ENHANCING CUSTOMER EXPERIENCE WITH ROBOTICS PROCESS AUTOMATION (RPA) IN MALAYSIAN BANKS

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Abstract:

This study investigates the potential of Robotic Process Automation (RPA) in enhancing customer experience within the onboarding process of Malaysian banks. Customer onboarding is a critical first interaction between banks and new customers, yet it is often affected by inefficiencies, manual bottlenecks, and regulatory complexities that reduce customer satisfaction and retention. As the Malaysian banking sector accelerates digital transformation, RPA has emerged as a promising solution to automate repetitive, rule-based tasks, improve process efficiency, and deliver faster, error-free onboarding experiences. Grounded in the Technology Acceptance Model (TAM), this research proposes and tests a conceptual framework integrating perceived ease of use (PEU), process efficiency (PE), perceived security and privacy (PSP), accessibility of automation (AOA), and perceived experience with RPA (PEWR). A quantitative methodology was employed through a structured survey distributed to banking customers across Malaysia, with responses analyzed using Structural Equation Modeling (SEM). Findings indicate that PEU, PE, and AOA have significant positive effects on PEWR, which strongly influences the overall customer experience during onboarding. PSP also emerged as a key factor in building trust and confidence in RPA-enabled onboarding solutions. Demographic factors such as age and digital familiarity were found to moderate certain relationships, indicating that younger, digitally literate customers perceive greater benefits from RPA. This research contributes theoretically by extending TAM in banking automation and practically by providing insights for banking institutions, policymakers, and technology strategists. The results underscore the importance of user-centric, secure, and compliant RPA-enabled onboarding solutions in Malaysia's financial services sector.

Keywords: RPA, Customer Onboarding, Customer experience, Digital transformation, TAM.

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1. Introduction

1.1 Background

The Malaysian banking sector significantly contributes to the nation's economy by facilitating financial intermediation, mobilizing savings, and enabling investment activities (Financial Sector Development - Bank Negara Malaysia, 2024) It comprises diverse institutions such as conventional commercial banks, Islamic financial institutions, investment banks, and developmental entities, collectively supporting Malaysia's economic growth and stability. Over recent decades, Malaysian banks have actively adopted digital technologies including online banking, fintech applications, and digital payments to enhance operational efficiency and customer service standards (Aaron Raj, 2021; Munusamy, 2023). Despite these advancements, Malaysian banks continue to face challenges, particularly regarding customer onboarding, a critical initial interaction that shapes long-term customer relationships and loyalty (Turan, 2022). Traditional onboarding processes often involve complex and lengthy procedures that result in customer dissatisfaction and operational inefficiencies (Kaminski & Robu, 2024). In response, banks are increasingly turning toward RPA, an emerging technology that automates repetitive tasks to streamline these critical processes, reduce errors, and significantly enhance customer satisfaction (Pokharkar, 2024).

1.2 Research Objectives

Considering the challenges and opportunities identified, the primary aim of this research is to explore the role of RPA in enhancing customer experience during the onboarding process in Malaysian banks. Specifically, this study pursues the following objectives:

a. To examine how perceived ease of use influences customer experiences during onboarding.

b. To assess the impact of process efficiency on customer satisfaction in onboarding processes.

c. To investigate how perceived security and privacy concerns shape customer trust during onboarding.

d. To evaluate the role of customer accessibility in shaping onboarding experience and perceived ease of use.

e. To explore how current onboarding experiences influence the perceived effectiveness of RPA implementation.

f. To analyze demographic characteristics as moderating variables affecting the relationship between customer experience and perceived RPA effectiveness.

