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Evaluation of the Effectiveness of P-SIGN Digital Signature Application Using Technology Acceptance Model (TAM) Approach at PT Pertamina Patra Niaga Regional South Sumatra

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Abstract: This study analyzes how employees at PT Pertamina Patra Niaga Sumbagsel accept and use the P-SIGN digital signature platform through Technology Acceptance Model (TAM) analysis. Results show that P-SIGN usage aligns with Pertamina's digital transformation goals while supporting environmental initiatives by decreasing paper and ink consumption. Validity testing across variables X1, X2, X3, and Y1 confirmed all items as valid, with calculated r-values surpassing the table r-value (0.273). Reliability assessment yielded a Cronbach's Alpha of 0.821, demonstrating strong measurement consistency. The normality test produced an L-value of 0.220, exceeding the 0.05 significance threshold, verifying normal data distribution. While users generally responded favorably to P-SIGN, insufficient training created knowledge gaps about application features among certain staff members, potentially affecting their perception of usability. The study suggests strengthening internal education programs to maximize technology adoption rates across the organization.

Keywords: P-SIGN; TAM; Digital Signature; Perceived Ease of Use; Digitalization; Pertamina.

1. Introduction

Digital transformation in the corporate sector has become essential as information and communication technologies advance rapidly. Companies now adopt digital solutions across various business operations to boost efficiency, cut costs, and speed up decision-making. Document management and approval workflows represent key areas where digitalization offers substantial benefits. Digital signature applications provide practical alternatives to manual signing processes, which often consume excessive time and create security vulnerabilities. By implementing digital signatures, organizations can execute document approvals more quickly and securely while maintaining proper records, strengthening operational reliability [1].

As a PT Pertamina (Persero) subsidiary engaged in energy trade and distribution, PT Pertamina Patra Niaga Sumbagsel fulfills a strategic role in supporting national energy security throughout southern Sumatra. To enhance service quality and accelerate both internal and external business processes, the company

continuously strengthens its digital capabilities. The P-Sign digital signature application represents a concrete example of these efforts. P-Sign facilitates various administrative tasks, from internal document approvals and partnership agreements to external business contracts. The application aims to speed up business processes, make better use of resources, reduce printing-related costs, and improve data accuracy and security. Additionally, the initiative supports the "*Green Office*" program by promoting paper reduction practices.

However, implementing new technology rarely proceeds smoothly. Success depends not only on system quality but also on user acceptance and perception. The Technology Acceptance Model (TAM) offers a framework to understand and measure factors affecting technology adoption, focusing on perceived usefulness (the belief that using technology enhances job performance) and perceived ease of use (the belief that using technology requires minimal effort) as primary determinants of user acceptance (Davis, in Jannah & Widodo, 2022) [2][3]. Therefore, evaluating P-Sign implementation at PT Pertamina Patra Niaga Sumbagsel through the TAM approach becomes a necessary step to assess how well employees accept and use the application.

Understanding the factors influencing P-Sign effectiveness benefits not only its adoption but also serves as a reference for strategic planning in the company's broader information technology development. Previous studies show that acceptance of new technologies within organizations depends significantly on supporting factors like system quality, management technical support, adequate user training, and integration with existing business processes [4]. A TAM-based evaluation will help PT Pertamina Patra Niaga Sumbagsel identify current barriers and determine needed improvements to ensure P-Sign supports ongoing digital transformation, enhances employee productivity, and strengthens the company's competitive position in the digital era.

2. Related Work

2.1 Effectiveness

Effectiveness refers to the extent to which an organization achieves its goals and objectives. According to Beni (2019) in Krisdayanti (2022), it represents the relationship between performance and targets, showing how well organizational procedures, policies, and actions meet their intended results [5][6]. Mardiasmo (2017) in Yulitiawati and Rusmidarti (2021) notes that an organization is effective when it successfully meets its goals, and the effectiveness indicators reveal how outputs contribute to achieving those goals [7][8]. Similarly, Mahmudi (2010) in Nazar, Tinangon, and Lambey (2016) defines effectiveness as the connection between outcomes and intended objectives, noting that a process is effective when it produces the desired policy goals [9][10]. In sum, effectiveness serves as a key measure of organizational success and reflects how well planned objectives have been achieved relative to the efforts and resources used.

