User Acceptance of Surgical Site Infection Information System: Applying the Extended Technology Acceptance Model

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Abstract

Objectives

Surgical site infections (SSI) continue to be a problem for surgeons, and unfortunately, utilization of SSI information systems is low. This study aimed to analyze the user acceptance of the surgical site infection information system based on the Extended Technology Acceptance Model (TAM2).

Methods

A cross-sectional questionnaire-based study. The variables studied Intention to Use (IU), Perceived Ease of Use (PEOU), Demographic Factors (FD), Subjective Norm (SN), Image (I), Job Relevance (JR), Output Quality (OQ), Result Demonstrability (RD), Perceived Usefulness (PU). Data were collected by filling out questionnaires, and then analyzed using structural equation modeling (SmartPLS 4).

Results

In total, 61 nurses were included. Most respondents aged 31-35 years, (26,23%) and the most working period are between 11-15 years (27.87%). The results showed that There were significant positive effects on subjective norm to perceived usefulness andImage, job relevance to perceived usefulness, result demonstrability to the perceived usefulness, perceived usefulness to intention to use, perceived ease of use to the intention to use, and perceived usefulness, demographic factor to the intention to use

and perceived usefulness. The relationship between the subjective norm and theintention to use and output quality to perceived usefulness were significantly negative.Image has no significant effect on perceived usefulness.

Conclusions

This study concluded that the most influential variable in the intention to use thesurgical site infection information system is perceived Ease of use.

Keywords: Surgical Wound Infection, Infection Control, Information System,

Medical Informatics Applications, Technology Transfer

Introduction

Infectious diseases are still one of the health problems in the world, including in Indonesia (1). Today, surgical site infection (SSI) is still a problem for surgeons (2,3).SSI can increase morbidity, mortality, and treatment costs due to the treatment length and other complications (4). Despite advances in prophylactic antibiotics, better anesthesia, advanced equipment, and increased postoperative vigilance, SSI remains common (4). According to WHO, more than one in ten people in developing countrieswho undergo surgery are affected by SSI, while in developed countries, it occurs in 500,000 people per year. In the Americas, SSI occurs in about 1% of patients undergoing surgery. In Morocco, the incidence of infection in the surgical site is 6.3%(5). SSI data in Indonesia is 5.1%-8.9% (6). Meanwhile, the SSI incident at the Haji Hospital in East Java Province in the first semester of 2022 was reported by 0.31% .

The Surgical Site Infection Information System is a HAIs surveillance application used for the identification and monitoring of every SSI incident at the HajiHospital East Java Indonesia. The application includes filling in preoperative data, during operation, and postoperatively. Since its creation in 2019, the application has never been evaluated and improved. Changing from a manual data-filling system to anelectronic is certainly a new challenge for officers (7). From the primary data of the Haji Hospital of East Java Province, it was found that the use of the application from 2019-2022 was not in accordance with the target.

Analysis of behavior change approaches to technology acceptance usually uses the Technology Acceptance Model (TAM) theory, which can predict human behaviorthrough factors that influence the information system acceptance model (8,9). While Venkatesh (10) used TAM as a starting point, creating TAM2 that incorporatesadditional theoretical constructs that include processes of social influence (subjective norms, voluntariness, and image) and cognitive instrumental processes (Relevance of work, quality of output, demonstrable results, and perceived Ease of use). This study aims to analyze the user acceptance of the surgical site infection information system using the TAM2 model.

Methods

1. Study Design and Setting

This study was designed as a cross-sectional questionnaire-based study. The subjects of this study were the Infection Prevention and Control Link Nurse (IPCLN) Team of Haji Hospital, East Java Province, as many as 61 nurses. The research was conducted at the Haji Hospital East Java Province Indonesia from January 2023 to March 2023. The inclusion criteria were All IPCLN RSUD Haji East Java Province and who had never filled out the application were excluded.

Data collection using the questionnaire adapted from “A Theoretical Extensionof the Technology Acceptance Model: Four Longitudinal Field Studies”, an original article by Venkatesh (10). The answer options in the form of a Likert scale with

intervals of 1 to 7, while the demographic factor questionnaire (age and length ofservice) is an open question.

