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Analysis Of Service Quality and User Acceptance of BMKG Info Application Using EgovQual Model and Technology Acceptance Model (TAM) In Central Java

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ABSTRACT

This study examines the service quality and user acceptance of the Info BMKG application in Central Java. We use a framework that combines the e-GovQual model and the Technology Acceptance Model (TAM). The Info BMKG application, developed by the Meteorology, Climatology, and Geophysics Agency (BMKG), aims to provide the public with quick and accurate access to critical weather and disaster information. Despite its wide adoption, previous research indicates challenges, such as delays in earthquake notifications, which could affect the application's effectiveness. Using a quantitative approach, we surveyed 239 Info BMKG users. Data was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings show that the measurement model is highly reliable and valid, with all constructs and questionnaire items demonstrating strong convergent (AVE value > 0.50 and loading factor > 0.70) and discriminant validity, as well as reliability (Cronbach's Alpha and Composite Reliability values > 0.70). The majority of the hypothesized relationships (seven out of nine) were statistically significant. Specifically, Perceived Ease of Use (PEOU) significantly influenced both Behavioral Intention to Use (BIU) and Perceived Usefulness (PU). Perceived Usefulness (PU) also significantly impacted Behavioral Intention to Use (BIU). Furthermore, Behavioral Intention to Use (BIU) was found to significantly affect Actual System Use (ATU). In the context of user satisfaction (SAT), Reliability (REL) and Citizen Support (SUP) have a significant positive influence on satisfaction. Finally, Actual System Use (ATU) also significantly influences Satisfaction (SAT). However, the direct influence of Efficiency (EFF) and Trust (TRU) on Satisfaction (SAT) was not statistically significant. These results generally support the conceptual model and offer valuable insights for enhancing digital public services.

1. Introduction

This Advances in information technology have brought significant changes to the provision of public services, including in the fields of meteorology and disaster management. The Meteorology, Climatology, and Geophysics Agency (BMKG), as a government agency tasked with providing weather and disaster information, has developed the Info BMKG application to facilitate fast and accurate public access to information. This application is crucial in providing early warnings of disasters such as earthquakes and extreme weather, which can assist the public in disaster risk mitigation [1].

Although the BMKG Info application has been widely used, several studies have shown that there are obstacles, especially related to delays in earthquake notifications which have the potential to reduce the application's effectiveness in providing critical information real-time [1]. In addition, user acceptance of an application is greatly influenced by perceived service quality and perceived ease and usefulness of the technology used [2]. From a sentiment analysis of user reviews of the BMKG Info application onGoogle Play Store In Indonesia, the results showed that 518 data had positive sentiment and 276 data had negative sentiment [3].

The e-GovQual model is an effective measurement tool for assessing the quality of e-Government services by examining dimensions such as ease of use, reliability, trust worthiness, information content, and user support [4]. Meanwhile,Technology Acceptance Model (TAM) has been widely used to analyze factors that influence technology acceptance by users, especially perceived usefulness and ease of use which influence usage intentions and behavior [5].

Various previous studies have shown that high service quality and positive perceptions of technology can increase satisfaction and intention to use the application e-Government [6]. Furthermore, digital literacy and accessibility are also important factors in the successful adoption of public digital services [7].

Based on this, this study aims to analyze the service quality of the BMKG Info application using a model e-GovQualand examine user acceptance based on TAM. This study is expected to provide a comprehensive overview of the factors influencing satisfaction and intention to use the BMKG Info application, thereby providing strategic recommendations to improve service quality and user acceptance. This research can serve as a reference for other government agencies seeking to develop or evaluate information technology-based public services. The service quality and user acceptance measurement models used can be adapted to improve the quality of e-Government services in general [8].