2.2 Evaluation

Evaluation involves assessing, measuring, and comparing actual results with planned objectives to improve future performance. It ensures activities align with initial plans and helps identify program success or failure. Evaluation serves various purposes, including improving program quality, assessing performance, and providing accountability. According to Crawford & Benedetto (2000), evaluation has four main objectives: (a) determining whether intended goals have been achieved, (b) providing an objective assessment of results, (c) evaluating capability and ensuring feasibility, and (d) gathering constructive feedback from conducted activities [11]. Ultimately, evaluation remains vital for organizational learning and ongoing improvement.

2.3 P-Sign Application

The P-Sign application enhances efficiency and security in digital document signing. Users upload PDF files and apply digital signatures that replace traditional handwritten ones. This method follows established electronic security standards, ensuring document authenticity and integrity. Digital signatures' role in protecting document integrity builds on advances in cryptographic methods, particularly elliptic curve cryptography, which creates a solid foundation for secure digital signatures [12][13]. The application offers three distinct signing methods for different user needs. Personal Sign allows individual users to apply their own digital signatures for personal documentation. Parallel Sign enables multiple users to sign documents simultaneously without a specific order, benefiting scenarios requiring rapid approvals and streamlining administrative workflows. Serial Sign requires users to sign documents in a predetermined sequence, an approach that works well for processes needing sequential approval, creating organized and traceable document handling. These signing methods save time and reduce paper dependency, aligning with growing digital transformation across various sectors. The legal validity of digital signatures means they stand up to scrutiny in legal settings, playing a key role in commercial and administrative operations. This matters especially as organizations maintain compliance with regulatory standards for document handling. P-Sign

brings together digital technology and administrative efficiency, with signing methods that promote speed, convenience, legal compliance, and security, creating more effective digital documentation processes [14].

2.4 Literature Review

The literature review examines basic concepts of effectiveness, evaluation, and P-SIGN application features used for secure digital signing. The Technology Acceptance Model (TAM) framework serves as the analytical foundation to assess how users adopt technology in organizational settings. Digital signatures work as cryptographic versions of handwritten signatures, verifying signer identity and document integrity. Their adoption and legal recognition vary across jurisdictions, as seen with the Digital Signature Act in Malaysia, which has faced questions about its effectiveness in securing online transactions [16]. When analyzing technology adoption, TAM offers a practical framework, suggesting that perceived ease of use and usefulness greatly affect how users accept new technologies [17]. Studies show that acceptance depends on users' actual experiences with features, highlighting the value of good user interface design and training in boosting adoption of digital signing tools [14]. P-SIGN features like Personal Sign, Parallel Sign, and Serial Sign address various user needs and make workflows more efficient. These functions match TAM principles, as user-friendly, beneficial applications tend to gain more acceptance [15][18]. Research also points to psychological aspects of digital signatures, where signing method and situation can affect perceived reliability and commitment [17]. By offering different signing approaches, P-SIGN meets varied organizational needs and may increase user confidence. Methods for sequential approvals create structured workflows where accountability matters, supporting TAM concepts about user comfort and effective technology use [19].

The literature review mostly describes rather than analyzes the referenced sources. Definitions come from several sources without clear connections to digital signature technology implementation, especially in studies about other organizations. As a result, readers get limited understanding of how effectiveness, evaluation, and TAM concepts apply to similar situations. The literature review would benefit from including studies on digital signature adoption in corporate or public sector organizations, particularly those using TAM. Such references would strengthen the analysis and clarify what makes this research unique compared to earlier work. Adding international references would provide global perspective and make the findings more broadly applicable.

3. Research Method

This research applies the Technology Acceptance Model (TAM) to study factors affecting technology adoption and user behavior. As Jogiyanto (2007) explains, TAM offers a theoretical basis for understanding how external variables shape users' beliefs, attitudes, and system usage behavior [26]. Davis developed the original model in 1989, including perceived ease of use, perceived usefulness, attitude toward using, behavioral intention to use, and actual system usage [31]. Perceived ease of use reflects users' belief that a technology requires minimal effort, while perceived usefulness represents their view that the technology improves job performance [22]. According to Jogiyanto (2017), these perceptions create the attitude toward using the system, which then forms behavioral intention and actual usage [27].