3. Data Analysis

The data analysis includes respondent characteristics and descriptions of research variables. The structural equation model (SmartPLS 4) is used to analyze theinfluence between variables, resulting in a structural model that is tested by path analysis. (11). The evaluation is based only on the value of the structural coefficient of

each path, either directly or indirectly. The value of the coefficient < 0.05 is insignificant, so it can be excluded from the model.

To assess the strength of the reflection for each measurement model, loading factor, average variance extracted (AVE), and composite reliability (CR) have been measured. The loading factor values of all indicators were above 0.5 (12–14). Cronbach's alpha and CR values were all above the threshold value of 0.7. In addition, the AVE values are all above the recommended value of 0.5. From the results of the Fornell-Larcker scale and cross-loading, all values have a less than 5, based on variance

inflation factor (VIF) results (12,15). From this, we can conclude that the reliability and validity (convergence and discriminability) have been confirmed and that the studyvariables are free of multicollinearity. (details available on request).

Ethical Consideration

This study was approved by the Institutional Ethics Committee (RSUD HajiProvinsi Jawa Timur Ethics Committee, File no.073/32/KOM.ETIK/2023).

Result

1. Demographic Respondents

Table 1 shows most respondents aged 31-35 years, as many as 16 respondents (26,23%). It can also be seen that respondents with the most working period are between 11-15 years, as many as 17 respondents (27.87%).

Table 1. Demography *Respondent*

Age (Years)	Frequent (N=61)	Percentage (%)	Length of Service (Years)	Frequent (N= 61)	Percentage (%)
20-25	4	6,56	1-5	11	18,03
26-30	10	16,39	6-10	12	19,67
31-35	16	26,23	11-15	17	27,87
36-40	11	18,03	16-20	8	13,11
41-45	3	4,92	21-25	6	9,84
46-50	13	21,31	26-30	5	8,20
51-55	4	6,56	>30	2	3,28

Table 2. Descriptive statistics

Variable/ Construct	Minimum	Maximum	Mean	Sum	Standard Deviation
FD	2	14	7,033	429	3,311
SN	2	14	10,508***	641	3,389
I	3	21	14,902**	909	4,679

JR	9	14	12,459***	760	1,444
OQ	6	14	10,803***	659	2,197
RD	12	28	21,066***	1.285	3,209
PU	15	28	24,098***	1.470	3,404
PEOU	14	28	22,639***	1.381	3,899
IU	6	14	12,066***	736	1,632

Notes: FD: Demographic Factor; I: Image; IU: Intention to Use; JR: Job Relevancy; OQ: Output Quality; PEOU: Perceived Ease Of Use; PU: Perceived Usefulness, RD: Result Demonstrability; SN: Subjective Norm.

* Low (SN: 2-5; I: 3-8; JR:2-5; OQ: 2-5; RD: 4-11; PU:4-11; PEOU:4-11 ; IU:2-5)

** Moderate (SN: 6-9; I: 9-14 ; JR:6-9; OQ: 6-9; RD: 12-19; PU: 12-19; PEOU:12-19; IU:6-9)

*** High (SN:10-14; I:15-21; JR:10-14; OQ:10-14; RD:20-28; PU:20-28; PEOU:20-28; IU:10-14)

Table 2 shows descriptive statistics for all variables considered in the followinganalysis. The total score produced in the SN variable was 641, with an average of 10.508. The measurement results showed that the average indicator of SN was high. This explains the respondent's perception that most people who are important to him think he should or should not perform such behavior quite high. The same applies to SN, the mean values for variables JR, OQ, RD, PU, PEOU, and IU are high. Only images are rated moderate with a mean score of 14.902.

2. Outer model

It is necessary to design an outer model first because the nature of the indicatorsof each variable FD, SN, I, JR, OQ, RD, PEOU, PU, and IU is reflexive. So that the direction of the arrow on the measurement model is from the direction of the construeto the indicator, the outer model design using smartPLS 4 software (Figure 1).

