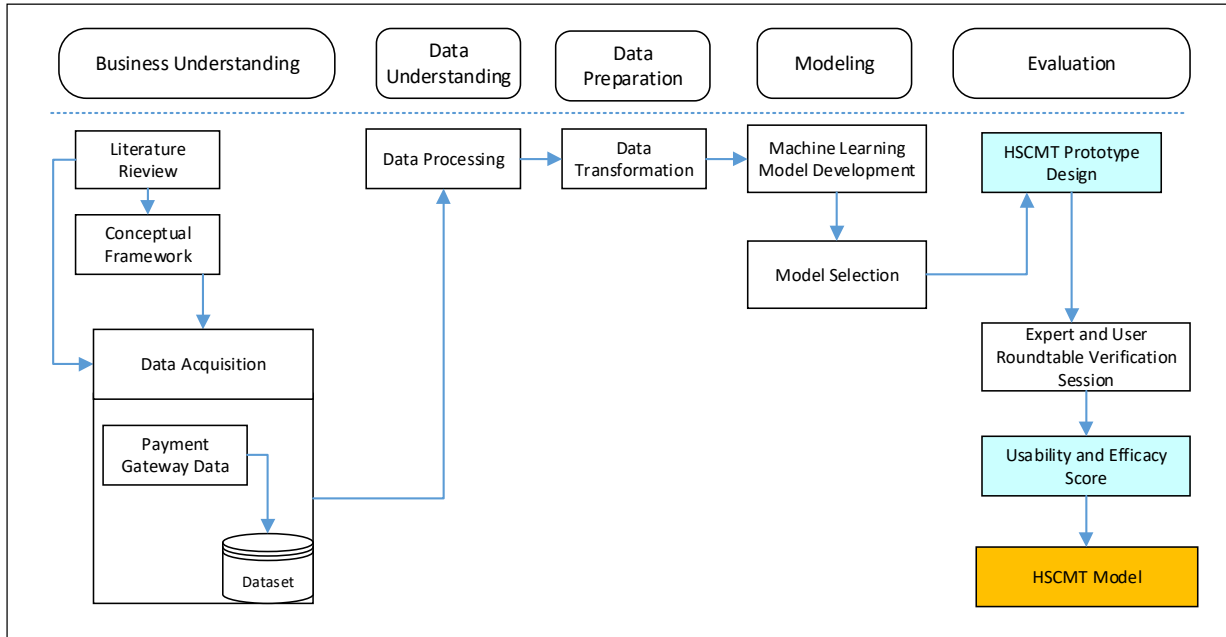


Fig. 3 An architectural methodology for this research's experimental activities

### III. RESULTS AND DISCUSSION

There are three categories related to calculating the usability of HSCMT: accuracy, reliability, and validity scores. The scores are first collected from each expert based on their categories, as shown in Table 3.

TABLE III  
CATEGORIZATION OF HSMCT EXPERT USABILITY SCORES

Category	Measurement
Accuracy	QA1: Data collection point, documentation, structuring, and verification QA2: Account transactional details in determining its Halal compliance are done correctly QA3: Transaction log displays enough basic and additional data for decision-making purposes QA4: Cumulative transaction graph is displayed correctly QA5: Transactional growth comparison graph is displayed correctly QA6: Geographical Transaction point is mapped and displayed correctly QA7: Analytical process and probability are done and displayed using the correct technique

Reliability	QR1: Data collection point is from an official, authorized, and trusted source QR2: Business transaction collection has proof of documentation QR3: Analytics model was developed using intelligence from the correct group of official and trusted experts with relevant expertise QR4: Analytics prototype was developed using intelligence from the correct group of official and trusted experts with relevant expertise QR5: Results from the transaction analytics dashboard can reliably be used by Halal SME owners to make business decisions
Validity	QV1: The conceptual framework is developed using confirmed and proven methods QV2: The analytics model is developed using confirmed and proven methods QV3: The prototype is developed using confirmed and proven methods that mimic actual Halal SME owner's transactions QV4: The prototype can be proven academically and implemented within the industry through payment gateway integration QV5: All the results discussed have been presented to and discussed with all experts within roundtable sessions

Then, the scores are measured based on the experts' agreeability on a scale of 1-5 (Highly disagreeable to highly agreeable). Each row category will first be averaged among all the experts (eq. 1), as seen in the example in Table 4.

