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ROBO-ADVISOR MODEL ADOPTION: A DIGITAL TRANSFORMATION TO ACCELERATE CONTINUANCE USAGE OF ISLAMIC BANKING PRODUCT

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ABSTRACT

As Islamic banking becomes one of vital sectors in driving National economic growth, accelerating its development is prominent. The use of Robo-Advisor in this sector can help Islamic banking increase its existence and market share to compete in a global financial market. This research aims to conduct a model for the adoption of Robo-Advisor in Islamic banking sector to accelerate continuance intention usage of Islamic banking product in Indonesia by exploring the role of sharia financial literacy and halal awareness as mediating variables. This is explanatory research with quantitative and survey method. This research picks Islamic banking users in Indonesia, using quota sampling technique to achieve a representative sample in each province of Indonesia, resulting in 403 respondents. Structural Equation Model (SEM-PLS) is used to analyze the data and the relationship among variables. Empirically, the result revealed that the Robo-Advisor model adoption significantly accelerates the continuance intention usage of Islamic banking product in Indonesia. This research contributes in broadening horizon in terms of Islamic banking continuance usage by proposing integrated model. Furthermore, this research recommends the implementation of Robo-Advisor as a digital transformation for Islamic banking sector to support the growth of Islamic financial industry in Indonesia, remembering that Robo-Advisor is currently not used in either Islamic or conventional banking sectors.

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INTRODUCTION

The banking and financial sector has become a vital driver of Indonesia's national economic growth (Kementerian Keuangan, 2023). A report by Indonesia's Financial Services Authority (OJK) indicates that the national financial sector remained stable and resilient in 2023. This resilience was reflected in asset growth across the capital market, banking, and non-bank financial industries, which increased by 3.35%, 8.99%, and 15.02%, respectively (Otoritas Jasa Keuangan, 2024a). This positive financial-sector performance contributed to broader macroeconomic stability. The Indonesian Central Statistics Agency (BPS) reported that Indonesia's economy remained relatively strong despite global uncertainty, with economic growth reaching 4.94% year-on-year in the third quarter of 2023 (Badan Pusat Statistik, 2023).

Within this broader financial landscape, Islamic banking has attracted increasing attention from Indonesian policymakers. Over the past decade, the sector has experienced rapid growth and has become one of the fastest-growing segments of the national financial industry (Kementerian Keuangan, 2021). This development is reflected in the growth of Islamic banking assets, which reached approximately 11.97% (Otoritas Jasa Keuangan, 2024b). Islamic bank financing also continued to grow strongly, reaching 15.8% year-on-year (Bank Indonesia, 2024). These indicators suggest that Islamic banking has significant potential to support national financial development, particularly amid sustained consumer optimism and global economic uncertainty.

However, despite this potential, Islamic banking in Indonesia continued to represent a relatively small share of the national banking industry, accounting for approximately 7.23% in 2023 (Otoritas Jasa Keuangan, 2024b). This limited market share is closely related to the low level of Islamic financial inclusion, which reached only 12.12% of the population (Otoritas Jasa Keuangan, 2022). The situation is further constrained by the low level of Islamic financial literacy, which was recorded at only 9.14% (Otoritas Jasa Keuangan, 2022). These figures indicate that the expansion of Islamic banking is not only a matter of institutional growth, but also depends on the public's ability to understand, trust, and continuously use Islamic financial products.

The low levels of Islamic financial inclusion and literacy also suggest that public awareness of halal financial products remains limited. This condition is noteworthy because Indonesia has one of the largest Muslim populations in the world, with approximately 237.56 million Muslims, or 86.7% of the total population (Otoritas Jasa Keuangan, 2024b). However, only 13.8% of Muslims in Indonesia are recorded as Islamic bank customers. In addition to low public participation, customer loyalty in Islamic banking also remains a concern. Some industry observations suggest that many customers use Islamic banking services primarily for administrative purposes rather than as their main banking preference. This condition indicates that Islamic banks need to strengthen customer engagement, service innovation, and value-based loyalty.

Given these challenges, Islamic banks in Indonesia need to strengthen service innovation to sustain customer interest, expand market share, and improve Islamic financial literacy. One possible strategy is the adoption of artificial intelligence (AI) in Islamic banking services. In addition to chatbots, Robo-Advisors (RA) have received growing attention in the financial industry because of their ability

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to analyze the suitability of financial products and provide data-based recommendations (Cheng, 2021; Dewasiri et al., 2023). In the context of Islamic banking, RA can support customers by providing accessible information on Islamic financial products and helping them understand product features, benefits, and risks. At present, RA is still largely used in the investment sector (Back et al., 2023; Mohapatra et al., 2025; Reher & Sokolinski, 2024). In Indonesia, the implementation of RA as a digital feature to support customers' understanding of Islamic banking products and services remains limited.

Prior studies by Belanche et al. (2019) and Cheng (2021) show that RA can help users understand, analyze, and select financial products that meet their needs. This technology can provide detailed information and personalized recommendations, thereby strengthening users' intention to continue using financial products (Back et al., 2023). Therefore, the implementation of RA in Islamic banking may increase public knowledge of Islamic financial products, improve Islamic financial literacy and inclusion, and support the growth of the Islamic financial sector.

Previous studies have demonstrated the potential benefits of RA for the banking and financial industries (Barile et al., 2025; Belanche et al., 2019). RA is also considered important for balancing financial innovation with the responsible use of AI and Sharia compliance (Kharisma et al., 2025). Reher and Sokolinski (2024) further reported that RA can help financial institutions achieve more effective wealth management. Similarly, Eren (2024) argued that RA is designed to be intuitive and user-friendly, enabling customers to invest in or manage financial portfolios without requiring advanced financial knowledge or substantial time commitment.