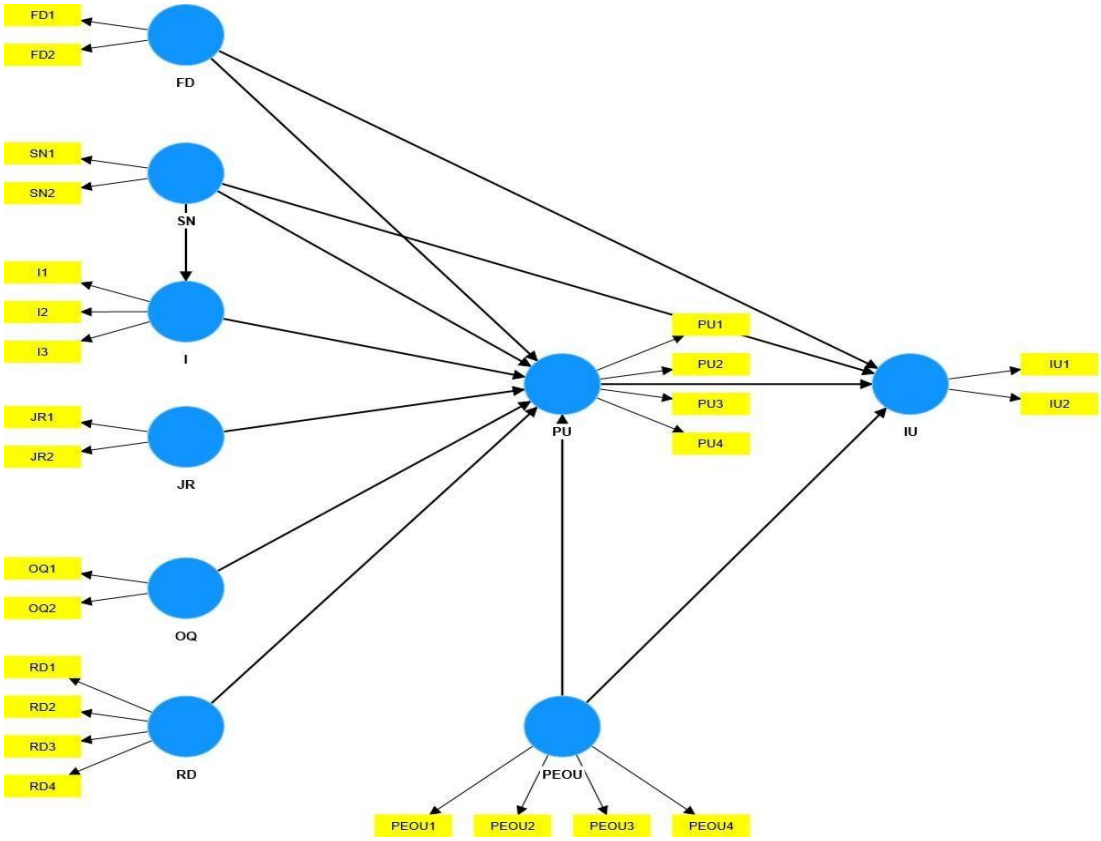

Figure 1. Outer model design with smartPLS 4 software

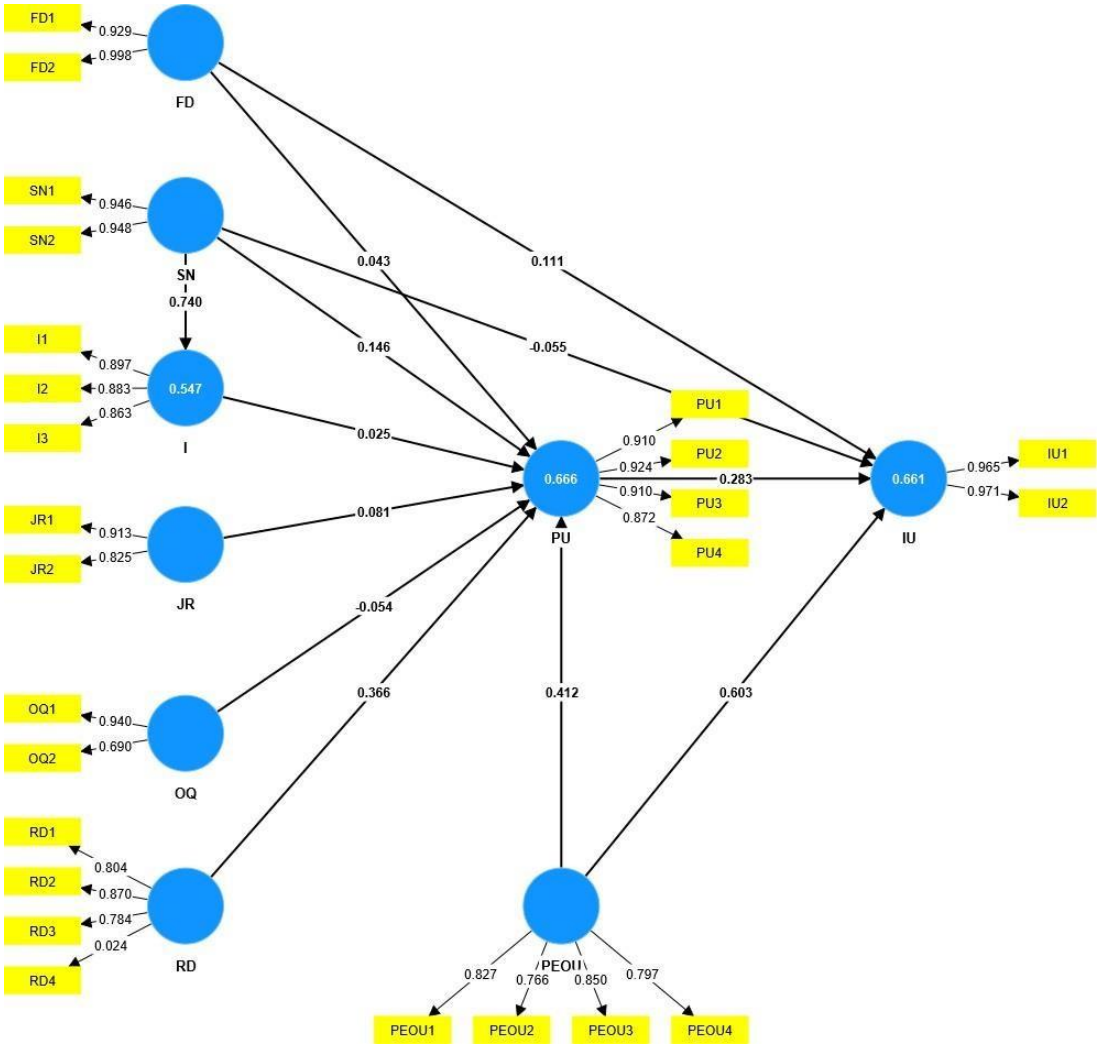

Figure 2. First model loading factor execution results

In Figure 2 of the results of the first model loading factor execution, it can be seen that there is one indicator whose value of the loading factor is < 0.5, namely the RD4 indicator. So the RD4 indicator must be omitted for further analysis.

3. Inner model

After determining the suitability of the measurement model, the next step is toevaluate the structural model. To assess the structural model, the coefficient of determination (R^2) and the path coefficient must be examined (12). R-Square measuresthe proportion of variation in the value of an affected variable (endogenous) that can be explained by the variable that affects it (exogenous).

Table 3. R-Square Results

	R-square	R-square adjusted
I	0.546	0.545
IU	0.667	0.665
PU	0.689	0.687

The criteria for justification in R-Square analysis are as follows:

- If the value of R^2 (R-Square) = 0.75 then substantial (big/strong)
- If the value of R^2 (R-Square) = 0.5 then moderate (medium)
- If the value of R^2 (R-Square) = 0.25 then weak (small)

Based on Table 3 about the results of R-Square, it can be stated that the R-Square modelpath I = 0.547. This means that the ability of the SN variable to explain variable I am 54.7% (medium). R-Square model line II = 0.667. This means that the ability of FD, SN, and PEOU variables to explain IU variables is 66.7% (medium). R-Square modelline III= 0.689. This means that the variables FD, SN, I, JR, OQ, RD, and PEOU in explaining the IU variable through the PU variable are 68.9% (medium).