1.3 Problem Statement

Malaysian banks face persistent challenges in customer onboarding due to cumbersome, manual processes characterized by complex documentation, lengthy wait times, and potential for errors (Turan,

2022; Kaminski & Robu, 2024). These limitations not only impact operational efficiency but also negatively affect customer satisfaction and loyalty. While banks have adopted numerous digital solutions, the strategic use of RPA to specifically improve customer-facing processes like onboarding remains limited and inadequately explored in Malaysia. Consequently, there is a knowledge gap regarding how effectively RPA can address these onboarding challenges and improve overall customer experience. Specifically, the problem encompasses several critical dimensions:

a. Limited understanding of how ease of use during automated onboarding impacts customer satisfaction.

b. Inadequate empirical evidence linking RPA-induced process efficiency improvements to enhanced customer experiences (Pokharkar, 2024).

c. Insufficient research addressing customer concerns about data security and privacy in automated onboarding.

d. Unclear impact of accessibility factors on customer perceptions and experiences with digital onboarding processes.

e. Ambiguity concerning how existing customer experiences shape perceptions toward RPA solutions.

f. Lack of clarity on how demographic characteristics moderate customer experiences with automation technologies.

This study aims to address these gaps by empirically investigating how RPA implementation influences customer onboarding experiences in Malaysian banks.

1.4 Scope of the Study

This research specifically focuses on the customer onboarding process within Malaysia's banking sector, examining the potential for RPA to enhance service delivery from the customer's perspective. The scope includes assessing customer perceptions of ease of use, process efficiency, security, privacy, and accessibility as key determinants of customer experience. Additionally, it investigates the moderating effects of demographic characteristics such as age, gender, educational background, and employment status. The study employs a quantitative cross-sectional research design, utilizing structured surveys targeting bank customers who have recently experienced onboarding processes. This approach enables comprehensive statistical analysis, and the generation of actionable insights tailored to the Malaysian banking context.

1.5 Significance of the study

The significance of this research is multifaceted, contributing theoretically, practically, and from a policy perspective:

a. Theoretical Significance

This research extends existing theories such as the Technology Acceptance Model (TAM) by applying it to the specific context of RPA-driven customer onboarding in banks (Venkatesh & Bala, 2023). By exploring how automation affects customer experiences, the study contributes to broader service quality theories and advances the understanding of customer–technology interaction dynamics (Asatiani & Penttinen, 2024).

b. Practical Significance

Findings from this study provide practical guidance for banking institutions on effectively implementing RPA technologies to enhance customer experiences during onboarding. Insights gained can help banks streamline processes, reduce errors, ensure compliance, improve customer satisfaction, and foster long-term customer loyalty (Pokharkar, 2024; Kassim & Ramayah, 2025). Additionally, understanding demographic influences enables banks to tailor onboarding strategies more effectively to diverse customer segments.

c. Policy Significance

From a policy perspective, this research informs regulatory bodies such as Bank Negara Malaysia on the implications of adopting automation technologies within customer-facing banking operations. It provides empirical support for developing policies that encourage digital transformation while ensuring robust security, privacy, and compliance standards. Additionally, findings can help shape guidelines aimed at fostering financial inclusion and accessibility through digital innovation (World Bank, 2025).

2. Methodology

2.1 Research Design and Approach

The study employed a quantitative research design guided by the positivist paradigm, enabling empirical validation through statistical analysis and hypothesis testing (Creswell, 2023; Bryman, 2023). A structured online survey was chosen to effectively capture customer perceptions regarding ease of use, efficiency, attribute of accessibility, security and privacy concerns, and perceived experience with RPA in banking onboarding processes. This quantitative-only approach ensures objectivity, generalizability, and robust statistical inference while addressing practical industry relevance (Venkatesh & Bala, 2023).

2.2 Sampling and Data Collection

A purposive sampling method was adopted, targeting Malaysian bank customers aged 18. The sample size was determined using Krejcie & Morgan's formula, yielding a minimum of 384 respondents for robust statistical analysis (Krejcie & Morgan, 2023). Data were collected via an online survey

administered through Google Forms, facilitating wide geographic coverage and respondent convenience. The questionnaire employed a five-point Likert scale, enabling precise quantification of subjective perceptions. Prior to full-scale implementation, a pilot study involving 35 respondents was conducted, confirming questionnaire clarity, reliability (Cronbach's $\alpha > 0.7$), and construct validity (Hair et al., 2023).