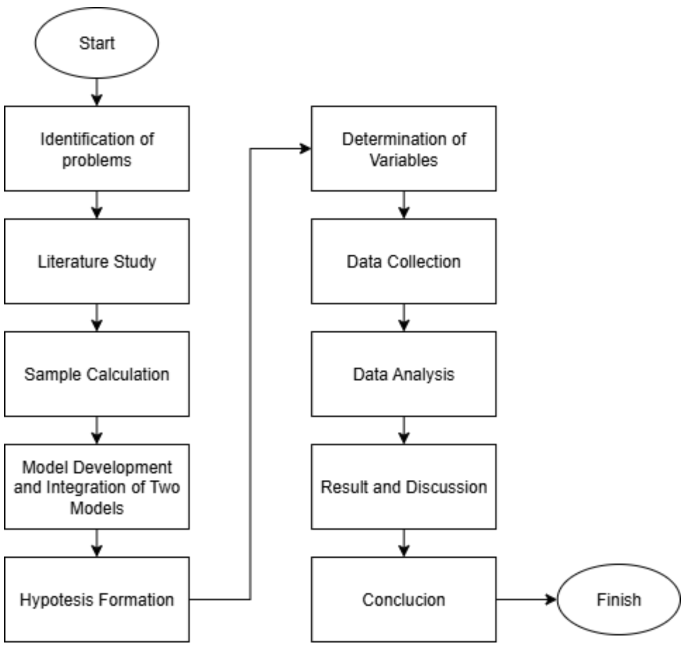

Figure 1. Research Stages

Extensive research on e-government service evaluation and technology acceptance has been conducted using various modeling approaches, including eGovQual and the Technology Acceptance Model (TAM). The eGovQual model is used to measure e-government service quality based on dimensions such as efficiency, reliability, trust, and citizen support [3]. Meanwhile, the TAM is used to analyze factors influencing public acceptance and use of technology, such as perceived usefulness, perceived ease of use, attitude, and intention to use [9].

2. Method

2.1. Research Flow

This research uses quantitative methods. The research stages to be implemented are shown in Figure 1. This figure illustrates a structured quantitative research flow, starting with problem identification, followed by a literature review to establish a theoretical foundation, and a sample calculation to determine respondents. Next, the research involved developing and integrating two models (e-GovQual and TAM) to formulate hypotheses and determine research variables. After methodological preparation, data were collected through a questionnaire and then statistically analyzed using validity and reliability tests, and SEM. The final stage involved presenting the analysis of the results in a discussion, concluding with conclusions and recommendations based on the research findings.

2.2 Conceptual Model of e-GovQual and TAM Development

This research conceptual model combines the eGovQual and Technology Acceptance Model (TAM) approaches to analyze the acceptance and quality of BMKG information services by users eGovQual, such as efficiency, trust, reliability, citizen support, ease of use, and information content and presentation, are used to measure service quality and government provided [10]. The results of this service quality measurement then influence user perceptions of usability (perceived usefulness) and ease of use (perceived ease of use) services, which are part of the TAM model. These two main TAM factors then encourage the emergence of intention to use (behavioral intention to use) and the actual system (actual system use) BMKG information services by users. The system actually uses these services, ultimately leading to user satisfaction and an incentive to reuse the service in the future [11]. Thus, this model comprehensively assesses service quality from a technical and user experience perspective, as well as psychological factors influencing the adoption of BMKG information technology. The conceptual model of this research can be described as follows:

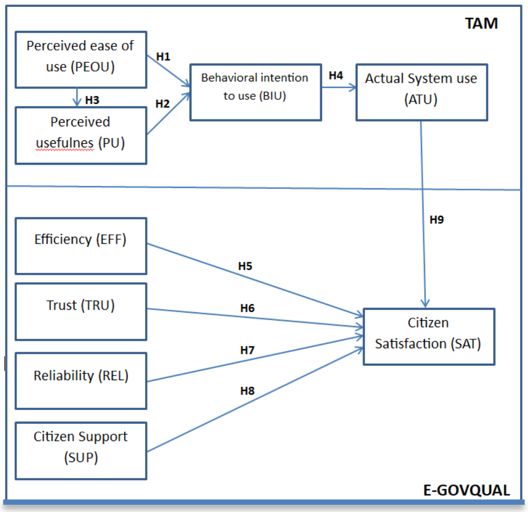

Figure 2. Conceptual Model of e-GovQual and TAM Development

This study conducted nine hypotheses to be tested, namely:

