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Analysis of Readiness and Acceptance Levels of the 'Customer Monitoring Apps' Technology in the Heavy Equipment Industry Using the Technology Readiness and Acceptance Model (TRAM)

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Abstract. This research aims to analyze the technology readiness and technology acceptance rate of UT Connect application users in the heavy equipment industry using the Technology Readiness and Acceptance Model (TRAM) approach. The analysis was carried out through the Structural Equation Modeling – Partial Least Square (SEM–PLS) method, including testing the outer model, inner model, and conducting hypothesis testing to assess validity, reliability, and relationships between constructs. The results of the study showed that all constructs met the criteria for validity and reliability. In terms of technological readiness, Optimism has a significant effect on Perceived Usefulness, while Innovativeness, Discomfort, and Insecurity have no effect on either Perceived Usefulness or Perceived Ease of Use. These findings indicate that users have a good level of readiness to embrace digital innovations, even though negative factors do not have a significant influence. Regarding technology acceptance, the variables Perceived Enjoyment, Technology Self-Efficacy, Perceived Ease of Use, and Perceived Usefulness have a significant influence on user attitudes (Attitude Toward Using) and actual usage behavior (Actual Usage). The relationship between Perceived Ease of Use and Perceived Usefulness was also found to be strong, and users' positive attitudes have an effect on their use of the application. The findings of this study provide empirical evidence that the TRAM model can explain the factors influencing the acceptance and use of digital applications and can serve as a basis for enhancing the effectiveness of UT Connect implementation.

Keywords: technology readiness, technology acceptance model, tram, technology acceptance, ut connect, heavy equipment industry.

INTRODUCTION

The heavy equipment industry plays a strategic role in infrastructure, construction, and mining activities, which are sectors forming the backbone of economic development in many countries, including Indonesia. The modernization of construction activities and major projects is driving the demand for reliable equipment and more efficient asset management. This condition requires heavy equipment providers to improve after-sales services, optimize unit usage, and manage spare parts logistics in order to reduce downtime and operational costs (Halonen, 2021; Islam, 2024; Sellitto, 2021).

To achieve this goal, many companies are turning to digital solutions such as remote monitoring systems (telematics) and customer monitoring applications. Monitoring heavy equipment using digital technology has become a crucial solution for cost optimization and for improving operational efficiency in key sectors such as construction, mining, and infrastructure. In addition, it can also help resolve contract disputes and ensure that risks are minimized and benefits maximized (Moreira et al., 2025).

With the advancement of sensor technology, the Internet of Things (IoT), Big Data, and Artificial Intelligence (AI), it has become possible to collect real-time data regarding machine performance, operating conditions, and maintenance needs. This connectivity enables continuous data collection and in-depth analysis, providing valuable insights for operators and managers. These insights facilitate more accurate and data-driven decision-making, ultimately leading to improved operational efficiency. The global market for telematics in the heavy equipment segment has shown significant growth; the CAGR for global construction is expected to rise from USD 7.76 billion in 2025 to USD 20.59 billion in 2034, with a Compound

Annual Growth Rate (CAGR) of 11.5%, according to the latest report published by Global Market Insights Inc. (September 2025). (https://www.gminsights.com/industry-analysis/construction-equipment-telematics-market?utm_source=chatgpt.com) This signifies the rapid adoption of heavy equipment by the construction, agriculture, forestry, and mining sectors.

The construction heavy equipment business unit United Tractors (UT), as the sole distributor of Komatsu, UD Trucks, Scania, Bomag, and Tadano in Indonesia, also utilizes telematics technology in its platform to monitor equipment, check prices and spare parts availability, and order parts online. The platform enables business partners to obtain accurate information about the condition and performance of their machines. The customer monitoring application called UT Connect was developed specifically to facilitate digital communication between customers and UT and can be accessed via mobile phones and personal computers. This customer tracking application can be used after the machine is handed over to the customer, who then receives an ID and password to access the app. UT Connect provides a direct interface for equipment owners to access unit data, order parts, and receive service notifications, which theoretically lowers the total cost of ownership (TCO) and improves customer satisfaction (Baumann et al., n.d.; Brad et al., 2018; Olesopia, 2016; Slama et al., 2015; Sullivan et al., 2023).

Through the features in UT Connect, users can track their orders, estimate order compliance, and obtain instant information quickly. Users receive alerts about their equipment so they can plan and schedule periodic maintenance and take timely action regarding unit handling. UT Connect provides customers with monthly summaries of unit performance, alerts, and periodic service schedules for each Komatsu product in a single report that can be easily downloaded and accessed. Moreover, the system allows customers to obtain machine performance data to improve reliability and physical availability through data collection, integration, and analysis presented in easy-to-read visualizations (Abualigah, 2025; Alshehhi et al., 2023; Amalina et al., 2019; Habibzadeh et al., 2019; Scaldaferri, 2021).

According to internal data as of May 2025, the total number of users registered on the UT Connect application reached 6,579 accounts. Of these, only 548 accounts were recorded as Monthly Active Users (MAU), representing approximately 8.3% of the total. Meanwhile, the number of visitors who accessed the application page without logging in was recorded at 1,160 people, and the average number of monthly accesses from registered users over the past three years was 325 accounts.

Total Registered Customers refers to the total number of customers who have created an account and logged in to UT Connect. Meanwhile, Active Users are customers who actively use the application, with an intensity of at least once per month after logging in to UT Connect.