Nevertheless, other studies have shown that RA does not always strengthen continuance intention. Ashrafi (2023) found that RA may fail to provide highly personalized financial advice, particularly for investors or customers with complex needs and specific risk profiles. Alam and Achjari (2024) also reported that RA faces challenges in deep personalization and interpersonal assurance, which may reduce long-term reliance unless users understand investment basics and how RA works. Furthermore, Robo-Advisor adoption may not significantly influence continuance usage when users find the technology difficult to understand, which in turn reduces their intention to use such novel technology (Chang et al., 2016; Gan et al., 2021; Xie et al., 2021). This condition is particularly associated with limited financial literacy and low awareness of the digital transformation of financial products and services (Aristei & Gallo, 2025).

Based on the preceding discussion, prior studies show inconsistent findings regarding the effect of RA adoption on continuance usage. Some studies report positive effects, whereas others indicate limited or insignificant effects. To address this gap, this study extends the RA adoption model by incorporating Islamic financial literacy and halal awareness as mediating variables. Customers who understand Islamic financial concepts are more likely to perceive RA not merely as a digital tool, but as a financial facilitator aligned with religious values. Without Islamic financial literacy, users may not fully understand RA recommendations, thereby reducing perceived value and adoption. In this sense, Islamic financial literacy transforms technological features into meaningful Sharia-oriented benefits.

In addition, halal awareness provides religious reassurance by helping customers

recognize whether digital financial advice aligns with halal requirements. Although RA may offer advanced technological functions, continuance intention is more likely to emerge when customers are confident that its recommendations comply with Islamic principles. Moreover, most previous studies have focused on institutional or technological perspectives, while the user perspective remains underexplored. This perspective is important because customers represent a key intangible asset for Islamic banking. Therefore, this study aims to develop a Robo-Advisor adoption model as an advanced digital feature in Islamic banking to accelerate the continuance usage of Islamic banking products.

LITERATURE REVIEW

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a widely used theoretical framework for explaining users' acceptance and use of information technology and information systems. Introduced by Davis et al. (1989), TAM was developed from the Theory of Reasoned Action (TRA), which explains human behavior from a psychological perspective. In this study, TAM provides a theoretical basis for understanding how Robo-Advisor (RA) adoption may influence customers' continuance usage of Islamic banking products and services (Najib & Fahma, 2020; Sari, 2022; S. Singh et al., 2020).

As an established model, TAM consists of two central constructs: perceived usefulness (PU) and perceived ease of use (PEOU), both of which are widely used to explain technology acceptance in digital financial services (Boonsiritomachai & Pitchayadejanant, 2017; Davis et al., 1989; S. Singh et al., 2020). PU refers to the extent to which users believe that a particular system or technology can improve their performance (Davis et al., 1989; S. Singh et al., 2020). This construct is related to users' expectations of positive outcomes from technology use, which can encourage adoption behavior (Bandura, 1982; Robey, 1979). Meanwhile, PEOU refers to the extent to which users believe that a system is easy to understand and operate (Davis et al., 1989; Taherdoost, 2018). Both constructs are important because they shape users' attitudes, behavioral intentions, and actual technology use (Davis et al., 1989).

In the context of RA adoption, perceived usefulness reflects customers' perception that RA can improve financial decision-making by providing practical, data-driven, and personalized recommendations (S. Singh et al., 2020). In Islamic finance, this usefulness may also be reflected in RA's ability to support users in identifying financial products that are aligned with Sharia principles. Meanwhile, perceived ease of use reflects customers' perception that RA can be understood and operated with minimal effort. When RA is perceived as intuitive and easy to use, customers may experience lower technological anxiety and higher satisfaction, which can strengthen their intention to continue using Islamic banking services.

Although TAM was initially developed to explain technology adoption, its constructs are also relevant in the post-adoption stage. Perceived usefulness becomes particularly important when users evaluate the actual benefits gained from using a technology (Davis et al., 1989; Taherdoost, 2018). Therefore, the success of RA implementation should not be viewed merely as a technical achievement, but also as a behavioral process in which users' perceptions of usefulness, ease of use, trust, and value shape their willingness to maintain long-

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term usage. In this context, TAM helps explain how initial acceptance of RA can develop into continuance usage when customers perceive the technology as valuable, accessible, and consistent with their financial and religious expectations.

In the Islamic finance industry, technology can also support users' Islamic financial literacy. Digital financial systems, particularly in banking, provide quick and efficient access to information about products, services, and financial mechanisms. This access may encourage users to explore Islamic financial services more actively and reduce technical barriers that often prevent them from learning and managing their finances effectively. As a result, technology can strengthen users' awareness of halal financial products and support more informed financial decision-making.

Task-Technology Fit (TTF) Model

The Task-Technology Fit (TTF) Model, developed by Goodhue and Thompson (1995), explains technology use by examining the extent to which a technology fits users' tasks and performance requirements. The model emphasizes that technology is more likely to be used effectively when its features support the tasks users need to perform. In the context of financial services, TTF is useful for explaining whether a digital system can enhance users' ability to access information, evaluate financial products, and make decisions efficiently (Tam & Oliveira, 2016; Zhou et al., 2010).

TTF consists of several key constructs, including task characteristics, technology characteristics, task-technology fit, technology utilization, and performance impact (Goodhue & Thompson, 1995; Rahi et al., 2020; Rahi & Abd Ghani, 2021). Task characteristics refer to the activities or needs that users seek to accomplish, while technology characteristics refer to the functions and features provided by the system. Task-technology fit reflects users' perception of how well the technology supports their needs. When the perceived fit is high, users are more likely to use the technology and perceive it as beneficial for improving their performance.