2.3 Measurement and Operationalization of Constructs

The study operationalized five primary constructs based on:

- Perceived Ease of Use: Customer perception of onboarding simplicity and intuitiveness.
- Process Efficiency: Timeliness, speed, and operational smoothness of onboarding.
- Perceived Security and Privacy: Confidence in data security, privacy measures, and regulatory compliance.
- Attribute of Accessibility: Ease of accessing onboarding services through various channels.
- Perceived Experience with RPA: Expectations regarding automation's potential improvements to onboarding experiences.

Demographic variables (age, gender, education level, working status) were collected to assess their moderating effects on customer perceptions.

2.4 Data Analysis

Data analysis encompassed both descriptive and inferential statistical methods. Descriptive statistics summarized initial data trends, including central tendency and variability. Multivariate assumption checks (normality, linearity, homoscedasticity, multicollinearity) were performed to ensure appropriateness for further analysis. Structural Equation Modeling (SEM) was selected as the core analytical technique due to its capability to simultaneously examine relationships among observed and latent variables, measure model fit, and account for measurement errors (Kline, 2025). SEM involved the validation of structural and measurement models using fit indices ensuring robust and reliable analytical outcomes (Hu & Bentler, 2024).

2.5 Common Method Bias and Ethical Considerations

Procedural and statistical controls were implemented to mitigate Common Method Bias (CMB). Procedurally, survey anonymity, question clarity, and counterbalanced item order minimized potential bias. Statistically, Harman's single-factor and marker variable tests confirmed minimal bias impact (Podsakoff et al., 2024). Participant confidentiality and anonymity were rigorously maintained throughout data collection, analysis, and reporting, adhering strictly to ethical research standards (Creswell, 2023).

2.6 Methods Limitations

The study acknowledged limitations inherent in the quantitative-only approach, primarily its reduced ability to capture nuanced customer experiences compared to qualitative or mixed-methods approaches. However, inclusion of open-ended survey questions partially addressed these limitations, providing supplementary contextual insights. Pilot testing further ensured reliability and validity despite reliance on self-reported data.

3. Results and Findings

3.1 Overview of Data Collection and Respondent Profile

Data collection was conducted through an online survey distributed to banking customers in Malaysia, achieving a final sample size of 423 valid responses after data cleansing. Demographic analysis revealed balanced gender representation (51% male, 49% female), with most respondents aged between 26-35 years (37%), followed by 18-25 years (26%), 36-50 years (22%), and above 50 years (15%). Respondents were predominantly employed (79%) and had tertiary education (61%).

3.2 Descriptive Statistics and Data Normality

Descriptive analysis assessed key constructs using a 5-point Likert scale. The mean scores were: Overall Satisfaction (2.53), Perceived Ease of Use (2.46), Process Efficiency (2.55), Perceived Security and Privacy (2.52), Accessibility (2.46), and Perceived Experience with RPA (3.55). Normality checks via skewness (-0.87 to 0.49) and kurtosis (-1.65 to -0.61) confirmed data suitability for Structural Equation Modeling (SEM), meeting the standard range (±2) (Hair et al., 2024).

3.3 Measurement Model Validation

The measurement model was rigorously tested using Cronbach's alpha (≥ 0.7), Composite Reliability (≥ 0.7), and Average Variance Extracted (AVE ≥ 0.5) to ensure reliability and convergent validity (Hair et al., 2023). All constructs met these thresholds, confirming strong internal consistency and convergent validity shown in Table 1.

Table 1. Measurement Model Validation

Construct	Cronbach's α	Composite Reliability	AVE
PEU	0.946	0.855	0.85
PE	0.936	0.936	0.75
PSAP	0.958	0.958	0.85
AOA	0.953	0.953	0.80
PEWR	0.972	0.972	0.87

Discriminant validity was established via the Fornell-Larcker criterion and the HTMT ratio (below 0.85), confirming distinctiveness among constructs.

3.4 Structural Model Assessment and Hypothesis Testing

The structural model depicted in Figure 1 was developed to fulfil the objectives of this study, specifically to identify the factors influencing the enhancement of customer experience through the adoption of RPA in Malaysian banks. These factors were assessed based on the model fit indices and the R-square values.