The analysis of usage trends presented in Figure 1.1 shows that since January 2022, there has been a significant increase in the number of users. However, after November of the same year, user growth displayed a fluctuating pattern and tended to stagnate. This phenomenon indicates a disparity between the number of registered users and those who consistently use the application. This condition emphasizes the importance of conducting empirical studies to identify factors contributing to the low level of user activity. By understanding the barriers and determinants influencing application adoption, this research is expected to make a strategic contribution to increasing the effectiveness of digital technology implementation in the heavy equipment industry.

A survey of 24 UT Connect users from the Mining (40%), Construction (30%), Agro (20%), and Forestry (10%) sectors showed that 88% of respondents were familiar with the UT Connect application, with most users accessing it more than once per month. The majority of customers (50%) have been in contact with PT United Tractors for between one and five years. Perception analysis showed an average score between 4.0 and 4.5 across usability, ease of use, positive attitude, and intention to continue using and recommending the app. These survey results indicate strong customer acceptance in adopting UT Connect.

Several previous studies have explored technology adoption using the Technology Readiness and Acceptance Model (TRAM) in various contexts. For instance, Lai and Lee (2020) integrated the Technology Readiness Index (TRI) into the Technology Acceptance Model (TAM) to explain behavior in the adoption of Building Information Modeling (BIM), finding that optimism significantly influences perceived usefulness. Similarly, Rozudin (2023) applied TRAM to analyze technology readiness and acceptance in a multifinance company, revealing that the driving factors of technology readiness significantly affect perceived usefulness, while psychological barriers such as discomfort and insecurity showed varying impacts depending on industry characteristics. In the heavy equipment sector, Park, Kim, and Lee (2019) examined user acceptance of telematics systems, highlighting the importance of perceived ease of use and usefulness in shaping attitudes toward technology adoption.

UT Connect's psychological factors—such as optimism, innovativeness, discomfort, and insecurity—as well as technological factors such as perceived usefulness and perceived ease of use that affect user intention and behavior were analyzed using the Technology Readiness and Acceptance Model (TRAM) approach. This model combines the Technology Readiness Index (TRI) and the Technology Acceptance Model (TAM). The approach allows for measuring both individual readiness and user acceptance of UT Connect technology, making it relevant in identifying gaps between registered and active users. In addition, this method facilitates the analysis of readiness and acceptance in new technology adoption, particularly when users' psychological readiness significantly determines technology success.

Amid rapid digital transformation in the heavy equipment industry, the UT Connect application is designed as an integrated platform to support customer operations, ranging from equipment monitoring and order tracking to ticketing systems. However, despite recording 6,579 registered accounts, an internal survey revealed that only 548 accounts (8.3%) were active monthly, indicating a possible phenomenon of veiled resistance to technology adoption.

An indication of this unpreparedness can be seen not only from statistical data but also from user behavior patterns that are contrary to expectations: the majority of users (91.7%) believe that the application is theoretically beneficial but are skeptical about realizing these benefits in their daily operational practices. This behavioral logic creates a cognitive dissonance in which positive beliefs (usability perceptions) do not lead to consistent behavior (regular use), as evidenced by the observed usage patterns:

- Passive login tendencies: Opening apps only to "browse through" without in-depth interaction
- Partial feature usage: Only takes advantage of 1-2 basic features out of the 6 main features available
- Return to traditional channels: Verify information via *WhatsApp*/phone even if *real-time data* is available in the app

This phenomenon indicates a behavioral gap between psychological readiness (technology readiness) and actual acceptance (technology acceptance), which is influenced by specific behavioral factors such as strong optimism but limited by discomfort, insecurity, and technology anxiety. This study uses the Technology Readiness and Acceptance Model (TRAM) to uncover these internal dynamics and formulate strategies to address the belief–behavior gap in the context of the Indonesian heavy equipment industry.

The objective of this research is to analyze the level of readiness and acceptance of the UT Connect customer monitoring application in the heavy equipment industry using the TRAM approach, and to identify the influence of psychological readiness factors and external variables on the perceived ease of use and usefulness of the application. Theoretically, the benefit of this research is to test the validity and extend the application of the TRAM model within the specific operational context of monitoring applications, thereby contributing to the literature on technology adoption in industrial settings. Practically, the findings are expected to serve as a foundation for the management of PT United Tractors Tbk and similar companies to formulate strategies for enhancing technology adoption—through interface refinement, targeted training programs, and user experience optimization—to increase active usage rates, operational efficiency, and customer satisfaction.

RESEARCH METHODS

This research aims to analyze the level of readiness and acceptance of Customer Monitoring Apps technology at PT United Tractors Tbk as implemented in the company's business processes, using an integrated approach that combines the Technology Readiness (TR) and Technology Acceptance Model (TAM) methods—commonly referred to as the Technology Readiness and Acceptance Model (TRAM). In the TR component, measurements will be carried out using the Technology Readiness Index 2.0 (TRI 2.0) approach, which consists of four dimensions: Optimism, Innovativeness, Discomfort, and Insecurity. TRI 2.0 is a development of the previous model, TRI 1.0, which was used in earlier studies to streamline the item scale from the original 36 items to 16 in the current version. Furthermore, measurement of the level of technology acceptance will be conducted using the TAM model to determine the perceived ease of use and perceived usefulness of the technology. This study applies the extended TAM 3 approach by incorporating several external factors that may influence technology readiness and acceptance—namely, Technology Self-Efficacy (TSE), Perception of External Control (PEC), Technology Anxiety (TA), and Perceived Enjoyment (PE). The data collection method employs questionnaire data obtained from several technology users, consisting of both customers and employees.