The TTF model is relevant to RA adoption in Islamic banking because RA can be evaluated based on how well it supports customers' financial tasks. In Islamic banking, customers need information that is accurate, accessible, personalized, and compliant with Islamic principles. RA may help meet these needs by providing product recommendations, financial guidance, and information about Islamic banking services. Therefore, a strong fit between RA features and customers' financial needs may accelerate the continuance usage of Islamic banking products and services.

Islamic Financial Literacy

Islamic financial literacy refers to an individual's understanding and knowledge of the basic principles of Islamic finance, including products, services, and mechanisms that comply with Islamic law (Antara et al., 2016; Ibrahim et al., 2009). This literacy includes the ability to make informed and responsible financial decisions in accordance with Sharia principles. Therefore, Islamic financial literacy plays a crucial role in accelerating the growth of the Islamic finance industry (Abdullah et al., 2023; Alshater et al., 2022). A higher level of Islamic financial literacy among the public can also generate significant productivity gains for the Islamic finance sector (Abd Razak, 2018).

Islamic financial literacy is particularly important for users of Islamic financial products and services. Individuals with a strong understanding of these products and services are

better equipped to make accurate financial decisions related to investing, saving, and financing (Candra Sari et al., 2022; Kristanto & Gusaptono, 2020; Mansyur & Ali, 2022). This understanding enables them to choose products or services that align with their financial needs and religious values. In addition, Islamic financial literacy can contribute to individual and community financial stability by encouraging more responsible and ethical financial practices.

Previous studies indicate that Islamic financial literacy is a predictive variable that can enhance individuals' interest in adopting Islamic financial products. This finding is consistent with earlier studies suggesting that higher literacy levels are associated with stronger financial behavior, including the adoption of digital Islamic finance. In Indonesia, OJK uses the financial literacy index, which comprises knowledge, beliefs, and skills, as the primary basis for assessing individuals' attitudes and behavior toward financial products and services. Thus, Islamic financial literacy is a crucial component in developing a financially literate society capable of managing its finances in accordance with Sharia principles. Individuals with stronger literacy are better positioned to make financial decisions that meet their needs and support long-term financial stability.

Halal Awareness

Halal awareness is generally defined as an individual's understanding of the importance of products that meet Islamic principles (Aziz & Chok, 2013). This awareness includes the ability to recognize halal attributes, understand certification processes, and consider their spiritual and economic implications (Zakaria et al., 2018). In the context of Islamic finance, halal awareness refers to an individual's understanding of the importance of using Islamic financial products and services that comply with Islamic principles. This includes understanding Sharia principles, recognizing the benefits of Islamic financial products, and avoiding riba (Bashir, 2019; Hasibuan et al., 2021).

In the development of the Islamic finance industry, halal awareness is an important driver of growth. A higher level of awareness regarding halal financial products is closely related to Islamic financial literacy because individuals with stronger knowledge of Islamic financial principles are more likely to recognize the importance of using Sharia-compliant financial services (Antara et al., 2016; Malik et al., 2019). In this context, halal awareness can influence the adoption and development of Islamic financial products and services (Hartani et al., 2020; Muslichah M. et al., 2019). As halal awareness increases, individuals are more likely to utilize Islamic financial products and services, thereby supporting more inclusive and sustainable economic growth. This argument is consistent with previous research showing that halal awareness can influence decisions to use halal products and services.

Hypothesis Development and Conceptual Framework

Based on the preceding theoretical discussion, this study proposes a conceptual framework that explains the relationships among Robo-Advisor adoption, Islamic financial literacy, halal awareness, and continuance usage of Islamic banking products. Robo-Advisor adoption is assumed to enhance Islamic financial literacy by providing users with accessible, personalized, and relevant information about Islamic banking products. Improved Islamic financial literacy may strengthen users' understanding of Sharia-

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compliant financial products and encourage the continued use of Islamic banking services.

Halal awareness is positioned as a mediating construct because users' awareness of halal and haram principles may reinforce the relationship between Islamic financial literacy and continuance usage. In this model, Islamic financial literacy provides cognitive understanding of Islamic financial products, while halal awareness provides religious and ethical assurance that the products are consistent with Islamic principles. The conceptual framework of this study is presented in Figure 1. Based on this framework, the following hypotheses are proposed:

H1: Robo-Advisor adoption significantly influences Islamic financial literacy.

H2: Robo-Advisor adoption significantly influences the continuance usage of Islamic banking products.

H3: Islamic financial literacy significantly influences the continuance usage of Islamic banking products.

H4: Islamic financial literacy significantly mediates the relationship between Robo-Advisor adoption and the continuance usage of Islamic banking products.

H5: Islamic financial literacy significantly influences halal awareness.

H6: Halal awareness significantly influences the continuance usage of Islamic banking products.

H7: Halal awareness significantly mediates the relationship between Islamic financial literacy and the continuance usage of Islamic banking products.