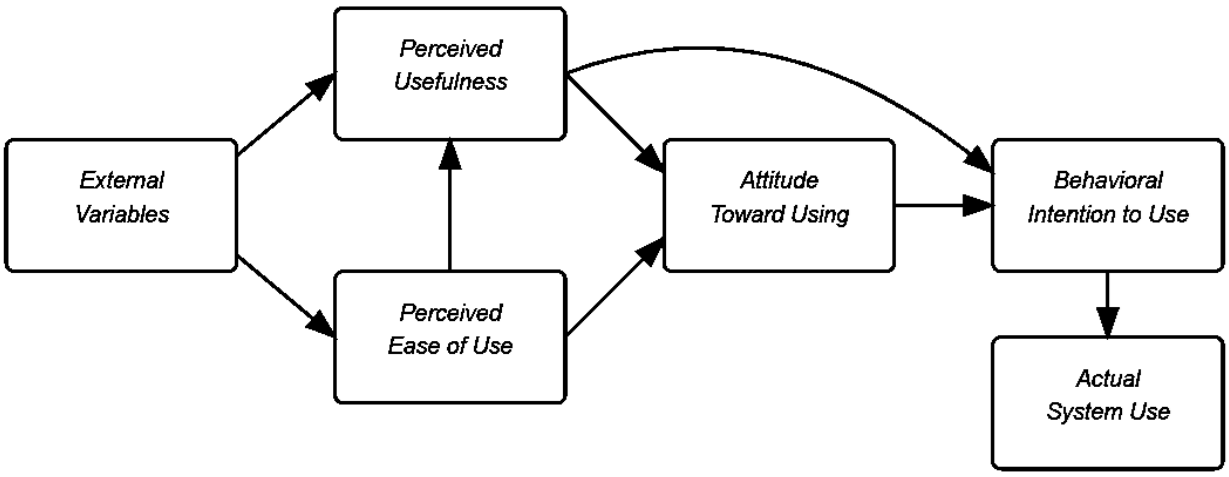

Figure 1. Technology Acceptance Model (TAM) Diagram [2]

Researchers have applied TAM across Indonesian settings, as shown by Fatmawati (2015), who analyzed information technology acceptance in various organizations [21]. We used purposive sampling to reach

employees with direct P-SIGN application experience. This approach follows Sugiyono (2019) guidance for research needing respondents with specific characteristics [32]. The sample included 30 respondents, meeting the minimum statistical validity threshold suggested by Susanto and Prabowo (2020) in their analysis of business research questionnaire reliability [33]. Selection criteria ensured participants had relevant experience with digital signature technology, reflecting the growing role of digital transformation in Indonesian organizations as described by Alamsyah (2020) in his work on transformation strategies in state-owned enterprises [20].

Data collection used a structured questionnaire based on TAM variables. Experts familiar with technology adoption frameworks reviewed the instrument for content validity, followed by pretesting with a small respondent group to address potential issues. We assessed statistical validity through item-total correlation using Pearson Product Moment, while measuring reliability via Cronbach's Alpha with a 0.70 threshold value, matching methodological standards outlined by Ghozali (2018) [23]. We distributed the questionnaire online through Google Forms with measures preventing duplicate responses and ensuring data completeness. The digital data collection method mirrors the administrative digitalization trend in organizations described by Widodo (2021) [34]. For analysis, we used SPSS software to perform several statistical techniques. These included validity and reliability testing, descriptive statistical analysis, correlation tests, and multiple linear regression analysis. The regression analysis examined relationships between independent variables (perceived usefulness and ease of use) and dependent variables (behavioral intention and actual usage), similar to the approach Guriting and Ndubisi (2006) used when evaluating customer perceptions and behavioral intentions [24]. We considered age differences in technology adoption, as identified by Morris and Venkatesh (2000), during analysis [29]. The analytical framework incorporated Handayani's (2017) TAM application in academic information systems [25], while placing findings within the broader digital transformation strategy of Indonesian organizations described by Kementerian BUMN (2022) [28]. The analysis approach allowed thorough examination of P-SIGN's effectiveness, adding to knowledge about digital signature implementation in corporate administrative processes, a topic Priyanto (2021) previously studied [30].