RESULTS AND DISCUSSION

After evaluating the *outer model* and *inner model*, the next stage is hypothesis testing using *the bootstrapping* method on SEM-PLS4. This test aims to determine the value of *the path coefficient* and *T-statistic* so that it can be determined whether the relationship between constructs in the TRAM model is accepted or rejected. Through *the bootstrapping test*, each hypothesis is tested based on the strength of the influence of exogenous variables on the endogenous variables that have been formulated in the conceptual model.

The hypotheses tested in this study include sixteen causal relationships, namely:
H1 = *Optimism* has a positive effect on *Perceived Usefulness*
H2 = *Optimism* has a positive effect on *Perceived Ease of Use*
H3 = *Innovativeness* has a positive effect on *Perceived Usefulness*
H4 = *Innovativeness* has a positive effect on *Perceived Ease of Use*
H5 = *Discomfort* has a negative effect on *perceived usefulness*
H6 = *Discomfort* has a negative effect on Perceived Ease of Use
H7 = *Insecurity* has a negative effect on *perceived usefulness*
H8 = *Insecurity* has a negative effect on *Perceived Ease of UseH9 = Technology Self-Efficacy* has a positive effect on *Perceived Ease of Use*
H10 = *Perception of External Control* has a positive effect on *Perceived Ease of Use*
H11 = *Technology Anxiety* has a positive effect on *Perceived Ease of Use*
H12 = *Perceived Enjoyment* berpengaruh positif terhadap *Perceived Ease of Use*
H13 = *Perceived Ease of Use* berpengaruh positif terhadap *Perceived Usefulness*
H14 = *Perceived Usefulness* has a positive effect on *Attitude Toward Using*
H15 = *Perceived Ease of Use* has a positive effect on *Attitude Toward Using*
H16 = *Attitude Toward Using* has a positive effect on *Actual Usage*

All of these hypotheses were then tested simultaneously through a *bootstrapping* process to obtain significance values and assess whether the proposed relationship was acceptable in the research model.

The value of the path coefficient has a range of values, which is between negative one (-1) to Positive one (+1). The value of the path coefficient close to (-1) indicates that there is a strong negative relationship between the hypothesis constructs. On the other hand, if the value (+1) indicates a strong positive relationship (Hair, et al., 2014). As for determining the value limit of acceptance and rejection, the hypothesis model uses T-Statistics. T-Statistics through *bootstrapping* have a value range of -1.96 to 1.96. A T-Statistical value that is between the value range of -1.96 to 1.96 indicates that the hypothesis is rejected and accepts the null hypothesis (H0).

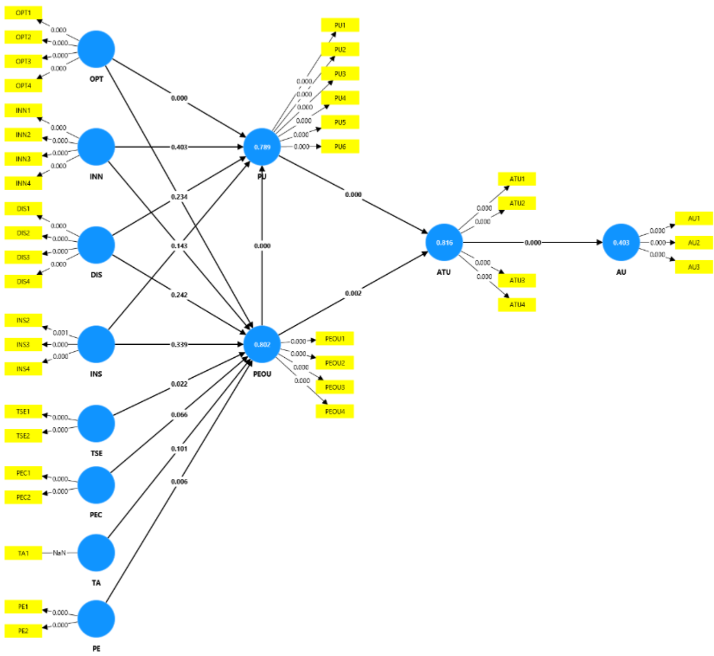

Figure 1. Bootstrapping Test Results
Source : SmartPLS4 Output (2025)

Figure 1 shows the results of *the bootstrapping test* used to assess the significance of the relationships between constructs in the research model. In addition to looking at *the path coefficient* and *T-statistic values*, the evaluation was also carried out by calculating the effect size using Cohen's f^2. Referring to Cohen (1988) in Hair et al. (2014), the f^2 value of 0.02 is categorized as small, 0.15 medium, and 0.35 large. The results of the calculation of the effect size and significance of each pathway in full can be seen in Table 1 below.