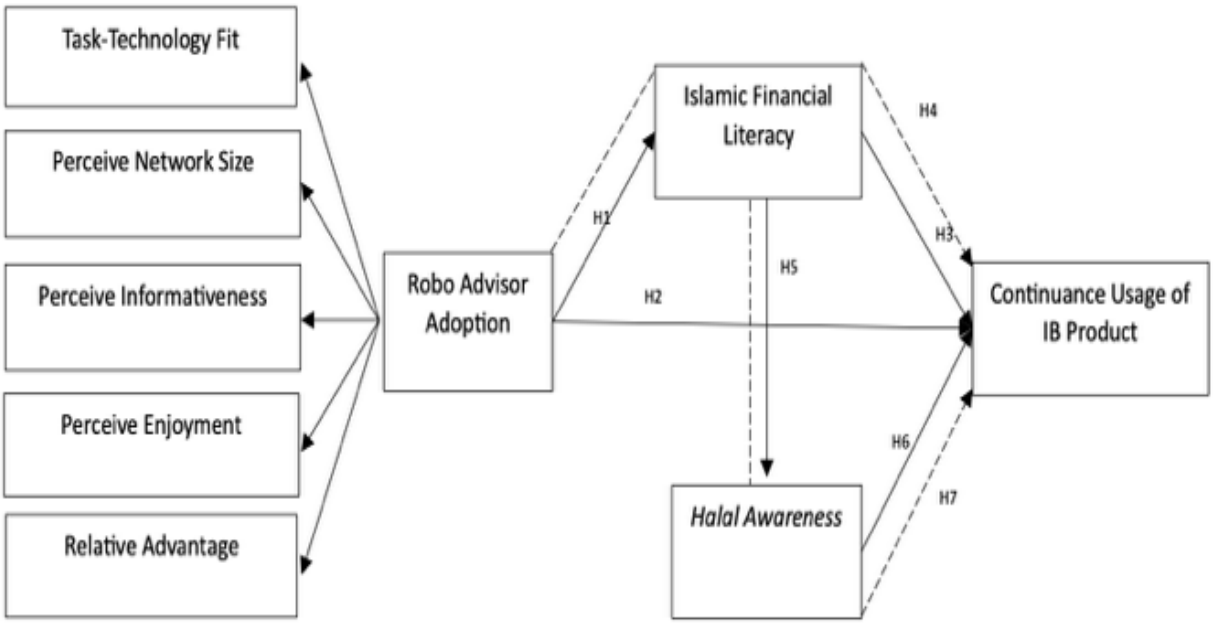

Figure 1. Research Conceptual Framework

RESEARCH METHOD

This study employed an explanatory research design with a quantitative approach. A survey method was used to collect data from Islamic bank customers regarding Robo-Advisor adoption in Islamic banking. The questionnaire served as the primary research instrument and was designed to measure respondents' perceptions of Robo-Advisor adoption, Islamic financial literacy, halal awareness, and continuance usage of Islamic banking products. The population of this study consisted of Islamic bank customers from 38 provinces in Indonesia.

According to data from the Financial Services Authority (OJK), approximately 41 million accounts are registered at Islamic banks in Indonesia. Since this population falls into the large-population category, this study applied the sample-size standard proposed by Krejcie and Morgan (1970), , which recommends a minimum sample of 350 respondents for populations exceeding 1,000. To obtain proportional representation across provinces, this study used a non-probability quota sampling technique based on the distribution of Islamic bank branch offices in each province. The respondent criteria included being at least 25 years old and having an Islamic banking account. Based on these criteria and quota distribution, this study collected data from 403 respondents.

The collected data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS software. SEM-PLS was selected because it is suitable for examining complex relationships among latent constructs, including direct and indirect effects. This method is also appropriate for evaluating models that involve predictor, mediating, and dependent variables. In this study, Robo-Advisor adoption was treated as the predictor variable, Islamic financial literacy and halal awareness were treated as mediating variables, and continuance usage of Islamic banking products was treated as the dependent variable. The empirical models are formulated as follows:

$$IFL = \alpha + \beta_1 ARA + \varepsilon_1 \quad (1)$$

$$HA = \alpha + \beta_2 IFL + \varepsilon_2 \quad (2)$$

$$CU = \alpha + \beta_1 ARA + \beta_2 IFL + \beta_3 HA + \varepsilon_3 \quad (3)$$

where ARA represents Robo-Advisor adoption, IFL represents Islamic financial literacy, HA represents halal awareness, and CU represents continuance usage of Islamic banking products.

Based on Table 2, most respondents were female Islamic bank customers (68.98%). The largest age group was 36–45 years old (56.33%), and most respondents held a bachelor's degree (59.31%). This profile indicates that the sample was dominated by educated and economically active customers, making it relevant for examining the adoption of digital financial services in Islamic banking.

To measure each variable, this study adopted and modified instruments from previous studies. Robo-Advisor adoption, as the predictor variable, consists of five dimensions: task-technology fit (Baabdullah et al., 2019; Cheng, 2021; Goodhue & Thompson, 1995; Zhou et al., 2010), perceived network size and perceived informativeness (Cheng, 2021; Ewe et al., 2015; Lin & Lu, 2011), perceived enjoyment (Cheng, 2021; Merhi, 2016), and perceived usefulness (N. Singh et al., 2020). Each dimension consists of three indicators. The dependent variable, continuance usage of Islamic banking products, was measured using four indicators adapted from Gong et al. (2020).

This study also included two mediating variables: Islamic financial literacy and halal awareness. Islamic financial literacy was measured using four indicators adapted from Pav-

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kovic et al. (2018). Halal awareness was measured using ten indicators adapted from Aziz and Chok (2013), Bashir (2019), and Özek and Ferraris (2018). These mediating variables were included to capture the mechanisms through which Robo-Advisor adoption may influence continuance usage in the context of Islamic banking.

Table 1. Sample Distribution by Province in Indonesia

Province	IB Branch Office	Std. Sample	%Province	Targeted Sample	Collected Sample
Nanggroe Aceh Darussalam	274	350	17,3%	61	69
Sumatra Utara	56	350	3,5%	12	14
Sumatra Selatan	35	350	2,2%	8	9
Sumatra Barat	33	350	2,1%	7	8
Bengkulu	11	350	0,7%	2	3
Riau	131	350	8,3%	29	33
Kepulauan Riau	58	350	3,7%	13	15
Jambi	17	350	1,1%	4	4
Lampung	23	350	1,5%	5	6
Bangka Belitung	4	350	0,3%	1	1
Kalimantan Barat	14	350	0,9%	3	4
Kalimantan Timur	27	350	1,7%	6	7
Kalimantan Selatan	21	350	1,3%	5	5
Kalimantan Tengah	5	350	0,3%	1	1
Banten	65	350	4,1%	14	17
DKI Jakarta	161	350	10,2%	36	41
Jawa Barat	226	350	14,3%	50	58
Jawa Tengah	97	350	6,1%	21	25
Yogyakarta	31	350	2,0%	7	8
Jawa Timur	151	350	9,6%	33	39
Bali	9	350	0,6%	2	2
Nusa Tenggara Timur	1	350	0,1%	0	0
Nusa Tenggara Barat	46	350	2,9%	10	12
Gorontalo	3	350	0,2%	1	1
Sulawesi Barat	3	350	0,2%	1	1
Sulawesi Tengah	12	350	0,8%	3	3
Sulawesi Utara	6	350	0,4%	1	2
Sulawesi Tenggara	9	350	0,6%	2	2
Sulawesi Selatan	38	350	2,4%	8	10
Maluku Utara	6	350	0,4%	1	2
Maluku	1	350	0,1%	0	0
Papua Barat	2	350	0,1%	0	0
Papua	4	350	0,3%	1	1
Total	**1.580**		**100%**	**350**	**403**