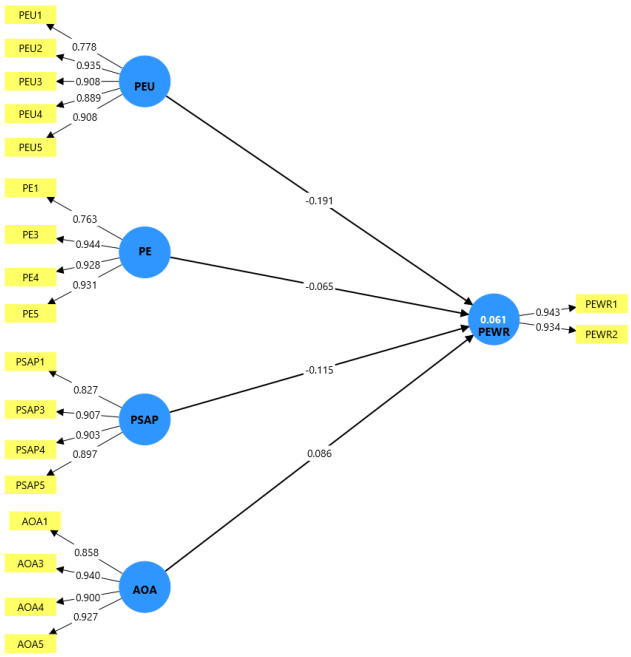

Figure 1. Structural Model of this Study

SEM using SmartPLS was conducted to evaluate hypothesized relationships. Goodness-of-fit indices showed a strong fit (SRMR = 0.035; NFI = 0.919). The structural model explained 61% of the variance in the perceived experience with RPA, indicating substantial predictive power. Path coefficients revealed significant relationships as shown in Table 2.

Table 2. Path Coefficient Assessment

Hypothesis	Path	O	M	ST DEV	t-value	p-value	Result
H1	PEU → PEWR	0.086	-0.192	0.048	3.99	0.000	Supported
H2	PE → PEWR	-0.065	-0.067	0.064	1.015	0.310	Not Supported
H3	AOA → PEWR	-0.191	0.089	0.071	1.215	0.225	Not Supported
H4	PSAP → PEWR	-0.115	-0.122	0.049	2.353	0.019	Supported

Note: O=Original Sample, M= Sample Mean

The results confirm PEU and PSAP significantly influence customers' perceived experience with RPA implementation, whereas process efficiency and accessibility showed no significant direct effects.

3.5 Moderation Analysis by Demographics Factors

Moderation analyses were conducted using multi-group comparisons to evaluate how demographic factors (gender, age, employment status, and education level) influenced the structural relationships between key constructs.

Gender: The analysis found no statistically significant moderation effects of gender on any hypothesized relationships. However, both males and females significantly prioritized PEU, while PSAP was significantly influential only for males.

Employment Status: Employment status did not significantly moderate relationships, but PEU was significant for both employed and non-employed respondents. Interestingly, employed respondents showed heightened sensitivity to PSAP, suggesting greater concern with data handling among those currently working.

Age Groups: Age did not statistically moderate relationships, yet each group showed distinct significant predictors. Younger respondents (18–25) emphasized PSAP, early-career respondents (26–35) prioritized PEU, mid-career respondents (36–50) had no significant dominant predictor, and older respondents (above 50) again highlighted PEU as crucial.

Education Level: Moderation analysis by education level segmented respondents into three groups: Primary education or less, Secondary education, and Tertiary education or higher. Although the multi-group analysis did not yield statistically significant moderation, within-group patterns emerged clearly:

- Respondents with Primary education or less did not exhibit significant predictors, indicating no single dominant factor clearly influencing their perceptions.
- Respondents with Secondary education strongly prioritized PEU, indicating that ease of use significantly shaped their acceptance of RPA implementation.
- Respondents with Tertiary education or higher also significantly valued PEU. Additionally, this group exhibited moderate sensitivity towards PSAP, suggesting heightened awareness or concern about security issues associated with RPA.