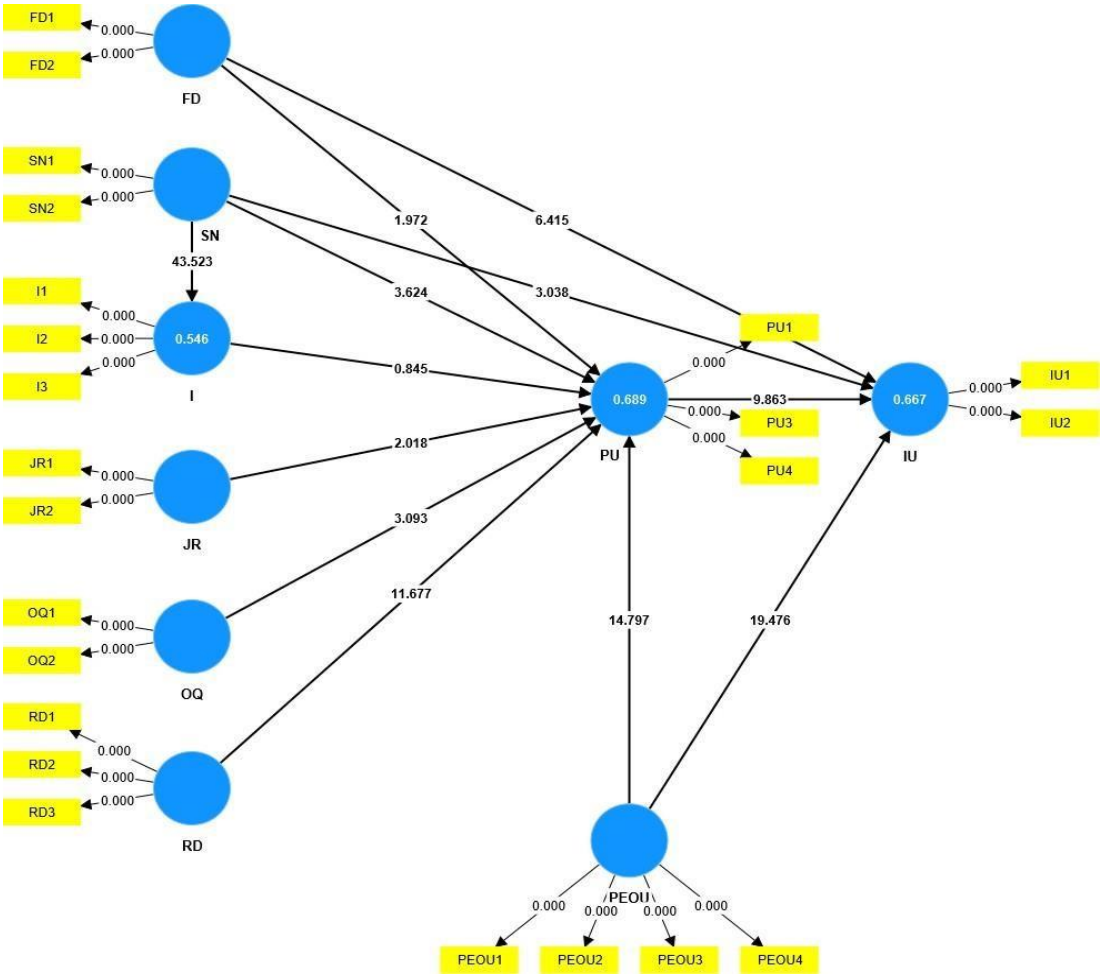

Figure 3. Test Results of Stuctural Model / Inner Model

Next, we measure the path coefficients between constructs for see the significance and strength of the relationship and also to test hypothesis. Figure 3 aboveshows an inner model (a structural model) specifies the relationship between independent and dependent variables.