Table 1. Testing Recapitulation

	Hypothesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
H1	OPT -> PU	0.375	0.362	0.106	3.529	0.000
H2	OPT -> PEOU	0.091	0.106	0.115	0.787	0.216
H3	IN -> PU	-0.020	0.006	0.089	0.226	0.411
H4	INN -> PEOU	0.106	0.082	0.096	1.108	0.135
H5	DIS -> PU	0.105	0.100	0.097	1.085	0.140
H6	DIS -> PEOU	-0.064	-0.073	0.093	0.684	0.248
H7	INS -> PU	-0.076	-0.075	0.087	0.864	0.195
H8	INS > PEOU	-0.039	-0.024	0.097	0.402	0.344

Hypothesis		Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
H9	TSE -> PEOU	0.217	0.239	0.098	2.212	0.015
H10	PEC -> PEOU	0.144	0.141	0.096	1.502	0.068
H11	TA -> PEOU	0.120	0.116	0.101	1.192	0.118
H12	PE -> PEOU	0.360	0.345	0.138	2.605	0.005
H13	PEOU -> PU	0.590	0.584	0.113	5.243	0.000
H14	PU -> ATU	0.528	0.515	0.145	3.631	0.000
H15	PEOU -> ATU	0.414	0.432	0.146	2.839	0.003
H16	TO >	0.635	0.648	0.116	5.486	0.000

Source: Processed data from SmartPLS4 bootstrapping analysis (2025)

Based on Figure 1 and Table 1, it can be seen that the results of the bootstrapping test show variations in the influence between constructs in the research model. Several relationships between variables have a T-statistic value above 1.96 with a p-value below 0.05, indicating that the corresponding hypotheses are acceptable. These findings suggest that the Technology Readiness and Acceptance Model (TRAM) effectively captures significant structural relationships between perceived usefulness, perceived ease of use, attitudes, and actual technology usage. The path coefficient values of the significant relationships also reflect the magnitude of each construct's contribution in influencing the intended endogenous variable.

Furthermore, the test results showed that several variables had a strong and significant influence, such as the relationships between Optimism and Perceived Usefulness, Perceived Enjoyment and Perceived Ease of Use, Perceived Ease of Use and Perceived Usefulness, Perceived Usefulness and Perceived Ease of Use with Attitude Toward Using, and Attitude Toward Using with Actual Usage. These findings indicate that aspects of technological confidence, positive user experience, and perceptions of system functionality play a dominant role in increasing acceptance of UT Connect technology. In addition, the Technology Self-Efficacy variable was also found to have a significant influence on the perception of ease of use, demonstrating that the level of user confidence in operating technology strengthens system adoption.

Meanwhile, some constructs—such as Discomfort, Innovativeness, Insecurity, Perception of External Control, and Technology Anxiety—did not show a significant influence on their respective target variables. The low T-statistic values and p-values above 0.05 in these relationships indicate that psychological barriers and innovative tendencies among users do not have a dominant role in shaping their perceptions of the system. These findings suggest that the acceptance of UT Connect technology is more strongly influenced by perceptions of usefulness, ease of use, positive experience, and self-confidence, rather than by inhibiting or hesitant factors.

After testing the outer model, inner model, and conducting hypothesis testing between constructs in the TRAM model, the next stage is to discuss each hypothesis. This discussion aims to explain how each construct affects the level of readiness and acceptance of UT Connect technology based on the bootstrapping results from SEM–PLS 4.

H1: Optimism has a positive effect → *on Perceived Usefulness* (OPT → PU)

The test results showed that Optimism had a positive and significant effect on Perceived Usefulness, with an original sample value of 0.375, a T-statistic of 3.529, and a p-value of 0.000. These findings indicate that the higher the user's optimism toward the technology, the greater their perception that the application provides real benefits. An optimistic attitude makes it easier for users to accept technology and evaluate that the available features can enhance effectiveness, efficiency, and work quality. In the context of Customer Monitoring applications, users with a high level of optimism tend to view technology as a means of supporting the monitoring process, presenting accurate data, and enabling faster decision-making. Thus, optimism plays an important role in shaping the perception that technology is not merely a tool, but a direct contributor to work activities.

These findings are consistent with several previous studies. Lai and Lee (2020) demonstrated that the optimism dimension in the Technology Readiness Index has a positive influence on Perceived Usefulness in the adoption of Building Information Modelling (BIM). Similar results were also found in the research of Rozudin (2020), which revealed that the driving factors of technological readiness significantly influence perceptions of usefulness. The alignment of these results indicates that optimism is a psychological aspect that enhances users' confidence in the benefits of technology across various sectors, including construction, finance, and information systems. The consistency of these findings reinforces that optimism not only facilitates technology acceptance but also influences how individuals assess the utility and contribution of technology to their professional activities.

H2: Optimism positively affects → *Perceived Ease of Use* (OPT → PEOU)

The results of the analysis showed that Optimism did not have a significant effect on Perceived Ease of Use, with an original sample value of 0.091, a T-statistic of 0.787, and a p-value of 0.216. This result indicates that although users may have an optimistic attitude toward technology, it is not strong enough to influence their perception of the application's ease of use. An optimistic attitude does not necessarily relate to technical understanding, interface comfort, or user interaction experience. Optimistic users may still find the application difficult to use if its features are less intuitive or require additional learning. Thus, Optimism is not a dominant factor in shaping perceptions of ease, as convenience is more strongly determined by design aspects, experience, and the frequency of technology use.