Source: Authors' calculation based on OJK data.

Table 2. Respondent Profile

Indicator	N	Percentage
Gender		
Female	278	68.98
Male	125	31.02
Age		
25 - 35 Years Old	113	28.04
36- 45 Years Old	227	56.33
> 45 Years Old	63	15.63
Education		
Highschool	80	19.85
Bachelor	239	59.31
Graduate	63	15.63
Others	21	5.21

Source: Authors' survey data, 2025.

Table 3. Measurement Item

Variable	Dimension	Items	Source
Robo-Advisor Adoption	Task-Technology Fit	1. Robo-Advisor can assist users in managing their financial management 2. Robo-Advisor can recommend the appropriate product or service of Islamic banking 3. Robo-Advisor can increase productivity	(Baabdullah et al., 2019; Cheng, 2021; Goodhue & Thompson, 1995; Zhou et al., 2010)
	Perceive Network Size	1. Robo-Advisor is needed in Islamic banking 2. Robo-Advisor will be highly beneficial for Islamic banking customers in the digital age With the features offered. 3. Robo-Advisors, I believe a significant number of people would be willing to use them.	(Cheng, 2021; Ewe et al., 2015; Lin & Lu, 2011)
	Perceived Informativeness	1. Robo-Advisor can help improve understanding of Islamic banking products and services. 2. Robo-Advisor can provide accurate information regarding Islamic banking products and services. 3. Robo-advisor can help in making accurate decisions about using Islamic banking products and services.	(Cheng, 2021; Ewe et al., 2015; Lin & Lu, 2011)
	Perceived Enjoyment	1. If a Robo-advisor were a person, I would feel	(Cheng, 2021; Merhi, 2016)

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Variable	Dimension	Items	Source
		comfortable interacting with them 2. A Robo-Advisor would make it easier to manage my financial activities 3. I find the Robo-Advisor easy to use	
	Perceived Usefulness	1. A Robo-Advisor can help complete my financial transactions 2. A Robo-Advisor can enhance my financial performance 3. Robo-Advisor improves the effectiveness of my financial activities	(N. Singh et al., 2020)
Islamic Financial Literacy		1. I am aware of Islamic banking products/services 2. I use Islamic banking products/services because I understand them. 3. I understand the scheme of the Islamic banking product/ service 4. Islamic banking products/services are different from conventional ones	(Pavković et al., 2018)
Halal Awareness		1. The level of self-understanding regarding halal and *haram*. 2. Self-effort in understanding halal products/services 3. The level of self-understanding regarding halal products/services. 4. The level of self-understanding regarding the limitations of the use of halal products/services 5. The level of self-understanding regarding the reasons for using halal products/services. 6. Understanding the impact of using halal products/services on others. 7. The level of self-concern by not recognizing halal products/services. 8. The level of self-need for halal products/services	(Aziz & Chok, 2013; Bashir, 2019; Özek & Ferraris, 2018)

Variable	Dimension	Items	Source
		9. Self-confidence in using halal products. 10. Understanding the consequences of using halal products/services	
Continuance Usage		1. If the Robo-Advisor feature is implemented in Islamic banks, I am inclined to continue using their products/services 2. By the presence of a Robo-Advisor at Islamic banks, I prefer to continue using Islamic banks over conventional ones 3. I intend to continue using Islamic banks in the future 4. If the implementation of Robo-Advisors is possible in Islamic banks, I would continue using this AI feature to assist with my financial activities	(Gong et al., 2020)

RESULTS AND DISCUSSION

Results

This study evaluated the model in two stages: measurement model assessment and structural model assessment. The measurement model was first assessed by examining the loading factor values. As shown in Figure 2, all indicators had loading factor values above the recommended threshold of 0.70, indicating that the indicators met the required level of indicator reliability (Hair et al., 2017).

In addition to the loading factor values, construct reliability and convergent validity were evaluated using Composite Reliability (CR) and Average Variance Extracted (AVE). As shown in Table 4, all CR values exceeded 0.70, while all AVE values were above 0.50. These results indicate that all constructs met the recommended criteria for construct reliability and convergent validity. Therefore, the measurement model was considered valid and reliable.

After assessing the measurement model, the structural model was evaluated using R-Square and Adjusted R-Square values. Table 5 shows that the R-Square value for Islamic financial literacy was 0.739, indicating that Robo-Advisor adoption explained 73.9% of the variance in Islamic financial literacy. The R-Square value for halal awareness was 0.666, indicating that Islamic financial literacy explained 66.6% of the variance in halal awareness. Meanwhile, the R-Square value for continuance usage was 0.726, indicating that Robo-Advisor adoption, Islamic financial literacy, and halal awareness explained 72.6% of the variance in continuance usage. These results suggest that the structural model has strong explanatory power.