H1: Perceived Ease of Use Influences Intention to Use

H2: Perceived Usefulness Influences Intention to Use

H3: Perceived Ease of Use Influences Perceived Usefulness

H4: Intention to Use Influences the System in Actual

H5: Efficiency Affects Citizen Satisfaction

H6: Trust Affects Citizen Satisfaction

H7: Reliability Affects Citizen Satisfaction

H8: Citizen Support Affects Citizen Satisfaction

H9: The System Actually Affects Citizen Satisfaction

Based on the figures and hypotheses, this study will test an integrated conceptual model that combines the e-GovQual framework and the Technology Acceptance Model (TAM). In this model, there are two main influence paths, namely the TAM path that tests user acceptance, where Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are hypothesized to influence Intention to Use (BIU). Intention to Use (BIU) is then tested for its influence on Actual System Use (ATU), next is the e-GovQual path that directly tests the influence of service quality dimensions such as Efficiency (EFF), Trust (TRU), Reliability (REL), and Citizen Support (CSR) on Citizen Satisfaction (SAT). In addition, this model also tests the relationship that bridges the two frameworks, namely the influence of Actual System Use (ATU) on Citizen Satisfaction (SAT).

2.3 Research Approach

This study used a quantitative approach with a survey method to collect data on user perceptions and expectations regarding BMKG information services. This approach was chosen because it can objectively measure the level of technology acceptance and the quality of e-government services provided by BMKG [12].

2.4 Data Types and Sources

The types and sources of data used in this study consist of two main types: primary data and secondary data. Primary data were obtained directly from users of BMKG information services through a questionnaire distributed to respondents, both the general public and BMKG employees who actively use the service. This questionnaire aims to collect user perceptions, expectations, and experiences regarding the quality of BMKG information services and acceptance of the technology used. In addition, secondary data also serves as the main support in this study, sourced from official documents, reports, BMKG publications, and open data available on the official BMKG website. This secondary data contains information about Publicly accessible performance, policy, and statistics on information services are used to strengthen analysis and validate research findings. The combination of these two types of data is expected to provide a comprehensive and accurate picture of the implementation of BMKG information services.

2.5 Research Instrumentation

The research instrument used in this study is a questionnaire specifically designed to measure the perceptions and expectations of BMKG information service users. This questionnaire is compiled based on e-government service quality indicators according to the eGovQual model, such as efficiency, trust, reliability, citizen support, and security, as well as technology acceptance indicators according to the Technology Acceptance Model (TAM), which include perceived usefulness, ease of use, and intention to use the service. Each question in the questionnaire uses a Likert scale so that respondents can objectively assess their level of perception and expectations. In addition to the main instrument, the questionnaire, this study may also involve short interviews to gain a deeper understanding of the survey results, especially regarding certain aspects that require additional explanation from respondents. Thus, this research instrument is expected to be able to collect valid and reliable data to support a comprehensive analysis of the quality of BMKG information services [13].

2.6 Data Collection and Analysis Techniques

The data collection techniques in this study were conducted through several main stages. Primary data were collected by distributing questionnaires to users of BMKG information services, both the general public and employees, to obtain their perceptions and expectations regarding service quality and acceptance of the information technology used. Furthermore, brief interviews were conducted with some respondents to gain a deeper understanding of the survey results. Secondary data were obtained from official documents, reports, and BMKG publications relevant to the research topic [14].