These findings are consistent with the research of Rozudin (2020), who stated that Optimism does not have a significant effect on Perceived Ease of Use in the acceptance of technology within multifinance companies. However, these results contrast with the research of Lai and Lee (2020), who found that Optimism in the Technology Readiness Index can enhance the perception of ease of use in Building Information Modelling (BIM) technology. Differences in industrial context and technological complexity may lead to variations in how Optimism influences perceptions of convenience. This study demonstrates that Optimism among Customer Monitoring application users has not been a strong enough factor to create the perception that technology is easy to use; therefore, other variables—such as personal experience or Self-Efficacy—may play a more substantial role.

H3: *Innovativeness* has a positive effect → *on Perceived Usefulness* (INN → PU)

The results of the analysis showed that the Innovativeness variable did not have a significant influence on Perceived Usefulness, with the original sample value being negative at 0.020, a T-statistic of 0.226, and a p-value of 0.411. This result indicates that a person's tendency to be innovative or enthusiastic about new technology does not automatically lead them to perceive the application as useful. Innovative users often have high expectations of technology; therefore, if an application's features or capabilities fail to meet those expectations, their assessment of its usefulness does not improve. This situation may also occur when user innovativeness is not directly related to the operational functions of the application, meaning that perceptions of usefulness are influenced more by tangible work outcomes than by personal characteristics.

This finding differs from the results of research by Lai and Lee (2020), which showed that Innovativeness has a positive effect on Perceived Usefulness in the adoption of Building Information Modelling (BIM) technology. However, this difference aligns with the findings of Rozudin (2020), who observed that the influence of factors in the Technology Readiness Index on usability perception is not always strong and may vary across industries. Furthermore, within the context of operational technology applications, such as equipment monitoring systems, perceptions of usefulness are more strongly influenced by system performance, information quality, and ease of integration with work processes than by users' innovative tendencies. Therefore, although Innovativeness is a positive trait, this variable has not been proven to increase perceptions of usefulness in this study.

H4: *Innovativeness* berpengaruh positif → Perceived Ease of Use (INN → PEOU)

The test results showed that Innovativeness did not have a significant effect on Perceived Ease of Use, with an original sample value of 0.106, a T-statistic of 1.108, and a p-value of 0.135. This indicates that users' propensity to try or adopt new technologies is not strong enough to enhance their perception of the application's ease of use. Innovative users may still perceive a technology as difficult to use if the interface design, navigation process, or application features do not meet their expectations of an ideal system. The ease-of-use factor is typically influenced more by the quality of system design and hands-on experience than by an individual's innovative tendencies.

This finding differs from the research of Rozudin (2020), which showed that Innovativeness had a significant effect on Perceived Ease of Use in the context of financing technology. However, these differences may arise because user characteristics in the machinery or monitoring application industries tend to focus more on technical functionality rather than experimentation with new technologies. Research by Lai and Lee (2020) also explains that the influence of psychological readiness factors on perceptions of convenience can vary depending on the technological context. Thus, this study demonstrates that Innovativeness has not yet become a determining factor in shaping perceptions of ease of use in Customer Monitoring applications, and that factors such as Self-Efficacy and work experience have greater potential to influence this perception.

H5: *Discomfort* negatively affects → *Perceived Usefulness* (DIS → PU)

The results of the analysis showed that Discomfort did not have a significant effect on Perceived Usefulness, with an original sample value of 0.105, a T-statistic of 1.085, and a p-value of 0.140. The positive yet insignificant coefficient value indicates that discomfort with technology does not reduce users' perception of the application's benefits. This may occur when the perceived benefits of the technology outweigh psychological barriers. Users may feel uneasy when interacting with certain features but still perceive the application as beneficial—such as by accelerating equipment monitoring or facilitating decision-making. Thus, Discomfort is not directly related to the assessment of usefulness, particularly in the context of technologies already integrated into daily operational processes.

This finding differs from the Technology Readiness Index theory, which positions Discomfort as an obstacle in technology adoption. In the research of Park, Kim, and Lee (2019), technical inconvenience was even cited as one of the factors that could reduce the acceptance of telematics technology. However, the study by Rozudin (2020) shows that the effect of TRI variables on perceived usefulness can vary depending on industry characteristics and levels of user familiarity. The results of this study suggest that, among users of the Customer Monitoring application, Discomfort is not strong enough to alter their assessment of technological benefits, as the application's functions are already considered to provide clear operational value.

H6: Discomfort negatively affects → Perceived Ease of Use (DIS → PEOU)

The analysis also revealed that Discomfort did not have a significant effect on Perceived Ease of Use, with a negative original sample value of 0.064, a T-statistic of 0.684, and a p-value of 0.248. This result indicates that discomfort with technology is not strong enough to influence users' perception of the application's ease of use. While users may feel uncertain or lack confidence when using certain features, such feelings do not directly affect their judgment of how easy the application is to operate. Ease of use is determined more by interface quality, clarity of instructions, and user interaction experience than by emotional or psychological barriers.

This finding differs from the research of Lai and Lee (2020), which states that Discomfort can be an inhibiting factor in perceptions of ease of use, as users who experience discomfort tend to find technology more difficult to operate. However, the results of this study align more closely with those of Rozudin (2020), who found that psychological barriers such as Discomfort do not always have a significant effect in particular industry contexts. In the use of Customer Monitoring applications, users are likely familiar with digital technology, so feelings of discomfort no longer have a substantial impact on their perception of ease of use. Adequate work experience and training may also reduce the effect of Discomfort on perceived ease.