4. Result and Discussion

4.1 Results

4.1.1 Validity Test

The validity test measures whether a questionnaire works as intended. A questionnaire proves valid when its questions accurately assess what they aim to measure. Each question item passes validation when its calculated r value (r_{count}) exceeds the critical r value from the table (r_{table}). For this study, researchers gave questionnaires to 30 respondents, containing 15 questions total.

Table 1. Validity Test Results

Variable	r table	r calculated	Description
Perceived Usefulness			
X1.1	0.273	0.437	Valid
X1.2	0.273	0.547	Valid
X1.3	0.273	0.379	Valid
X1.4	0.273	0.562	Valid
X1.5	0.273	0.644	Valid
Perceived Ease of Use			
X2	0.273	0.613	Valid
X2.1	0.273	0.632	Valid
X2.2	0.273	0.301	Valid
X2.3	0.273	0.667	Valid
X2.4	0.273	0.623	Valid
X2.5	0.273	0.475	Valid
Attitude Toward Use			
X3	0.273	0.644	Valid
X3.1	0.273	0.632	Valid
X3.2	0.273	0.667	Valid
X3.3	0.273	0.475	Valid
X3.4	0.273	0.475	Valid
Behavioral Intention to Use			
X4	0.273	0.522	Valid

X4.1	0.273	0.379	Valid
X4.2	0.273	0.437	Valid
X4.3	0.273	0.572	Valid
X4.4	0.273	0.644	Valid
Overall System Acceptance			
Y1	0.273	0.355	Valid
Y1.1	0.273	0.412	Valid
Y1.2	0.273	0.572	Valid
Y1.3	0.273	0.522	Valid
Y1.4	0.273	0.479	Valid

The data processing yielded the r count values shown above. We determined the r table value using statistical tables with degree of freedom (df) = 29 (df = N-1, where N equals 30 respondents). All question items passed validation because each calculated r value exceeded the r table value (r count > 0.296) at a 5% significance level, meeting all validity requirements.

4.1.2 Reliability Test

The reliability test evaluates questionnaire consistency as a variable indicator. A questionnaire shows reliability when respondent answers remain stable over time. An instrument demonstrates reliability when its Cronbach's Alpha value exceeds 0.70. We obtained reliability test results through SPSS software:

Table 2. Reliability Test Results

Reference Value	Cronbach's Alpha Value	Conclusion
0.80	0.821	Reliable

The table shows Cronbach's Alpha exceeding 0.70, confirming all statement instruments as reliable. We compare the Reference Value against the Cronbach's Alpha Value to determine reliability. Reliable instruments produce consistent results even through repeated research. The reliability requirement was satisfied, as the SPSS program's Cronbach's Alpha test yielded a value greater than 0.70 (0.821 > 0.80).

4.1.3 Normality Test

The normality test determines whether residuals or error terms in a regression model follow normal distribution. Excel program output yielded:

Table 3. Normality Test Results

L Calculated	L Table	Conclusion
0.708	0.220	Normal

The calculated L value exceeds 0.220, confirming normal data distribution. The normality test result stands at 0.708 > 0.220. P-SIGN forms part of Pertamina's strategic digital transformation efforts. Using the application shows the company's dedication to innovation and adaptation to technological advances, creating a modern, efficient, and responsive work system that meets current needs. Pearson correlation tests on questionnaire data revealed that perceived ease of use positively and significantly correlates with behavioral intention to use and actual system usage. When users find the P-SIGN application easy to use, they grow more likely to use it continuously, increasing actual usage rates. Field findings confirm that most respondents found P-SIGN easy to use, even those without technical backgrounds. The straightforward navigation, remote access capability, and quick signing process without manual procedures have sped up administrative processes and cut document waiting times dramatically. The perceived ease of use correlates directly with increased work efficiency as experienced by users, reflected through:

1) Document processing time reduction from days to minutes
2) Productivity increases as time formerly spent on manual processes shifts to strategic tasks
3) Fewer administrative errors thanks to structured, automated digital systems

A high perceived ease of use affects not only application usage intention but also meaningfully improves work efficiency. The design of workplace digital systems clearly benefits from prioritizing ease of use.