TABLE IV  
SAMPLE CATEGORIZATION CALCULATIONS BY ROW FOR 3 EXPERTS

Measurement	Expert			Mean Agreeability Score
	Expert 1	Expert 2	Expert 3	
QA1	4	4	3	3.67
QR1	4	5	5	4.67
QV1	4	5	3	4.00

$$\text{Average Agreeability Score} = \frac{\text{Sum}(\text{Expert } n)}{\text{Total number of Experts}} \quad (1)$$

Then, each category mean is converted to a percentage and averaged to the total of its category (eq. 2, where Q(Cat)n is the measurement number, e.g., QA1), as seen in the example in Table 5. In the Table 5 sample, the mean usability score for accuracy was 78.57%, reliability was 82.86%, and validity was 82.85%.

TABLE V  
SAMPLE CATEGORIZATION CALCULATIONS BY CATEGORY FOR 14 EXPERTS

Measurement	Mean Agreeability Score	Mean Category Percentage
QA1	4.14	
QA2	4.07	78.57
QA3	3.57	
QR1	4.00	82.86
QR2	4.29	
QV1	4.21	
QV2	4.07	82.85
QV3	4.14	

$$\text{Average Category Percentage} = \frac{\text{Sum}[Q(\text{Cat})n \text{ Average Agreeability Score}]}{\text{Total number of Measurements in Category}} \quad (2)$$

So, for HSCMT, the average usability score for accuracy was 81.02%, the average usability score for reliability was 85.71%, and the average usability score for validity was 84.29%. The overall mean usability score for HSCMT was 83.67%. The full results are shown in Table 6.

TABLE VI  
FULL MEAN CATEGORIZATION CALCULATIONS BY CATEGORY FOR 14 EXPERTS

Measurement	Mean Agreeability Score	Mean Category Percentage
QA1	4.14	
QA2	4.07	
QA3	3.57	
QA4	4.00	81.02
QA5	4.21	
QA6	4.29	
QA7	4.07	
QR1	4.00	
QR2	4.29	
QR3	4.57	85.71
QR4	4.57	
QR5	4.00	

Measurement	Mean Agreeability Score	Mean Category Percentage
QV1	4.21	
QV2	4.07	
QV3	4.14	84.29
QV4	4.07	
QV5	4.57	
Total Average Percentage		83.67

The experts agreed that the context includes all data from the extraction of HSCMT transactions up to the MHSO internal commerce data. These data undergo transactional analytics before being categorized into decision-making information through the prototype system.

Results also indicated that the basic mechanisms to verify permissibility include the source of the transaction, use of the transaction, transaction flow, and transaction agreement. These are aligned with literature done by previous Islamic scholars, as well as aligned with Qur'an and hadith [26], [27], [28], [29], [30]. Based on these findings, it was determined that the HSCMT model and the prototype system were accurate, dependable, and valid. To further enhance the system, a few ideas were taken into consideration.

According to an Islamic finance technologist, the prototype reflected similarities to the AML system. The prototype can also adopt reinforced compliance scoring to examine further the patterns of transactions and behaviors of its SMEs and consumed through REST API. Other experts, on the other hand, concurred that an API could be provided and preserved for tech-savvy micro MHSOs, while a CSV-based database would be suitable for amateur micro MHSO users.

An expert in Halal technology and an SME owner suggested that MHSOs are technologically advanced and have a wide variety of data points and flexible systems. Their main goals are to be able to view and download data with ease. Therefore, an accessible integration made accessible through API and CSV methods is feasible, productive, and efficient. Moreover, it is a great strategy to improve micro-MHSOs' technological readiness by making both alternatives accessible if pre-existing SaaS or internal systems currently used for their businesses are utilized.