The hypothesis testing results are presented in Table 6 based on standardized path coefficients and significance values. The results

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show that all direct and indirect relationships were statistically significant. Robo-Advisor adoption had a positive and significant effect on Islamic financial literacy and continuance usage. Islamic financial literacy also had a positive and significant effect on continuance usage and halal awareness. Furthermore, halal awareness had a positive and significant effect on continuance usage. The mediation results confirmed that Islamic financial literacy significantly mediated the relationship between Robo-Advisor adoption and continuance usage, while halal awareness significantly mediated the relationship between Islamic financial literacy and continuance usage. Thus, all proposed hypotheses were supported.

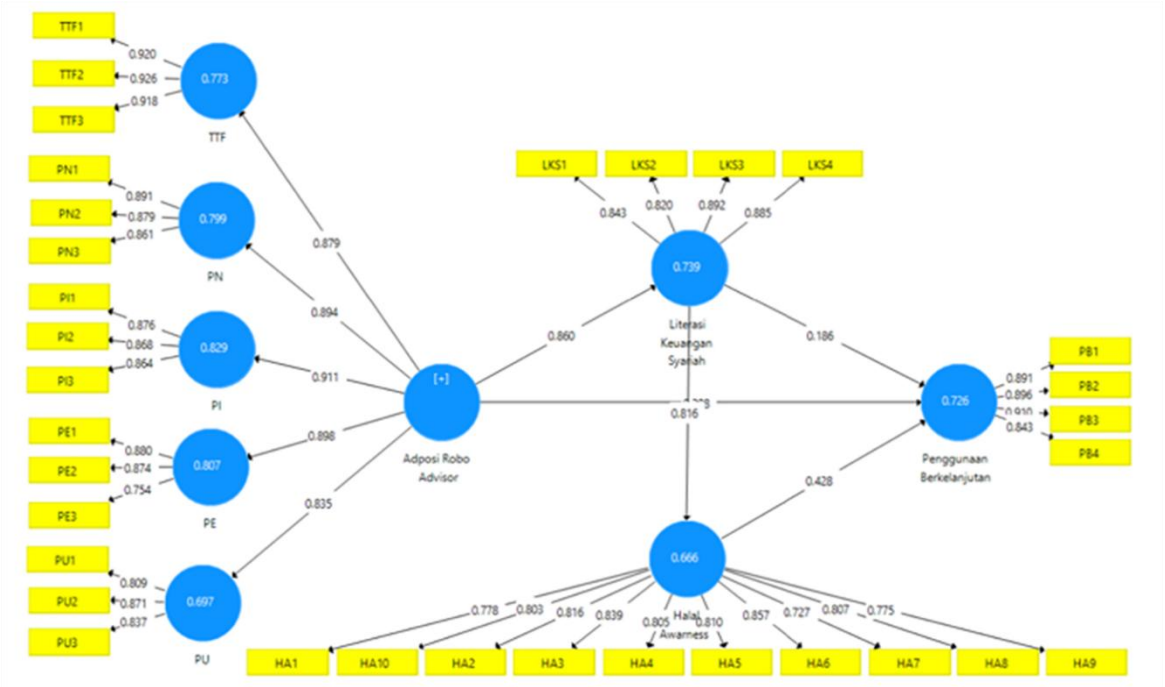

Figure 2. Measurement and Structural Model Results
Source: Authors' calculation using SmartPLS, 2025.

Table 4. Validity and Reliability Results

Variable	CR	AVE
Task-Technology Fit	0.944	0.849
Perceived Network Size	0.909	0.769
Perceived Informativeness	0.903	0.755
Perceived Enjoyment	0.875	0.702
Perceived Usefulness	0.877	0.704
Islamic Financial Literacy	0.919	0.741
Halal Awareness	0.947	0.644
Continuance Usage	0.935	0.784

Note: CR = Composite Reliability; AVE = Average Variance Extracted. Constructs are considered reliable when CR > 0.70 and demonstrate acceptable convergent validity when AVE > 0.50. Data was processed using SmartPLS, 2025.

Table 5. Coefficient of Determination Results

Variable	R-Square	Adj. R^2
Islamic Financial Literacy	0.739	0.739
Halal Awareness	0.666	0.665
Continuance Usage	0.726	0.724

Source: Data processed using SmartPLS.

Table 6. Hypothesis Testing Results

Hypotheses	Path	Coefficient	Sig.	Decision
H1	ARA → IFL	0.860	0.000	Supported
H2	ARA → CU	0.288	0.000	Supported
H3	IFL → CU	0.186	0.004	Supported
H4	ARA → IFL → CU	0.160	0.004	Supported
H5	IFL → HA	0.816	0.000	Supported
H6	HA → CU	0.428	0.000	Supported
H7	IFL → HA → CU	0.349	0.000	Supported

Note: ARA = Robo-Advisor Adoption; IFL = Islamic Financial Literacy; HA = Halal Awareness; CU = Continuance Usage. The coefficient values represent standardized path coefficients, while Sig. indicates the probability value. Data was processed using SmartPLS, 2025.

Discussion

The Influence of Robo-Advisor Adoption on Islamic Financial Literacy and Continuance Usage of Islamic Banking Products

The hypothesis testing results show that Robo-Advisor adoption has a positive and significant effect on Islamic financial literacy and continuance usage, with coefficient values of 0.860 and 0.288, respectively. These findings indicate that Robo-Advisor adoption is more strongly associated with Islamic financial literacy than with continuance usage. This suggests that Robo-Advisors may first function as an informational and educational tool before directly influencing customers' long-term use of Islamic banking products.

In the context of Islamic banking, this finding is important because customers require not only efficient digital services but also clear information about product schemes, benefits, risks, and Sharia compliance. This finding is consistent with previous studies suggesting that digital transformation in Islamic financial services can facilitate customer access, strengthen service delivery, and support financial decision-making (Abdulquadri et al., 2021; Dewasiri et al., 2023).

