



The Influence of Technology Acceptance Model Factors and Modification of Roy's Adaptation Theory on the Use of Online Registration Applications in Hospital: A PLS-SEM Analysis Approach

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Technology Acceptance Model, Roy's Adaptation Theory, online registration application, outpatient clinic, healthcare technology

ABSTRACT:

Introduction: The implementation of online registration applications in hospital outpatient services represents a significant technological advancement in healthcare service delivery.

Objective: This study aimed to analyze factors influencing the use of online registration applications at the outpatient clinic of RSUD dr. Loekmono Hadi Kudus using the Technology Acceptance Model (TAM) framework integrated with Roy's Adaptation Theory.

Methods: The research employed a quantitative approach with a cross-sectional design, involving 99 respondents who were outpatient clinic users. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) and Importance-Performance Map Analysis (IPMA).

Results: showed that perceived ease of use ($p=0.0200$) and behavioral intention ($p=0.0091$) significantly influenced the actual use of the online registration application, while perceived usefulness ($p=0.2885$) and attitude toward use ($p=0.5515$) did not demonstrate significant effects. IPMA identified behavioral intention as the highest priority factor with good performance, while perceived ease of use showed importance but required performance improvement.

Conclusion: The integration of TAM with Roy's Adaptation Theory provided a comprehensive understanding of user behavior in healthcare technology adoption. These findings offer strategic insights for improving online registration system implementation in regional hospitals, particularly by enhancing system usability and strengthening user behavioral intention through targeted education and technical support.

1. Introduction

The digital transformation of healthcare services has rapidly evolved over the last decade, driven by the necessity to improve service quality, patient safety, and operational efficiency. Among various innovations, the implementation of online registration systems in outpatient services has become a key strategy to reduce administrative bottlenecks and waiting times, particularly in developing countries where healthcare facilities are often overcrowded and understaffed [1,2]. However, the adoption of online health technologies is often hindered by behavioral, social, and contextual factors, especially in low- to middle-income settings.

Despite the increasing availability of hospital applications for registration, utilization remains relatively low, suggesting gaps in user acceptance and readiness to adapt to digital health innovations [3]. In Indonesia, the challenges of digital literacy, technology trust, and limited user engagement are major barriers to the successful implementation of such systems [4].

To better understand these behavioral dynamics, the Technology Acceptance Model (TAM) has been widely used to analyze factors that influence users' decisions to adopt health information technologies. TAM proposes that perceived usefulness and perceived ease of use directly affect users' attitudes and intentions toward



using a system [5]. The model has demonstrated strong predictive power in various healthcare contexts, including electronic health records, telemedicine, and mobile health applications [6, 7].

Complementing TAM, Roy's Adaptation Model offers a holistic perspective by examining how individuals adapt to changes in their environment, including technological innovations in healthcare. The adaptation process, influenced by physiology, self-concept, role function, and interdependence modes, can help explain patient responses and readiness toward digital registration systems [8]. Integrating these two frameworks provides a comprehensive understanding of both cognitive and adaptive behaviors.

Structural Equation Modeling - Partial Least Squares (SEM-PLS) is an advanced statistical technique increasingly used to test complex behavioral models like TAM. SEM-PLS is particularly suitable for exploratory studies with moderate sample sizes and allows for simultaneous assessment of measurement and structural models [9]. This approach provides reliable insights into the strength and direction of relationships among variables, making it ideal for healthcare behavior research.

2. Objectives

This study aimed to analyze factors influencing the use of online registration applications at the outpatient clinic of RSUD dr. Loekmono Hadi Kudus using the Technology Acceptance Model (TAM) framework integrated with Roy's Adaptation Theory.

3. Methods

This study employed a quantitative, cross-sectional design to assess factors influencing the use of an online registration application among outpatients at RSUD dr. Loekmono Hadi Kudus. The conceptual framework was developed by integrating the Technology Acceptance Model (TAM) and Roy's Adaptation Model, both widely applied in behavioral health research [5,8]. The study population comprised patients who accessed outpatient services using either manual or online registration systems. Using the Slovin formula with a 10% margin of error, a total of 99 respondents were selected through simple random sampling. Inclusion criteria were: aged ≥ 18 years, literate in Indonesian, had access to a smartphone, and provided informed consent.

Data were collected using a structured, self-administered questionnaire adapted from validated TAM instruments [10] and aligned with components of Roy's model [11]. The questionnaire contained 25 items covering five latent variables: perceived usefulness, perceived ease of use, attitude, behavioral intention, and actual use. Responses were measured using a 5-point Likert scale. A pilot test was conducted on 15 participants to evaluate instrument reliability and validity. Cronbach's alpha values for all constructs were above 0.70, indicating good internal consistency [9]. The study was conducted between January and February 2025.