Data analysis in this study uses a combination of the eGovQual and TAM (methods)Technology Acceptance Model) to obtain a comprehensive picture of the quality of BMKG information services and user acceptance of technology. Using the eGovQual method, researchers can measure the level of user satisfaction with service attributes such as efficiency, trust, reliability, citizen support, and security. Meanwhile, the TAM model is used to analyze factors influencing technology adoption, namely perceived usefulness (perceived usefulness), ease of use (perceived ease of use), intent to use (behavioral intention) and the actual system (actual system use) [15].

In the analysis process, data obtained from the questionnaire were statistically processed to identify the gap between user expectations and perceptions of BMKG services using gap analysis (eGovQual). Further analysis was conducted using the TAM model, where the relationship between variables such as perceived usefulness, ease of use, and intention to use the service was tested using regression analysis or SEM-PLS. The combination of these two methods allows researchers to determine not only service quality but also psychological and technical factors that influence the acceptance of BMKG information technology by users. Thus, the research results can provide more holistic and empirically evidence-based recommendations [16].

This study tested the BMKG's service quality measurement model in the form of a reflective model with several stages, including: First, testing composite reliability to assess internal consistency. Second, testing the reliability of each indicator. Third, calculating the average variance extracted (AVE) value to assess convergent validity. Finally, calculating the Fornell-Larcker criterion and cross-loading to test discriminant validity.

The first criterion evaluated is internal consistency reliability. The appropriate measure for internal consistency reliability is composite reliability. A good composite reliability value is in the range of 0.7–0.9. However, a value above 0.95 is considered undesirable because it indicates that the indicators in the latent variable are measuring the same phenomenon and may therefore not be a valid measure of the latent variable [17].

The next step is to conduct a discriminant validity test. The method used to test discriminant validity is to test the cross-loading of the indicators and use the Fornell-Larcker criterion. The test using cross-loading is met if the cross-loading value on the indicators in a latent variable is very large compared to the cross-loading on other latent variables. Meanwhile, the test using Fornell-Larcker, the criterion is met if the square root of the AVE value on each latent variable is greater than the highest correlation with other latent variables [3].

2.7 Structural Model Evaluation

The first step that must be taken is to conduct a collinearity test on the structural model. In conducting the collinearity test, the values used are the valuesVariance Inflation Factor (VIF). If the VIF value is above 5.00 for the latent predictor variable, then collinearity is indicated [18]. Based on the results of the collinearity test, it was found that the VIF value for all latent predictor variables was below 5.00. This result indicates that the path model does not indicate collinearity.

The next test is the significance and relevance test of the structural model relationships. This test uses path coefficients, where the path coefficient value ranges from -1 to +1. When the estimated path coefficient approaches +1, it indicates a strong positive relationship (and this also applies to negative values) that is statistically significant [19]. The significance level used in this study is 5%, so the t value is 1.96.

The next step is to use the T-statistic and P-values for significance testing. The t-statistic is 1.96 and the p-value is 0.05 (significance level = 5%). If the t-statistic is >1.96 and the p-value is <0.05, the hypothesis is considered significant, and vice versa [20].

3. Results and Discussion

3.1. Data Collection

Data were obtained from a questionnaire distributed to respondents online using Google Forms. Of the questionnaires distributed, 239 respondents completed the questionnaire, divided into three categories: gender, age, and education.

Table 1. respondent data

Respondent Data	Category	Amount	Percentage
Gender	Man	183	76 %
	Woman	56	24 %
Age	< 30 Years	20	8 %
	31 – 40 Years	37	15 %
	41 – 50 Years	87	36 %
	51 – 60 Years	88	37 %
	>61 Years	7	4 %
Education	Bachelor/Postgraduate	90	38 %
	Diploma	21	9 %
	High School	109	45 %
	Junior High School	19	8 %

Based on Table 1 regarding Respondent Data, it can be explained that this study involved 239 respondents. Of this number, the majority of respondents were male, namely 183 people or 76%. Meanwhile, female respondents numbered 56 people or 24%. Judging by age category, respondents were dominated by the 51–60 years age group (37%) and 41–50 years (36%). For the education category, the majority of respondents had a high school education level, namely 109 people or 45%. The second highest education group was Bachelor/Postgraduate with a total of 90 people or 38%.