Besides that, an MHSO present during the roundtable verification proposed reinforcing classification data with more transaction data, such as non-compliant file-sharing summary. According to the MHSO, the summary can be used as a guide to request compliance files from a non-compliant business owner or customer, securing a more Sharia-compliant transaction between both parties involved.

Moreover, a micro MHSO can re-evaluate individual transactions and choose to view the summarized transaction details. Additionally, this might gradually evolve into the compliance enhancement module of the system. This step could improve the overall compliance score of the transaction and build strong rapport for B2B and B2C relationships through transparent compliance transaction management. The Halal community can employ an intelligent yet proactive awareness strategy by requiring micro MHSOs to monitor the compliance of their business accounts. One of the SME technologists and finance experts agreed that this step could ensure the authority of micro MHSOs.

Another Halal MHSO, a technologist, added that cross-border trading data could be another reference point for future international Halal transaction studies. Thus, it gave rise to the need for a strategic international transactions guide and proper documentation, particularly in countries with different transaction policies and data-sharing acts. Data tagging can also mitigate over-profiteering locally and globally via Supply Chain transaction details and its effects on the whole Halal ecosystem.

#### IV. CONCLUSION

This research focuses on an effective Sharia-compliant analytics system in the Halal business and the requirement for MHSOs to become digital and financially literate through the dashboard. The prototype analytics dashboard and conceptual framework for Halal supply chain management transactions (HSCMT) provide practicable long-term solutions to MHSO's literacy and knowledge intervention limitations and help manage Halal transactional decision-making. HSCMT can effectively resolve underlying concerns present in previous models regarding confidentiality issues, restricted scope, and small sample size. Despite the pseudonymization concerns, this model also includes an extra layer of compliance to widen the comprehension of the HSCMT data structure. In addition, the model's scope was split and restricted by the SME's size, not by the industry's or specialist industries' scope.

Based on the results, the model was adaptable to serve as an annual predictive categorization model for all sectors of the same SME size. The dataset can also be tailored based on the transaction pattern or behavior of its MHSO. The sample size is generally considered more significant, with 500 active MHSOs transacting annually. However, a few outliers were found in each sample size. These outliers comprised about 2.2% of the total micro MHSOs in the P1 dataset.

There were also no issues with under or oversampling throughout the wrangling procedures. HSCMT usability can be improved by enhancing transaction dataset pseudonymization to comply with the MHSO survey, employing minimalistic yet practical data visualization tools, and employing a more user-friendly interface. On the other hand, future practitioners and researchers could compare the characteristics between a shariah-compliant and non-shariah-compliant FinTech.

This study can determine whether the present Malaysian FinTech sector has met the compliance standards and the procedures that need more coverage in both the technology and industry. Based on the comparison, the differences in transaction patterns and behavior for both users based on their SME sizes can be determined. Both types of FinTech policies to improve user transaction effectiveness may be mapped and standardized to pave the way for developing a new standard for higher-quality transaction management in Malaysia.

The use and effects of leveraging multisource data points for HSCMT can also be investigated in the future, particularly in enhancing transaction compliance scores. The existing HSCMT compliance methods were derived from a single data point calculation, and hence, the scores were acknowledged as temporary log scores. The inclusion of multisource data points could build a multisource compliance scoring module for HSCMT that must be completed to standardize the scores based on their sources successfully.

Therefore, the essential structure and methods for improving the log score table may be improved inside the existing block diagram. The multisource can also be compared between local and foreign multisource data points to record and evaluate different data-sharing regulations.

Small and medium-sized enterprises (SMEs) may benefit from supply chain management in a number of ways: it allows them to align supply chain objectives with business strategy better; it helps them better understand the stages, the time, the costs, and the value drivers; it fosters the development and maintenance of relationships; and, perhaps most importantly, it helps them identify skills and competencies, allowing them to concentrate on life-cycle management.

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