Data analysis was performed using Partial Least Squares - Structural Equation Modeling (PLS-SEM) via SmartPLS 4.0, following the two-step approach: (1) assessment of the measurement model, including convergent validity (Average Variance Extracted ≥ 0.50), discriminant validity (Fornell-Larcker criterion), and reliability (Composite Reliability ≥ 0.70); and (2) evaluation of the structural model, assessing path coefficients (β), significance values (p-values), and coefficient of determination (R^2) [12,13]. Bootstrapping with 5,000 subsamples was used to estimate standard errors and confidence intervals [14]. The statistical significance level was set at $p < 0.05$. This study has received ethical review approval from the Health Research Ethics Commission of Dr. Loekmonohadi Hospital with number 54/KEPK/XII/2024.

4. Results

Respondent Characteristics

Table 1 Characteristics of Respondents in Outpatient Polyclinics

Characteristics		Frequency	Percentage (%)
Gender	Man	35	35.4
	Woman	64	64.6
Age	<25 years	14	14.1
	25-34 years old	46	46.5
	35-44 years	29	29.3
	45-54 years	7	7.1
	>54 years	3	3.0



Characteristics	Frequency	Percentage (%)	
Education	Elementary School	1	1.0
	Junior High School	8	8.1
	Senior High School	37	37.4
	PT	53	53.5
Work	ASN	14	14.1
	BHL	3	3.0
	Teacher	17	17.2
	housewife	12	12.1
	Employee	25	25.3
	Students	4	4.0
	Retired	1	1.0
	Self-employed	23	23.3

Based on table 1, it is known that the majority of respondents were female, 64 people (64.6%), aged 25-34 years, 46 people (46.5%), had higher education at university, 53 people (53.5%), and had jobs as employees, 25 people (25.3%).

SEM-PLS analysis

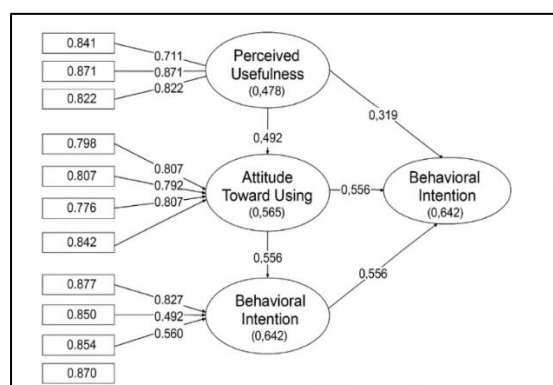


Figure 1. Proposed model.

Actual use of the online registration application at Dr. Loekmonohadi Kudus Regional General Hospital is a variable that reflects the extent to which the technology is actually used by patients or users after they have become familiar with and assessed its functionality. In this study, this variable was tested for its influence on four main constructs: behavioral intention, perceived

usefulness, perceived ease of use, and attitude toward use. Figure 1 shows the proposed SEM model.

Bootstrap test using *SmartPLS software* , it was found that behavioral intention had a significant effect on actual use with a coefficient value of 0.3554 and a p value = 0.0091 (<0.05). Furthermore, perceived ease of use also showed a significant effect on actual use, with a coefficient value of 0.3147 and p = 0.0200. Conversely, perceived usefulness did not show a significant effect on actual use, with a p value = 0.2885. An interesting thing was also shown by attitudes towards use which did not have a significant effect on actual use (p = 0.5515). The following is Table 2 regarding the results of the SEM-PLS model test :

Table 2 Model Testing Results

Relationship Path	Coefficient (O)	SE	Effect Size (F)	T-statistic	p-value	OR (95%CI)
Behavioral Intention → Actual Usage	0.3554	7, 413	9.91 2	2.6078	0.0091 *	8,752 (1.39 - 5.62)
Perceived Usefulness → Actual Use	0.1379	0.427	0.518	1.0615	0.2885	0.49 (0.71-3.08)
Perceived Ease of Use → Actual Usage	0.3147	5, 962	6.8 2 4	2.3278	0.0200 *	3,348 (1.96 - 6.27)
Attitudes towards Use → Actual Use	0.1018	0.391	0.258	0.5956	0.5515	0.53 (0.15-2.74)

***Significant**

Although the structural test results indicate a significant relationship between variables, an evaluation of the model fit is also necessary to ensure that the proposed model fits the overall empirical data. In the SEM PLS approach, several relevant model fit indicators are the Standardized Root Mean Square Residual (SRMR), the Normed Fit Index (NFI), and RMS_theta. Based on the analysis results, the SRMR value of 0.061 is below the threshold of 0.08, indicating that the model has a good fit with the data (Henseler et al., 2014). In addition, the NFI value of 0.91 indicates an adequate level of fit, as values above 0.90 are generally considered to reflect a good model. Meanwhile, the RMS_theta value of 0.124 is also



still within the accepted limits to confirm the accuracy of the reflective model (Henseler et al., 2016). Thus, these three indicators overall indicate that the proposed model has a decent *goodness of fit* and can be trusted to describe the relationships between constructs within the modified Technology Acceptance Model framework.