H7: Insecurity negatively affects → Perceived Usefulness (INS → PU)

The test results showed that Insecurity did not have a significant effect on Perceived Usefulness, with a negative original sample value of 0.076, a T-statistic of 0.864, and a p-value of 0.195. This indicates that users' insecurities or concerns about technology do not affect how they assess the application's benefits. Users may still experience tangible advantages from the technology even if they harbor doubts about its reliability or security. In the context of a Customer Monitoring application, users may continue to perceive it as beneficial because its features support operational tasks—such as equipment monitoring, condition analysis, and productivity tracking—so Insecurity does not diminish perceived usefulness.

This finding is consistent with Rozudin (2020), who reported that psychological barrier variables in the Technology Readiness Index do not always significantly influence perceptions of technology usefulness in the multifinance industry. However, these results contrast with those of Park, Kim, and Lee (2019), who found that concerns about data privacy and security pose real barriers to the adoption of telematics technology. Differences in results may stem from variations in technological complexity and organizational readiness in providing technical support. In this study, clear benefits and the integration of technology into routine activities appear to have a stronger influence on perceived usefulness than users' feelings of insecurity.

H8: Insecurity negatively affects → Perceived Ease of Use (INS → PEOU)

The results of the analysis showed that Insecurity did not have a significant influence on Perceived Ease of Use, with a negative original sample value of 0.039, a T-statistic of 0.402, and a p-value of 0.344. This indicates that insecurity or doubt about technology does not affect users' perceptions of the application's ease of use. Users tend to evaluate ease of use based on interface design, navigation, and system interaction experiences; hence, emotional factors such as uncertainty or anxiety play a minimal role in these judgments. Although some users may still harbor doubts about the system's stability or security, such concerns do not necessarily make the application more difficult to use.

This finding differs from the research of Lai and Lee (2020), who suggested that Insecurity can hinder technology adoption, as users who feel insecure often perceive technology as difficult to use. However, the present result aligns more closely with Rozudin (2020), who explained that the influence of psychological barriers on perceived ease can vary depending on industry characteristics and the type of technology implemented. In the context of Customer Monitoring applications, the availability of training, technical support, and habitual use likely mitigates the impact of Insecurity, resulting in no significant effect on perceptions of ease of use.

H9: Technology Self-Efficacy positively affects → Perceived Ease of Use (TSE → PEOU)

The results of the analysis showed that Technology Self-Efficacy had a positive and significant influence on Perceived Ease of Use, with an original sample value of 0.217, a T-statistic of 2.212, and a p-value of 0.015. These findings indicate that the higher the confidence users have in their ability to operate the technology, the greater their perception that the application is easy to use. Users with a high level of self-confidence tend to understand application functions more quickly, solve simple technical problems independently, and are not easily burdened by the system learning process. In the context of Customer Monitoring applications, user confidence accelerates adaptation and strengthens the perception that the application is convenient and easy to operate in daily work activities.

These findings align with the research of Park, Kim, and Lee (2019), which shows that technology readiness and an individual's ability to operate digital devices are important factors in enhancing perceptions of ease of use in telematics technology. Similarly, Chen (2018) found that psychological factors such as self-confidence have a positive effect on perceived ease in using digital-based health applications. The consistency of these findings reinforces that Technology Self-Efficacy is an important component in technology acceptance models, especially when users engage with operational applications that demand technical precision and understanding.

H10: Perception of External Control positively affects → Perceived Ease of Use (PEC → PEOU)

The test results showed that Perception of External Control had no significant effect on Perceived Ease of Use, with an original sample value of 0.144, a T-statistic of 1.502, and a p-value of 0.068. Despite the positive coefficient direction, the results did not reach a level of statistical significance. These findings indicate that users' perceptions of external support—such as technological facilities, technical assistance, or organizational support systems—are not strong enough to influence their perception of the application's ease of use. In other words, ease of use is more influenced by individual ability and application design quality than by perceptions of external support.

In the context of prior research, these results differ from the findings of Park, Kim, and Lee (2019), who demonstrated that organizational support plays an important role in adopting telematics technology, including its impact on perceived ease of use. However, these results are more consistent with those of Rozudin (2020), who found that external support factors do not always have a significant influence across industries. In the case of Customer Monitoring applications, users may already be familiar with digital technologies, so personal ability affects perceived ease more than external assistance. This finding illustrates that internal training, work experience, and Self-Efficacy are more decisive factors in shaping users' judgments of application convenience.

H11: Technology Anxiety positively affects → Perceived Ease of Use (TA → PEOU)

The results of the analysis showed that Technology Anxiety did not have a significant effect on Perceived Ease of Use, with an original sample value of 0.120, a T-statistic of 1.192, and a p-value of 0.118. These findings suggest that users' levels of anxiety toward technology do not significantly influence their perception of the application's ease of use. While some users may feel nervous or apprehensive about new technologies, such emotions are not strong enough to make them perceive the application as difficult to use. Perceptions of ease are generally shaped by direct experience, interface design, and the availability of training support; hence, anxiety does not play a dominant role in usability assessments.

This finding diverges from the rationale of the Technology Readiness Index, which positions Anxiety as one of the psychological obstacles to technology acceptance. However, it aligns more closely with Rozudin (2020), who found that psychological barriers do not always have a significant influence on user perceptions, particularly in industries already accustomed to digital systems. Chen (2018) also noted that education and prior experience using similar applications can reduce the impact of Anxiety on perceived ease. In the case of Customer Monitoring applications, users familiar with similar systems appear less affected by anxiety, suggesting that Technology Anxiety does not significantly impact perceptions of ease of use.