As artificial intelligence (AI)-based financial technologies, Robo-Advisors can support users by analyzing product suitability and providing data-based recommendations (Cheng, 2021; Dewasiri et al., 2023). In Islamic banking, this function may help customers understand financial concepts such as diversification, asset allocation, and financial risk management, while also considering the suitability of products with Islamic financial principles (Boustani, 2022; Suhartanto et al., 2022). Through this process, customers are exposed to key Islamic banking concepts, which can enhance their financial understanding and confidence in evaluating Islamic financial products.

The relatively strong coefficient of Robo-Advisor adoption on Islamic financial literacy

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is also supported by the measurement results, in which perceived informativeness had the highest loading value, at 0.911. This indicates that customers perceive Robo-Advisors as useful because they provide relevant and understandable information about Islamic banking products. Such informativeness is essential in reducing knowledge barriers that may prevent customers from understanding and using Islamic financial services. This finding is in line with previous research showing that digital financial technologies can improve access to financial information, reduce technical barriers, and enhance users' financial understanding (Barile et al., 2025; Fatima & Chakraborty, 2024).

Robo-Advisor adoption positively influences continuance usage, although its effect is weaker than on Islamic financial literacy. This suggests that continued use depends on customers' perceptions of usefulness, convenience, and relevance. By offering faster access and personalized recommendations, Robo-Advisors can enhance satisfaction and encourage continued use of Islamic banking products (Belanche et al., 2019; Boustani, 2022). The high loading values of perceived informativeness and enjoyment, at 0.911 and 0.898, further show that customers value Robo-Advisors as informative and engaging tools that strengthen information quality, personalization, engagement, and transparency.

The Influence of Islamic Financial Literacy on the Continuance Usage of Islamic Banking Products

Islamic financial literacy has a positive and significant effect on continuance usage, with a coefficient value of 0.186. Although the coefficient is relatively moderate, the result confirms that customers with stronger Islamic financial literacy are more likely to continue using Islamic banking products. This finding indicates that knowledge of Islamic financial principles, contracts, and product schemes plays an important role in shaping customers' long-term commitment to Islamic banking services. Customers who understand Islamic banking products are better able to evaluate whether these products are consistent with their financial needs and religious values (Abdullah et al., 2023; Ahmad et al., 2020).

This finding is supported by the indicator related to customers' understanding of Islamic banking product schemes, which had the highest loading value, at 0.892. This suggests that understanding product mechanisms is a central component of Islamic financial literacy. Customers with stronger literacy can better distinguish Islamic banking products from conventional banking products, assess product benefits and risks, and make more informed financial decisions. This is consistent with previous studies showing that financial literacy helps individuals make better decisions related to investment, savings, and financing (Candra Sari et al., 2022; Kristanto & Gusaptono, 2020; Mansyur & Ali, 2022).

The result also supports previous research indicating that higher levels of literacy are associated with stronger financial behavior, particularly in the adoption of digital Islamic finance (Abdullah et al., 2023; Ahmad et al., 2020; Antara et al., 2016; Muslichah M. et al., 2019). In Indonesia, the Financial Services Authority uses financial literacy indicators, including knowledge, beliefs, and skills, as a basis for assessing individuals' attitudes and behavior toward financial products and services. Therefore, Islamic financial literacy should not be viewed merely as a cognitive factor, but also as a behavioral driver that strengthens customers' confidence, product evaluation, and continuance usage of Islamic banking products.

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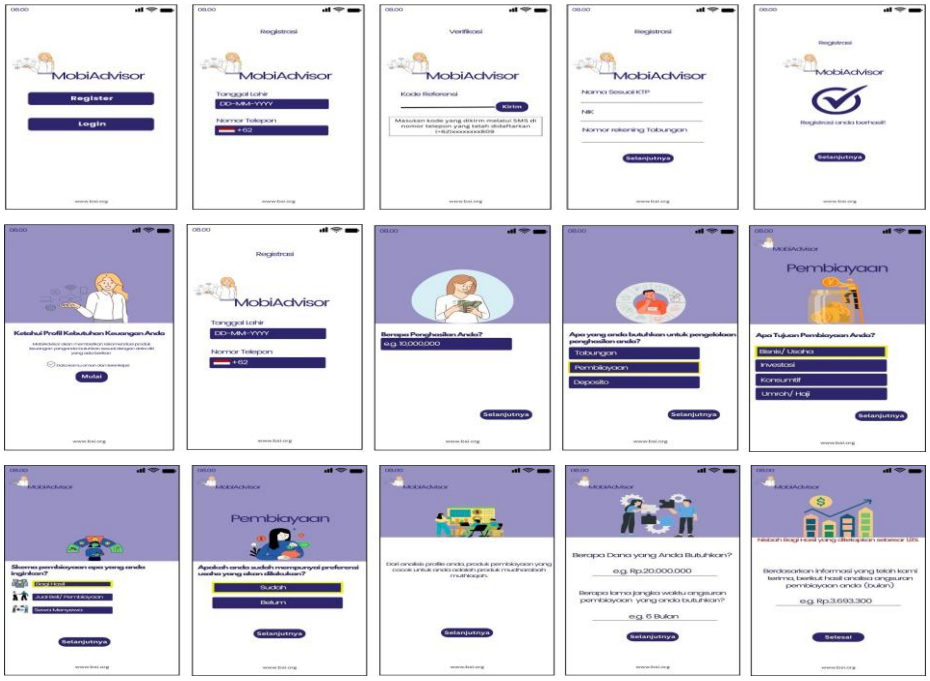

Figure 3. The Simulation of Robo-Advisor at Islamic Banking
Source: Author, 2024

The Mediating Effect of Islamic Financial Literacy on the Relationship between Robo-Advisor Adoption and Continuance Usage

The results show that Islamic financial literacy significantly mediates the relationship between Robo-Advisor adoption and continuance usage, with a coefficient value of 0.160. This finding indicates that Robo-Advisor adoption can indirectly strengthen continuance usage by improving customers' Islamic financial literacy. In other words, Robo-Advisors do not only function as digital service tools but also serve as educational instruments that help customers understand Islamic banking products more effectively.