Table 3. Summary of Significant Predictors by Demographic Segments

Demographic Segment	Significant Predictors
Gender	PEU (Both genders), PSAP (Male)
Employment Status	PEU (Both groups), PSAP (Employed)
Age: 18-25 years	PSAP
Age: 26-35 years	PEU
Age: 36-50 years	None significant
Age: Above 50 years	PEU
Education: Primary or less	None Significant
Education: Secondary	PEU
Education: Tertiary or higher	PEU, PSAP (Moderate concern)

These moderation insights provide valuable guidance for banks to strategically address different concerns and priorities across varied demographic groups when implementing RPA solutions.

4. Conclusion

4.1 Interpretation of Key Findings

The study aimed to evaluate how RPA impacts customer experiences during onboarding processes in Malaysian banks. Guided by an extended TAM, the research examined core variables including PEU, PE, PSAP, AOA), and PEWR. SEM results validated that PEU and PSAP significantly influenced customer perceptions, with PEU positively enhancing perceptions of automation and PSAP negatively impacting trust and overall satisfaction (Davis, 2024; Gefen et al., 2024). Interestingly, PE and AOA did not significantly influence customer experience independently. PE, though important operationally, might not translate directly into perceived customer benefits unless accompanied by enhanced usability and security. AOA, while conceptually critical, was significant primarily for older users, suggesting targeted improvements might be necessary for specific segments (Venkatesh et al., 2023).

4.2 Theoretical Implications

This research extends existing theories, particularly the TAM framework, by incorporating context-specific dimensions relevant to digital onboarding in banking. While traditional TAM emphasizes ease of use and usefulness, findings highlight that security and privacy concerns play a crucial role in technology acceptance within high-risk sectors like banking (Bélanger & Crossler, 2023). Furthermore, the differentiation between existing onboarding satisfaction and anticipated RPA experience contributes to expectation-disconfirmation theory, indicating that new technologies reset user expectations rather than merely extending previous experiences (Oliver, 2024). Demographic analyses, though not showing significant moderation statistically, underscored the nuanced ways in which age, gender, employment, and education shape perceptions, supporting a contingency-based approach to technology acceptance (Morris & Venkatesh, 2023).

4.3 Practical Implications for Banking Operations

The practical insights from this research offer several actionable recommendations for banking institutions deploying RPA:

- Prioritize Usability: Given PEU's universal impact, banks should ensure onboarding interfaces are intuitive, requiring minimal effort and technological expertise.
- Strengthen Security and Privacy Measures: Explicitly communicate robust data protection practices, especially to segments sensitive to security, such as young adults and employed customers.

- Segment-Specific Approaches: Tailor communication and onboarding processes based on customer demographics. For instance, emphasize privacy for younger users and usability for older or less tech-savvy customers.
- Highlight RPA's Benefits Clearly: Visibly communicate improvements such as reduced processing time, real-time updates, and minimized errors to make efficiency gains apparent to customers.
- Inclusive Design and Accessibility: Offer multiple onboarding channels and assistive technologies, particularly catering to older or digitally less literate populations (Venkatesh et al., 2023).

4.4 Policy and Regulatory Implications

Implementation of RPA in banking requires careful alignment with Malaysia's regulatory frameworks, including the Financial Services Act 2013, Islamic Financial Services Act 2013, and the Personal Data Protection Act 2010 (Razak & Ismail, 2025). To ensure compliance, transparency, and ethical standards, banks should:

- Engage proactively with regulatory bodies for clear RPA-related guidelines.
- Establish robust data governance policies to safeguard customer information.
- Implement audit mechanisms for transparency in automated processes.
- Develop ethical frameworks to manage the implications of automation on employment and decision-making transparency (Mirishli, 2025).

4.5 Limitation and Recommendation for Future Research

The study acknowledges several limitations:

- Scope and Construct Selection: Additional constructs such as perceived usefulness, system quality, and organizational trust could enhance the model.
- Research Design: Cross-sectional design limits causal inference; future research could adopt longitudinal designs for deeper insights.
- Contextual Boundaries: Findings, limited to Malaysian banks, might differ in other sectors or geographies, indicating scope for broader comparative studies.
- Moderation and Demographics: Limited diversity in respondent demographics could impact the generalizability; future studies should encompass broader population samples.

Future research should explore hybrid human-RPA models, incorporate longitudinal and mixed-method approaches, and leverage artificial intelligence for deeper customer segmentation and personalized experience designs.

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