H12: Perceived Enjoyment positively affects → Perceived Ease of Use (PE → PEOU)

The results of the analysis showed that Perceived Enjoyment had a positive and significant influence on Perceived Ease of Use, with an original sample value of 0.360, a T-statistic of 2.605, and a p-value of 0.005. These findings indicate that the sense of pleasure or enjoyment users experience while using the application contributes to enhancing their perception of ease of use. Users who have positive experiences interacting with the application tend to view the technology as easy, engaging, and convenient to operate. Moreover, a pleasant user experience encourages exploration, leading to a deeper understanding of the available features and a perception that they are easy to learn.

These results are consistent with numerous studies based on the Technology Acceptance Model (TAM), including Park, Kim, and Lee (2019), who found that positive experiences with telematics technology improve user perceptions of ease of use. Their study explained that comfort, enjoyment, and interactive engagement can cultivate stronger perceptions of ease than purely technical factors. Similarly, Sorce and Issa (2021) demonstrated that perceptions of convenience are influenced not only by technical competence but also by emotional experiences during technology use. These findings suggest that improving user experience and interface quality can be an effective strategy to strengthen technology acceptance.

H13: Perceived Ease of Use positively affects → Perceived Usefulness (PEOU → PU)

The analysis showed that Perceived Ease of Use had a positive and significant influence on Perceived Usefulness, with an original sample value of 0.590, a T-statistic of 5.243, and a p-value of 0.000. These findings demonstrate that the easier the technology is to use, the greater the perception that it provides practical benefits to users. Ease of use fosters an efficient user experience by reducing cognitive load, lowering learning time, and enabling smoother system interactions—thereby amplifying the perceived benefits of the technology. In the context of the Customer Monitoring application, easy navigation, clear features, and an intuitive display structure help users recognize the added value of the system in real-time equipment monitoring, historical data tracking, and improved information accuracy.

These findings are consistent with previous research. Sorce and Issa (2021) demonstrated that within the Technology Acceptance Model, Perceived Ease of Use plays a critical role in shaping perceptions of technological benefits, particularly in the U.S. construction industry. Similarly, research by Park, Kim, and Lee (2019) supports the notion that Perceived Ease of Use significantly influences Perceived Usefulness in the use of telematics systems for heavy equipment. The alignment of these findings reinforces the stable relationship between ease and usefulness across various technological contexts. In this study, this relationship is once again validated, showing that users are more likely to perceive the benefits of technology when they find it easy to use.

H14: *Perceived Usefulness* positively affects → *Attitude Toward Using* (PU → ATU)

The results of the analysis showed that *perceived usefulness* had a positive and significant influence on *attitude toward using*, with an original sample value of 0.528, T statistics 3.631, and a p value of 0.000. These results show that the greater the benefits that users feel from a technology, the more positive their attitude towards the use of that technology will be. Users who judge that apps help increase productivity, speed up work, and improve the quality of decisions tend to have a strong attitude of acceptance. In the context of *Customer Monitoring* applications, the perception of benefits related to data accuracy, tool monitoring efficiency, and ease of supervision are factors that encourage users to be positive and more open to using applications.

These findings are in line with the research *of Sorce and Issa (2021)* who affirm that in the *Technology Acceptance Model*, the perception of benefits is the main predictor of the formation of positive attitudes towards technology, especially in the construction industry and the use of information systems. Research *by Park, Kim, and Lee (2019)* also shows that the benefits of telematics technology contribute strongly in shaping attitudes and increasing the acceptance of technology by heavy equipment operators. In addition, *Putri's (2020)* research found that *perceived usefulness* is one of the most influential variables in increasing attitudes and intentions to use the KMS system in the banking sector. The consistency of these findings reinforces that the perception of benefits is an important aspect that encourages users to have a positive attitude towards technology in various industry sectors.

H15: *Perceived Ease of Use* positively affects → *Attitude Toward Using* (PEOU → ATU)

The results of the analysis showed that *perceived ease of use* had a positive and significant influence on *attitude toward using*, with an original sample value of 0.414, T statistics of 2.839, and p value of 0.003. These findings show that users' perceptions of the ease of use of technology have an impact on the formation of positive attitudes towards the technology. When an application is considered easy to understand, easy to operate, and does not pose significant obstacles, users tend to feel more comfortable and confident in using it. In the context of *Customer Monitoring* applications, ease of navigation, simple interface, and smooth user experience are factors that encourage users to have a more open attitude and be more prepared to continue using the application.

This research is in line with the findings of *Park, Kim, and Lee (2019)* who stated that the perception of ease of use affects user attitudes towards telematics technology in the heavy equipment industry. The findings are also supported by research by *Sorce and Issa (2021)* who explain that in the *Technology Acceptance Model*, the perception of convenience is one of the important factors that shape positive attitudes towards technology. In addition, *Putri (2020)* found that the perception of ease of use plays a significant role in creating a positive attitude towards digital systems in the banking sector. The consistency of these findings shows that the perception of convenience is an important component in encouraging user acceptance attitudes in various industries, including the use of operational applications such as *Customer Monitoring*.