This mediating effect can be explained through the informational and personalized features of Robo-Advisors. By providing product information and recommendations that match customers' needs, Robo-Advisors expose users to Islamic banking concepts, product schemes, and financial decision-making processes. This exposure can help customers understand the value and relevance of Islamic banking products, which in turn strengthens their intention to continue using them. When customers are better informed, they are more likely to perceive Islamic banking products as useful, transparent, and aligned with their financial and religious expectations.

This finding highlights that digital innovation in Islamic banking should be accompanied by customer education. Robo-Advisors may provide fast and efficient access to information, but their effect on continuance usage depends on customers' ability to understand and interpret the recommendations provided. Therefore, Islamic financial literacy acts as a mechanism that converts technological features into meaningful Sharia-oriented financial benefits. Through improved literacy, customers become more capable of evaluating Islamic financial products and more confident

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in maintaining their use of Islamic banking services.

The Influence of Halal Awareness on the Continuance Usage of Islamic Banking Products

Halal awareness has a positive and significant effect on continuance usage, with a coefficient value of 0.428. Compared with Islamic financial literacy, halal aareness shows a stronger direct effect on continuance usage. This indicates that customers' awareness of halal and haram considerations in financial decision-making is an important factor in encouraging the long-term use of Islamic banking products. In Islamic finance, halal awareness reflects customers' understanding that financial activities should comply with Islamic principles, including the avoidance of riba and the use of Sharia-compliant financial products.

Halal awareness can strengthen customer trust because Islamic banking products are designed to meet financial needs in accordance with Islamic values. Customers with strong halal awareness are more likely to choose banking products that reflect their religious commitments and ethical preferences. This awareness encourages customers to ensure that their financial activities remain consistent with Islamic principles. As a result, halal awareness becomes an important factor in building customer loyalty and strengthening continuance usage.

Moreover, customers with higher halal awareness may perceive the use of Islamic banking products as part of their contribution to the broader Islamic economy. They understand that using Islamic financial products not only fulfils personal financial needs but also supports the development of a fairer and more sustainable financial system. This argument is consistent with previous studies indicating that halal awareness is related to Islamic financial literacy and can influence the adoption of halal products and services (Antara et al., 2016; Malik et al., 2019). It also supports the view that halal awareness can influence the development and adoption of Islamic financial products (Hartani et al., 2020; Muslichah M. et al., 2019).

The Mediating Effect of Halal Awareness on the Relationship between Islamic Financial Literacy and Continuance Usage

The results show that halal awareness significantly mediates the relationship between Islamic financial literacy and continuance usage, with a coefficient value of 0.349. This finding indicates that halal awareness strengthens the effect of Islamic financial literacy on customers' willingness to continue using Islamic banking products. Customers with higher Islamic financial literacy are more likely to understand the principles, contracts, and schemes of Islamic financial products. This understanding can increase their awareness of halal and haram considerations in financial decision-making.

Islamic financial literacy provides customers with cognitive understanding of Islamic financial products, while halal awareness provides religious and ethical assurance that these products are consistent with Islamic principles. This mechanism explains why customers who understand Islamic finance are more likely to develop confidence in using Islamic banking products. When customers recognize that Islamic banking products are aligned with halal requirements, they are more likely to trust these products and continue using them (Abdullah et al., 2023; Albaity & Rahman, 2019).

This finding is consistent with previous studies showing that customers with strong halal awareness are more likely to choose products that comply with Islamic principles (Hartani et al., 2020; Muslichah M. et al., 2019). In

this context, halal awareness functions as a bridge between knowledge and behavior. Islamic financial literacy helps customers understand Islamic banking products, while halal awareness reinforces their religious motivation to continue using them. Therefore, Islamic banking institutions need to strengthen both Islamic financial literacy and halal awareness to promote more sustainable customer engagement and continuance usage.

CONCLUSION

This study demonstrates that Robo-Advisor adoption is a relevant digital innovation for strengthening the continuance usage of Islamic banking products in Indonesia. The findings confirm that Robo-Advisor adoption positively influences Islamic financial literacy and continuance usage. Islamic financial literacy also has a positive effect on continuance usage and mediates the relationship between Robo-Advisor adoption and continuance usage. Furthermore, halal awareness positively affects continuance usage and mediates the relationship between Islamic financial literacy and continuance usage. These results indicate that the effect of Robo-Advisor adoption on continuance usage is not merely technological, but also operates through customers' financial understanding and Sharia-based awareness.

The study contributes to the Islamic banking literature by extending the discussion of digital transformation beyond service efficiency. It shows that Robo-Advisors can function as informational and educational tools that improve customers' understanding of Islamic banking products, strengthen halal awareness, and support long-term customer engagement. Thus, the adoption of Robo-Advisors in Islamic banking should be viewed as part of a broader strategy to integrate digital innovation, Islamic financial literacy, and Sharia-compliant customer experience.

From a practical perspective, Islamic banking institutions should consider developing Robo-Advisor-based services that provide personalized recommendations, explain Islamic banking product schemes, and help customers evaluate products according to their financial needs and Sharia values. Policymakers and regulators may also use the proposed model as a reference for encouraging responsible digital innovation in the Islamic banking industry. However, this study is limited to Islamic banking customers in Indonesia and relies on a cross-sectional survey design. Future research may extend the model by comparing different Islamic financial institutions, examining other digital Islamic finance platforms, or using longitudinal data to capture changes in customer behavior over time.

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