4.2 Discussion

Research shows that P-Sign markedly boosts efficiency across Pertamina's signature request processes. The application offers a practical answer to administrative hurdles, letting managers request, provide, and

approve signatures digitally from anywhere with internet access. Digital signatures can cut document processing time by up to 80% while maintaining security and validity [1]. P-Sign's flexibility emerges as its chief advantage. In today's mobile work landscape, the application removes geographical and time barriers that previously slowed document approval workflows. The Technology Acceptance Model established that perceived usefulness directly shapes user attitudes toward adopting new technologies [2]. Our findings match this theory, as managers noted higher productivity when using P-Sign for tasks that once required physical presence. The application speeds decision-making through instant notifications alerting users to pending signature requests. This feature addresses a critical factor in technology acceptance within organizations - the ability to improve workflow efficiency without disrupting established processes [3]. Security features validate digital signatures while protecting document confidentiality, addressing concerns about digital signature authentication in sensitive transactions [16]. Beyond operational gains, P-Sign supports environmental sustainability by decreasing paper usage. Digital signing solutions can reduce paper consumption by 85% in organizations fully implementing such systems [14]. This aligns with Pertamina's sustainability goals and delivers measurable savings on printing supplies and physical storage.

User satisfaction with P-Sign reflects positive technology acceptance indicators - perceived ease of use paired with clear usefulness [21]. Even users with limited technical knowledge reported finding the application intuitive, supporting the assertion that interface simplicity greatly affects adoption rates for workplace technologies [22]. The link between perceived ease of use and actual system usage confirms the original TAM framework [2]. Users who found P-Sign straightforward showed higher engagement and greater willingness to incorporate it into daily workflows. This relationship appears especially strong among users previously frustrated with paper-based approval processes, as noted in similar technology implementation studies [25]. Document processing time reduction from days to minutes represents a concrete efficiency gain crucial for successful digital transformation in public organizations [34]. The shift from manual to digital processes allows staff to focus on strategic tasks rather than administrative paperwork, enhancing overall organizational performance as measured by public sector performance metrics [9].

P-Sign security architecture addresses concerns regarding document authentication in digital environments [18]. The application's audit trail ensures signature validity while guarding against unauthorized changes, building trust necessary for widespread adoption within Pertamina's operational framework. The organized document management system eliminates physical storage needs, addressing a key challenge in state-owned enterprise digital transformation - transitioning from paper archives to searchable digital repositories [20]. Users can retrieve, track, and archive documents without risk of physical damage or loss, improving information accessibility across departments. P-Sign represents a strategic part of Pertamina's digital transformation initiative, aligning with essential modernization efforts to maintain competitiveness [28]. The application demonstrates how targeted digital solutions can address specific operational pain points while boosting broader organizational efficiency. Implementation challenges persist, particularly regarding user training and system integration. Age differences can affect technology adoption rates, suggesting that customized training approaches may work better for different user demographics [29]. Additionally, ensuring consistent connectivity for remote users presents an ongoing challenge requiring infrastructure investment to fully realize P-Sign's benefits across all operational settings.

5. Conclusion and Recommendations

Research on P-SIGN usage at Pertamina shows the application delivers positive results for administrative efficiency, document approval speed, and digital transformation progress. Our research instruments demonstrated validity and reliability, with most participants expressing favorable views about the application's ease of use and benefits in their daily work. The study uncovered notable challenges affecting wider adoption. Insufficient training programs and awareness campaigns have created barriers, especially for employees with varying levels of technical ability. These findings suggest the need for a more thoughtful implementation strategy that considers diverse user backgrounds and capabilities.

Several practical recommendations emerge from our analysis. First, Pertamina should establish regular training sessions tailored to different skill levels, with special attention to employees who struggle with digital tools. Second, developing accessible reference materials would provide just-in-time support when users encounter difficulties. Third, closer collaboration between HR and IT departments would strengthen cross-functional support for technology adoption. Finally, setting up ongoing monitoring would help quickly identify and address both technical glitches and user experience problems. Looking ahead, researchers should broaden their focus to examine P-SIGN's effects across Pertamina's nationwide operations and various business units. Such research would yield valuable insights about the application's real-world impact on work efficiency throughout the organization. Any future studies should acknowledge the current research limitations, including

sample size constraints and the focus on a single operational area, to strengthen methodological approaches in subsequent investigations.

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