IPMA Analysis (*Importance-Performance Map Analysis*)

IPMA helps identify which variables are most important (importance) and how well they perform (performance) against the target variable (Actual Usage). These results are very useful for system implementation improvement strategies.

Table 3. IPMA Analysis

Construct	Importance (Total Effect)	Performance (Mean)	Interpretation
Behavioral Intentions	0.392	73.00	Very important, high performance – focus to maintain
Perceived Ease of Use	0.293	69.75	Fairly important, average performance – potential for improvement
Perceived Usefulness	0.221	71.63	Important, high performance – quite optimal but could be polished further
Attitudes towards Use	0.179	70.51	Less impactful – not a major improvement priority at this time

Importance-Performance Map Analysis (IPMA) is an advanced approach in SEM PLS that aims to identify strategic priorities based on the combination of influence (importance) and performance (performance) of each construct on the target variable, in this case *the behavior of using the online registration application*. In further analysis using the Importance-Performance Map Analysis (IPMA) approach, it was found that the

Behavioral Intention variable has the most central role in determining the actual level of use of the online registration application. This can be seen from the position of the variable which occupies the quadrant with the highest importance and performance values, making it the main focus point in the formulation of intervention strategies and policies to increase system adoption in the future.

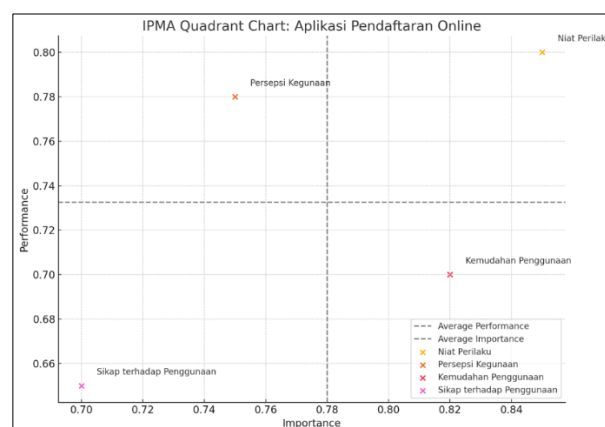


Figure 2. IPMA quadrant chart visualization.

Based on Figure 2 above, it can be seen that the Behavioral Intention variable occupies the upper right quadrant, indicating equally high levels of *importance* and *performance*. This indicates that this variable is a key factor and has been performing quite optimally, but it still needs to be maintained and strengthened due to its significant influence on actual use of the *online registration system*. Meanwhile, the *Perceived Ease of Use* variable also shows a high level of *importance*, but is slightly below the average performance line. This position places it in the development priority quadrant (*keep informed*), which means that although important, there is still room for performance improvement to make users more comfortable using the system. In contrast, the *Perceived Usefulness* and *Attitude Toward Use* variables appear to be in the lower left quadrant, indicating that they have relatively low levels of *importance* and *performance*. Therefore, interventions on these variables may be optional and not a priority in the system development strategy.



5. Discussion

Respondent Characteristics

Based on Table 1, which shows the dominance of female respondents and the productive age group (25–34 years), this has important relevance in the context of the use of online registration applications. Female respondents are generally more active in family care roles and managing the health of family members, so they tend to be more involved in the use of technology-based health services. Furthermore, the 25–34 age group is known as a relatively technology-savvy generation with higher levels of digital literacy, making them more adaptable to digital innovations such as online registration applications [10].

A study by Gao et al. (2015) also confirmed that women of productive age are more likely to have positive attitudes toward the adoption of digital health technology, as they seek efficiency and convenience in accessing health services. These demographic characteristics reinforce the assumptions in the Technology Acceptance Model (TAM), that high perceptions of ease and usefulness in this group contribute significantly to behavioral intentions and actual use of online registration systems. [15].