After data collection, data processing is carried out by applying SEM-PLS with the SmartPLS 4 tool. In this stage, an assessment is carried out.outer model (measurement model), assessmentinner model (structural model) and hypothesis testing.

3.2. Measurement Model

3.2.1 Outer Model (Measurement Model Evaluation)

This assessment aims to determine the relationship between each indicator and the latency variable. The outer model is assessed using convergent and discriminant validity, composite reliability, and Cronbach's alpha.

Based on table 2 Outer Model The above shows that of the various constructs tested, such as ATU, BIU, EFF, PEOU, PU, REL, SAT, SUP, and TRU, all have a valueCronbach's Alpha more than 0.70, with most exceeding 0.80 or 0.90, this indicates good to very good reliability. This consistency is also seen in the valuesComposite Reliability all of which are well above 0.70, with most approaching or exceeding 0.90, confirming that the measurement of the construct is highly internally stable.

Table 2. Outer Model (Measurement Model Evaluation)

	Cronbach's alpha	Composite reliability
ATU	0.777	0.777
BIU	0.785	0.788
EFF	0.926	0.927
PEOU	0.923	0.925
PU	0.890	0.894
REL	0.928	0.929
SAT	0.883	0.884
SUP	0.937	0.939
TRU	0.911	0.911

3.2.2 Convergent Validity

According to the Rules, to meet convergent validity, the factor loading value must be above 0.7.

Table 3. Outer Model (Measurement Model Evaluation)

Variables	ATU	BIU	EFF	PEOU	COU	REL	SAT	SUP	TRU
ATU1	0.810								
ATU2	0.839								
ATU3	0.846								
BIU1		0.803							
BIU2		0.893							
BIU3		0.813							
EFF1			0.883						
EFF2			0.912						
EFF3			0.906						
EFF4			0.916						
PEOU1				0.805					
PEOU2				0.859					
PEOU3				0.906					
PEOU4				0.919					
PEOU5				0.880					
PU1					0.815				
PU2					0.891				

PU3					0.836				
PU4					0.849				
PU5					0.775				
REL1						0.927			
REL2						0.906			
REL3						0.924			
REL4						0.869			
SAT1							0.920		
SAT2							0.882		
SAT3							0.899		
SUP1								0.922	
SUP2								0.907	
SUP3								0.914	

The table includes the factor loading values for each questionnaire item on its respective latent construct, which is an important indicator in evaluating the convergent validity of this measurement model. This factor loading assesses how strongly each question item relates to the construct it is supposed to measure, with higher values indicating a better indicator of that construct. In research practice, factor loading values above 0.70 are generally considered very good, indicating that the item has a significant contribution to the construct.

Based on the results presented, it can be concluded that each item within each construct has a very high factor loading value. Nearly all values are well above the 0.70 threshold, with a significant number exceeding 0.80 or even 0.90. This indicates that each question in the questionnaire accurately and consistently assesses the construct it is intended to measure. This consistency and strength of the relationship between elements and constructs provide very convincing evidence for convergent validity at the item level, confirming that the measurement instrument successfully captured the expected latent dimensions accurately. Therefore, overall, the measurement quality in this study can be considered very satisfactory.