Table 4. Results of the model structure / inner model

H	Relationship	path	t-values	p Values	decission
H1	Subjective Norm → Intension to Use	-0.054	3.038*	0	Accepted
H2	Subjective norm → Perceived Usefulness	0.12	3.624*	0.049	Accepted
H3	Subjective norm → Image	0.739	43.523*	0.398	Accepted
H4	Image → Perceived Usefulness	0.025	0.845	0.044	Rejected
H5	Job Relevance → Perceived Usefulness	0.058	2.018**	0.002	Accepted
H6	Output Quality → Perceived Usefulness	-0.075	3.093*	0	Accepted
H7	Result Demonstrability → Perceived Usefulness	0.364	11.677*	0	Accepted
H8	Perceived Usefulness → intention to use	0.322	9.863*	0	Accepted
H9	Perceived Ease Of Use → intention to use	0.565	19.476*	0	Accepted
H10	Perceived Ease Of Use → Perceived Usefulness	0.476	14.797*	0	Accepted
H11	Faktor Demografi → Intention to Use	0.109	6.415*	0.002	Accepted
H12	Faktor Demografi → Perceived Usefulness	0.03	1.972**	0	Accepted

Notes: H: Hypothesis

* $p < 0.1$, ** $p < 0,05$

Based on Table 4 above can be interpreted as follows:

1) H1 ($\beta = -0.054$; $p < 0.01$) indicates that the relationship between the Subjective Norm variable and the Intension to Use the variable is significantly negative. Where it can be interpreted that for every 1% increase in the subjective norm, the intention to use experiences a decrease of 0.054%.
2) H2 ($\beta = 0.12$; $p < 0.01$) shows that the relationship of subjective norm variables to perceived usefulness variables is significantly positive. Where it can be interpreted that for every 1% increase in the subjective norm, perceived usefulness will increase by 0.12%.
3) H3 ($\beta = 0.739$; $p < 0.01$) indicates that the relationship of subjective norm variables to the Image is significantly positive, where it can be interpreted that for every 1% increase in the subjective norm, the Image increases by 0.739%.

4) H4 ($\beta = 0.025$; $p > 0.01$ and > 0.05) showed that the relationship of image variables to perceived usefulness variables had no significant effect. This is indicated by the value of p-values which are at > 0.01 and >0.05.
5) H5 ($\beta = 0.058$; $p < 0.05$) shows that the relationship between the job relevancy variable and the perceived usefulness variable has a significant positive relationship. Where it can be interpreted that for every 1% increase in job relevancy, perceived usefulness increases by 0.058%.
6) H6 ($\beta = -0.075$; $p < 0.01$) indicates that the relationship of the output quality variable to the perceived usefulness variable has a significantly negative relationship. Where it can be interpreted that for every 1% increase in output quality, perceived usefulness decreases by 0.075%.
7) H7 ($\beta = 0.364$; $p < 0.01$) indicates that the relationship between the result demonstrability variable to the perceived usefulness variable has a significant positive relationship. Where it can be interpreted that for every 1% increase in result demonstrability, perceived usefulness increases by 0.364%.
8) H8 ($\beta = 0.322$; $p < 0.01$) shows that the relationship between perceived usefulness variables to intention to use variables has a significant positive relationship where it can be interpreted that with every 1% increase in perceived usefulness, the intention to use increases by 0.322%.
9) H9 ($\beta = 0.565$; $p < 0.01$) shows that the relationship between the perceived Ease of use variable to the intention to use variable has a significant positive relationship where it can be interpreted that every 1% increase in perceived ease of use, thein intension to use increases by 0.565%.