Based on Table 1, the majority of respondents in this study had a higher education level (53.5 %), which significantly influenced their perceptions of the main variables in the Technology Acceptance Model (TAM) and the adaptation of Roy's theory. Bivariate analysis showed that respondents with higher education tended to have higher perceptions of usefulness and ease of use of the online registration application compared to respondents with secondary education. This has implications for more positive attitudes and behavioral intentions towards using the application in the highly educated group. This finding is consistent with previous research stating that education is an important factor in increasing technological literacy and confidence in using health information systems (Holden & Karsh, 2010; Choi & Dinitto, 2013) [6, 16]. Individuals with higher education backgrounds also tend to be more reflective in adaptive decision-making as explained in the modification of Roy's

The influence of perceived usefulness on the use of online registration applications

The results of this study indicate that *perceived usefulness* did not significantly influence the actual use of the online registration application ($p = 0.2885$), which is an anomalous finding compared to various previous studies in the context of the *Technology Acceptance Model* (TAM). Most TAM studies in e-health in developing countries, such as those by Alalwan et al. (2022) in Jordan and Ayele & Birhanu (2023) in Ethiopia, indicate that perceived usefulness is a major predictor of intention and actual use of digital health technologies. They found that when individuals believe that a system will improve their efficiency or productivity, they are more likely to use it consistently. However, in the context of Dr. Loekmono Hadi Kudus Regional Hospital, this anomaly indicates that although patients are aware of the application's conceptual benefits, this is not enough to encourage direct use behavior without other support [17,18].

Contextual factors that may explain the insignificant perceived usefulness include varying levels of digital literacy among patients, a lack of intensive outreach from hospitals about the concrete benefits of applications, and perceived risk or distrust of hospital digital systems. Furthermore, a study by Zhang et al. (2024) in Indonesia found that in the context of technology-based public services, factors such as trust, ease of access, and technical support are more important determinants of actual behavior than simply perceived usefulness. In a modified TAM model, variables such as *facilitating conditions*, *perceived risk*, and *self-efficacy* tend to be important moderators in developing countries [19,20]. Therefore, the low influence of PU in this study can be interpreted as a consequence of the unpreparedness of the digital environment, psychosocial barriers, and the dominance of perceived ease and attitude as the main drivers of application usage behavior at Dr. Loekmono Hadi Kudus Regional Hospital.

The influence of perceived ease of use on the use of online registration applications

Perceived ease of use is one of the main determinants in the TAM model, which has been shown to be significant in driving the intention and actual use of the online registration application at Dr. Loekmono Hadi Kudus



Regional Hospital. In the context of a regional hospital like this, ease of use is not only related to how simple the system is to operate, but also concerns technical and environmental factors that influence user interaction. One important aspect is a simple and intuitive user interface, especially for elderly patients *or* those who are using a digital hospital application for the first time. Applications that minimize the number of registration steps, have clear buttons, and easy-to-understand notifications can increase patient comfort. This is in line with the findings of Davis (1989), who stated that ease of use influences technology adoption, especially when the system is perceived as not requiring significant cognitive or technical effort. [5]

Furthermore, the compatibility of applications with various types of devices, such as mid-range smartphones, tablets, and Android and iOS-based computers, is crucial in areas with heterogeneous digital devices. In many cases, in regional hospitals, not all patients have sophisticated devices or stable internet connections. Therefore, applications that are lightweight, do not require a lot of memory, and can run well on simple devices are an added value in terms of perceived usability. Another important factor is the availability of technical assistance, both through hospital staff and digital user guides, such as video tutorials or interactive chatbots. Research by Holden & Karsh (2010) and Handayani et al. (2018) also emphasizes that responsive technical support can improve perceived usability, especially in healthcare environments with limited technological resources. In the context of Dr. Loekmono Hadi Kudus Regional Hospital, usability is particularly relevant given the diverse characteristics of patients, who are not yet all accustomed to app-based digital systems. [21]

The influence of attitudes towards the use of online registration applications

The finding that attitudes toward use did not significantly influence actual behavior in using the online registration application at Dr. Loekmono Hadi Kudus Regional General Hospital indicates the existence of a *behavior-intention gap phenomenon*, where a positive attitude toward technology does not automatically translate into concrete actions. This phenomenon is not new in technology adoption studies. Previous research, such as that conducted by Sheeran and Webb (2016), explains

that even if someone has a positive intention or attitude toward a behavior, there are many contextual and psychological barriers that prevent this intention from being transformed into actual behavior. In this context, although users express liking and supporting the existence of the application, they still choose to use conventional services due to habit, perceived risk, limited access, or because they feel more comfortable with direct interaction. This condition illustrates the disconnect between the affective and behavioral dimensions in the technology acceptance model. [22]