3.2.3 Validation Discriminant Test

Validation discriminants are obtained from the cross-loading results of the indicators. The results of each indicator should have a higher value than the results of the other indicator.cross loading others [16]

Table 4. Cross loading table

	ATU	BIU	EFF	PEOU	PU	REL	SAT	SUP	TRU
ATU1	0.810	0.666	0.626	0.635	0.642	0.575	0.653	0.506	0.552
ATU2	0.839	0.607	0.602	0.529	0.599	0.661	0.672	0.689	0.750
ATU3	0.846	0.677	0.648	0.553	0.657	0.608	0.635	0.650	0.711

BIU1	0.575	0.803	0.681	0.624	0.719	0.637	0.636	0.519	0.609
BIU2	0.659	0.893	0.722	0.686	0.731	0.698	0.707	0.588	0.640
BIU3	0.725	0.813	0.575	0.561	0.676	0.546	0.568	0.580	0.596
EFF1	0.703	0.706	0.883	0.745	0.710	0.747	0.717	0.624	0.682
EFF2	0.642	0.713	0.912	0.726	0.685	0.798	0.693	0.620	0.693
EFF3	0.680	0.706	0.906	0.722	0.699	0.764	0.702	0.602	0.687
EFF4	0.694	0.723	0.916	0.740	0.728	0.789	0.757	0.602	0.724
PEOU1	0.556	0.593	0.667	0.805	0.653	0.654	0.646	0.505	0.580
PEOU2	0.592	0.632	0.650	0.859	0.717	0.628	0.577	0.516	0.534
PEOU3	0.589	0.667	0.731	0.906	0.706	0.711	0.685	0.576	0.574
PEOU4	0.614	0.693	0.765	0.919	0.717	0.743	0.686	0.566	0.602
PEOU5	0.659	0.669	0.729	0.880	0.710	0.705	0.660	0.549	0.626
PU1	0.577	0.676	0.690	0.735	0.815	0.700	0.711	0.575	0.592
PU2	0.662	0.729	0.691	0.696	0.891	0.671	0.679	0.585	0.554
PU3	0.660	0.764	0.735	0.726	0.836	0.715	0.714	0.556	0.612
PU4	0.610	0.694	0.604	0.635	0.849	0.569	0.610	0.556	0.535
PU5	0.670	0.657	0.510	0.528	0.775	0.553	0.612	0.610	0.551
REL1	0.679	0.707	0.798	0.733	0.703	0.927	0.803	0.663	0.757
REL2	0.646	0.671	0.793	0.717	0.697	0.906	0.778	0.686	0.699
REL3	0.660	0.669	0.812	0.739	0.720	0.924	0.816	0.667	0.714
REL4	0.695	0.669	0.701	0.666	0.687	0.869	0.768	0.753	0.778
SAT1	0.706	0.715	0.748	0.695	0.735	0.805	0.920	0.688	0.693
SAT2	0.720	0.664	0.659	0.614	0.672	0.767	0.882	0.751	0.755
SAT3	0.696	0.676	0.736	0.702	0.755	0.786	0.899	0.658	0.692

SUP1	0.695	0.597	0.635	0.584	0.646	0.712	0.743	0.922	0.755

Table 4 shows the factor loading values for each questionnaire item on its respective latent construct. Factor loading is a statistical measure that describes the strength of the relationship between a question item and the construct it is intended to measure; the higher the loading value, the better the item represents the construct. In the context of assessing measurement models, factor loading values are crucial for evaluating convergent validity at the item level. In general, a factor loading value of 0.70 or higher is considered a strong indicator that the item effectively measures the intended construct.

The table above shows that each item in each construct, from ATU (Actual System) to TRU (Trust), shows a very satisfactory factor loading value. Almost all values are well above the 0.70 limit, with many even exceeding 0.80 or 0.90. For example, items such as PEOU3 (0.906), PEOU4 (0.919), EFF2 (0.912), and SUP4 (0.925) show a very close relationship with their respective constructs. This consistent and strong relationship between each item and the constructs it measures convincingly demonstrate that the measurement instrument has excellent convergent validity at the item level. This indicates that the items in the questionnaire are effective in capturing the underlying dimensions (constructs) accurately and reliably, thus providing a strong basis for further data analysis in the study.

3.3 Hypothesis Testing

Hypothesis testing is conducted using bootstrapping. This test is conducted to determine or prove whether the research hypothesis is accepted or rejected by observing the correlation between variables.