10) H10 ($\beta = 0.476$; $p<0.01$) shows that the perceived ease of use variable has a significant positive relationship. Where it can be interpreted that for every 1% increase in perceived Ease of use, perceived usefulness increases by 0.476%.
11) H11 ($\beta = 0.109$; $p< 0.01$) shows that the relationship of demographic factor variables to the intention to use variables has a significant positive relationship where it can be interpreted that with every 1% increase in demographic factors, the tension to use experiences an increase of 0.109%.
12) H12 ($\beta = 0.03$; $p<0.05$) shows a significant positive relationship between demographic factor variables and perceived usefulness variables. Where it can be interpreted that for every 1% increase in demographic factors, perceived usefulness is 0.03%

Discussion

Based on the results of the inner model above, this study is in accordance with the previousstudies (Lai TY et al, 2008; Alshurideh M et al, 2019; Lederer AL, at al, 2000; Schubring S et al,2016; López-Bonilla LM, 2017; Tubaishat A, 2018) where the variables of demographic factors measured by the age and length of service of respondents, result from demonstrability, job relevancy, perceived Ease of use have a significant positive effect on the variable perceived usefulnessas an intervening variable, and the variable subjective norm, perceived Ease of use also has a directinfluence on the variable intension to use as a dependent variable (16–21). In this study, it was also found that Image has no influence on perceived usefulness. This is in accordance with researchconducted by Khasawneh (2015), the sudy about a mobile banking adoption model in the Jordanianmarket. It is stated that social privacy risks do not affect technology use (22). It was also mentioned by Doo MY (2023) in the study “An investigation of the social influence processes of

flipped class students" that Image negatively affected perceived usefulness but they were not statistically significant (23).

Next, we discovered an unexpected significant negative effect of subjective norm on intention to use. Where it can be interpreted that for every 1% increase in the subjective norm, theintention to use experiences a decrease of 0.054%. This depicts that the subject's perception that most people who are important to him think he should engage in the application even lower the intention to use the application. Descriptive statistics show high values for subjective norms and intention to use, but Subjects have no intention to use the application when these two variables arelinked. This is very closely related to the results of the relationship of subjective norms to perceivedusefulness, in which subjects believe that application use is still perceived as less useful. This is anew discovery in TAM2 model research. Previous study conducted by Biucky ST (2017) showedsocial risks have no noticeable effect on commerce adoption (24). It was also mentioned by Pratama RW (2020) and Ho SM (2017) that subjective norm variables as moderate variables haveno influence on technology use (25,26). However, research conducted by Doo MY (2023) in thestudy "An investigation of the social influence processes of flipped class students" stated that subjective norm had a significant influence on perceived usefulness and intention to register (23).Another study by AL-Nawafleh EA (2019) demonstrates that subjective norm positively affectedtheir intention toward Jordanian telecommunication companies patronization (27). Zhuang X (2021) also explains that there are strong positive interactions between subjective norms of augmented reality technology and tourists' intention to use this technology(28).

In this study, output quality also has a negative influence on perceived usefulness, where an increase in perception of how well a system works can be interpreted as a decrease in perceivedusefulness. It is contrast to study conducted by Zobeidi T (2023), which stated that output quality

and Internet self-efficacy indirectly affected attitude and intention (29). A study by Nguyen XA (2021) postulated that OQ has a significant positive impact on perceived usefulness (30). Differ from previous studies, the respondents believe that using applications actually slows down their performance, makes them less productive, makes them less efficient, and makes them less useful for work. This is consistent with application usage data, which is still low. This is due to a lack ofsocialization and training on how to use the application, which makes the job less easy and more tedious.

Our findings have some practical implications that can explain how hospital managementimproves the successful implementation of an application or technology. Hospitals should conductregular training activities and providing knowledge about system functionalities and possible changes to work routines. This requires an early communication strategy to convince users of the benefits of the application. Subjective norms are essential because of their indirect impact on image and perceived usefulness, and their direct impact on intention to use the application. Management should be actively involved in implementation.

Our study also has many limitations. The application used is only available at the Haji Hospital where this study was conducted, so the number of subjects using the application is limited.The limitations of the indicators used in measuring these two variables make the possibility of negative influences occurring so that these two things become interesting to become the next research topic. Additionally, our study may have a gender bias due to the relatively many female nurses. Women-men's perceptions of overload are different, and that affects IT Ability to innovatebetween men and women. Further research need to investigate whether there are significant genderdifferences present in our model.

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Notes

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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