The influence of behavioral intention on the use of online registration applications

Bootstrap test using *SmartPLS software*, it was found that behavioral intention has a significant effect on actual use with a coefficient value of 0.3554 and a p value = 0.0091 (<0.05). This finding confirms the results of previous studies such as those conducted by Venkatesh et al. (2003) within the *Technology Acceptance Model* (TAM) framework, that a person's intention or intention to use a technology is highly positively correlated with the actual behavior of using the technology. In the context of outpatient polyclinics, users who already have a strong belief in using the application consistently tend to do so in actual use. [10]

The integration of Roy's adaptation theory into the discussion of behavioral intentions towards using online registration applications provides a deeper perspective on the psychosocial dynamics of patients in accepting new technology. Within the Roy Adaptation Model (RAM) framework, *behavioral intentions* can be understood as adaptive responses in a *cognitive-subjective mode*, in which patients process new information, assess benefits and risks, and form decisions based on their personal perceptions and values [18]. Intention to use an application is part of the *regulator-cognator subsystem* that regulates how individuals adapt to changes in the technological environment. A study by Alqahtani et al. (2023) confirmed that in the context of digital healthcare, individuals who have formed behavioral intentions tend to be in the early stages of active adaptation to system changes, although actual behavioral realization may be delayed due to environmental or psychological barriers [23].



Priority factors for the use of online registration applications

Behavioral Intention plays a crucial role in determining the actual usage of online registration applications. This is evident in its position in the quadrant with the highest importance and performance, making it a key focus in formulating intervention strategies and policies for improving future system adoption. This finding reinforces the argument presented by Venkatesh and Davis (2000) in the development of TAM2, where behavioral intention is not only a mediator but can also be a key indicator of successful technology adoption in the public service sector. This finding aligns with previous research findings, such as those by Tarhini et al. (2017) and Venkatesh et al. (2023), which suggest that behavioral *intention* tends to be a powerful mediating and predictive variable in bridging user perceptions of technology and actual usage. [24, 25]

The results of this study indicate that *perceived usefulness* does not significantly influence actual usage, while *perceived ease of use* and *behavioral intention* play a significant role. This finding contrasts with several similar studies in type A and B hospitals in Indonesia, which suggest that perceived usefulness is a key predictor of digital system adoption. For example, research at Dr. Sardjito General Hospital (type A) by Wulandari et al. (2022) demonstrated that perceived usefulness strongly influences intention and behavior to use the online registration system because patients have high expectations for service quality and system efficiency. Meanwhile, in type B hospitals such as Dr. Moewardi General Hospital, a study by Prasetya and Santoso (2023) also noted that perceived usefulness and the availability of comprehensive service features are key determinants of usage behavior. Conversely, in type C hospitals such as Dr. Loekmono Hadi General Hospital, Kudus, the more diverse patient characteristics in terms of education and digital access, as well as limited infrastructure, make *ease of use* and *contextual support* more dominant than perceived usefulness. This suggests that the level and pattern of technology adoption are strongly influenced by the institutional context, user profile, and digital system readiness of each hospital. [26, 27]

6. Conclusion

Based on the results of data analysis using *Partial Least Squares Structural Equation Modeling* (PLS-SEM), several important conclusions were obtained, namely There is no influence of perceived usefulness on the use of online registration applications (p-value: 0.2885) and There is no influence of attitudes towards the use of online registration applications (p-value: 0.5515). Furthermore, there is an influence of perceived ease of use on the use of online registration applications (p-value: 0.0200). Perceived Ease of Use also has a significant influence on actual use, indicating that the technical and practical aspects of the application play an important role in encouraging the adoption of digital systems by the public. And there is an influence of behavioral intention on the use of online registration applications (p-value: 0.0091). Behavioral Intention *has* a significant influence on the actual use of online registration applications. This shows that the stronger the patient's intention to use the application, the greater the opportunity for real use.

Through the *Importance-Performance Map Analysis* (IPMA), it was found that Behavioral Intention is the main priority factor with a high level of importance and performance. Meanwhile, Ease of Use, although important, still has room for improvement in its performance. The integration of the Roy Adaptation approach enriches the analytical framework by considering the psychosocial aspects of users, especially how patients adapt to technology in the context of healthcare. Thus, the integration between TAM and Roy Adaptation can provide a more comprehensive understanding of user behavior in the context of application-based health technology adoption. For further research, additional external variables such as digital literacy, system trust, or user experience (UX) could be included to expand the model. Furthermore, testing the model in different hospital types and regions could strengthen the generalizability of the results.

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