Table 5. *Path Coefficient*

Hypothesis	**HYPOTHESIS TESTING**			
	Path Coefficient	**T statistics**	**P values**	**Information**
ATU -> SAT	0.226	3.498	0.000	Positive and
BIU -> ATU	0.782	24.033	0.000	Positive and
EFF -> SAT	0.053	0.661	0.509	No significant
PEOU -> BIU	0.187	2.677	0.007	Positive and
PEOU -> PU	0.802	23.247	0.000	Positive and
PU -> BIU	0.696	10.247	0.000	Positive and
REL -> SAT	0.524	6.068	0.000	Positive and
SUP -> SAT	0.159	2.197	0.028	Positive and
TRU -> SAT	0.019	0.248	0.804	No significant

Based on Table 5, it can be seen that of the nine existing hypotheses, most show statistical support, while two hypotheses are not proven significant. Seven of the nine hypotheses show a significant and positive impact, as evidenced by p-values below 0.05 (most are 0.000) and absolute t-statistics greater than 1.96. This indicates that the hypothesized relationship is robust and did not occur by chance. Specifically, Perceived Ease of Use (PEOU) is proven to have a positive and significant influence onBehavioral Intention to Use (BIU) and Perceived Usefulness (PU). In the same way, Perceived Usefulness (PU) has a significant impact on Behavioral Intention to Use (BIU).

Next,Behavioral Intention to Use (BIU) has been shown to have a significant influence onActual System Use (ATU). In addition, in the context of user satisfaction (Citizen Satisfaction - SAT), it was found thatReliability (REL) and Citizen Support (SUP) provides a significant positive influence on satisfaction. Finally, Actual System Use (ATU) also significantly influences Citizen Satisfaction (SAT), shows that the actual level of system usage that occurs relative to usage contributes greatly to final satisfaction.

However, there are two hypotheses that are not statistically supported by the data. The influence Efficiency (EFF) against Citizen Satisfaction (SAT) did not show significance, as seen from the p-value of 0.509 and t-statistic of 0.661, which did not exceed the established significance limit. A similar phenomenon was seen in the impact of Trust (TRU) againstCitizen Satisfaction (SAT), where the high p-value (0.804) and low t-statistic (0.248) indicate that this relationship is also not statistically significant. This indicates that users' self-confidence in their abilities (Efficiency) and the level of confidence they have (Trust) may not directly influence their satisfaction as previously hypothesized.

This phenomenon suggests that in the context of the BMKG Info application, where information is crucial, users prioritize visibility and support over access speed or more technical aspects of trust, particularly in relation to overall satisfaction. This also aligns with previous research on earthquake notification delays, where trust did not directly impact user satisfaction. Although Efficiency (EFF) and Trustworthiness (TRU) do not directly influence satisfaction, the Reliability (REL) and Citizen Support (CSR) dimensions prove crucial. Thus, this study provides a holistic picture that improvements in service quality (especially reliability and support) and a positive user experience will effectively increase user satisfaction of the BMKG Info application.

4. Conclusion

Based on the results of the SEM-PLS analysis, this study concludes that measurement model (outer model) shows very good quality; all The constructs and questionnaire items were proven to be convergently valid (AVE value >0.50) and loading factor > 0.70) and discriminant, and also reliable (Cronbach's value Alpha and Composite Reliability >0.70). Furthermore, in hypothesis testing (inner model), the majority of the proposed relationships received support statistically significant, where seven of the nine hypotheses were proven to have positive and significant impact. However, two hypotheses that test the impact Efficiency (EFF) towards Satisfaction (SAT) and Trust (TRU) towards Satisfaction (SAT) proved to be insignificant. In general, these results indicate that the research tools are strong and most of the relationships between variables in conceptual model is empirically supported. A similar phenomenon is seen in the impact of Trust (TRU) on Satisfaction (SAT), where the high p-value (0.804) and low t-statistic (0.248) indicate that this relationship is also not statistically significant.

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