H16: *Attitude Toward Using* positively affects → *Actual Usage* (ATU → AU)

The results of the analysis showed that *attitude toward using* had a positive and significant influence on *actual usage*, with an original sample value of 0.635, T statistics 5.486, and a p value of 0.000. These findings show that the more positive a user's attitude towards technology, the more likely they are to use it in real life in their daily work activities. A positive attitude can be formed from a good user experience, perceived benefits of technology, and convenience in operating the application. In the context of *Customer Monitoring* applications, users who have a strong acceptance attitude tend to be more active in using applications to monitor tools, read operational reports, and make decisions based on digital data, so that the frequency and consistency of use are increasing.

This finding is in line with the research *of Putri (2020)* who explains that *attitude toward using* is one of the most influential variables in encouraging the actual use of the KMS system in the banking sector. Research *by Sorce and Issa (2021)* also shows that a positive attitude towards technology plays an important role in encouraging the real adoption of information systems in the construction industry. In addition, research *by Park, Kim, and Lee (2019)* found that user attitudes towards telematics technology significantly affect the level of use of this technology in heavy equipment operational activities. The consistency of these findings shows that a positive attitude is an important element in bridging user perception of real technology use actions so that the better the attitude formed, the higher the actual level of application usage.

Based on the results of the hypothesis test, the following is a sequence of variables that have a strong and significant influence. As well as the idea of managerial recommendations and the level of realization of the proposal which can be seen through table 4.13 below.

Table 2. Test Recapitulation

Yes		**Hipotesis**	**P values**	**Recommendations**	**The Rate of Proposal Implementation**
1	H1	*Optimism* (OPT) → *Perceived Usefulness* (PU)	0.000	UT Connect *Main Flow Simplification*	*Height*
2	H13	*Perceived Ease of Use* (PEOU) → *Perceived Usefulness* (PU)	0.000	Easily accessible UT *Connect* Support Service	Height
3	H14	*Perceived Usefulness* (PU) → *AttitudeToward Using* (ATU)	0.000	UT Connect *Digital Service Integration*	Height
4	H16	*Attitude Toward Using* (ATU) → *Actual Usage (AU)*	0.000	The "UT *Connect Champion*" program at each customer's company to encourage internal role models.	Low
5	H15	*Perceived Ease of Use (PEOU)* → *Attitude Toward Using* (ATU)	0.003	*Gamified Engagement Module* pada UT *Connect*	Height
6	H12	*Perceived Enjoyment* (PE) → *Perceived Ease of Use* (PEOU)	0.005	*UT Connect Main Dashboard Visualization More Interesting*	*Height*
7	H9	*Technology Self Efficiacy* (TSE) → *Perceived Ease of Use* (PEOU)	0.015	UT *Connet* Onboarding & *Training Program*	*Height*

Source: Processed data from hypothesis testing and managerial analysis (2025)

CONCLUSION

This research successfully answers the three problem formulations systematically through the Technology Readiness and Acceptance Model (TRAM) approach in the context of the UT Connect Customer Monitoring Apps in the heavy equipment industry: Technology Readiness Level and UT Connect User Acceptance. The level of technology readiness and user acceptance is measured through the TRAM dimensions integrated with SEM-PLS. The results of the analysis showed that Optimism had a significant effect on Perceived Usefulness (PU) ($p = 0.000$), while Innovativeness, Discomfort, and Insecurity had no significant effect on PU or Perceived Ease of Use (PEOU).

In terms of acceptance, Technology Self-Efficacy (TSE) and Perceived Enjoyment (PE) were proven to increase PEOU ($p = 0.015$ and $p = 0.005$), while PEOU → PU ($p = 0.000$), PU → Attitude Toward Using (ATU) ($p = 0.000$), PEOU → ATU ($p = 0.003$), and ATU → Actual Usage (AU) were all significant. These findings confirm that UT Connect’s CMA acceptance is driven more by personal factors (confidence and positive experiences) and cognitive perceptions (convenience and usefulness) than general technological personality tendencies. Innovativeness, Discomfort, and Insecurity were declared insignificant, and the hypotheses were rejected because they were not proven to have a direct effect on perceptions of usability (PU) and convenience (PEOU).

The results of the analysis of the relationships between dimensions in the TRAM framework show that this model is empirically able to explain the mechanism of technology acceptance among UT Connect users. The path of influence from Optimism → PU; TSE and PE → PEOU; then PEOU → PU → ATU → AU proved significant and consistent with theory, thus providing empirical validation that interface variables such as Perceived Usefulness and

Perceived Ease of Use act as a bridge between users' psychological readiness and actual usage behavior. On the other hand, the insignificance of Innovativeness, Discomfort, and Insecurity for PU and PEOU indicates that in the context of the heavy equipment industry—which is very task-specific and guided by strict SOPs—general technology readiness factors are not always determinants of the perception of work applications. Thus, TRAM remains valid and relevant to use; however, the sensitivity of the influence of each dimension of technological readiness is greatly affected by sectoral characteristics and the context of application use.

Implications of TRAM Analysis Results for Strategic and Managerial Recommendations. Based on the relationship patterns found in the TRAM model, this study concludes that efforts to increase the effectiveness of UT Connect use need to focus on strengthening factors that have proven significant in encouraging user attitudes and actual use. This includes improving Perceived Ease of Use through simplification of key flows and intuitive interfaces, enhancing Perceived Usefulness through integration of digital service flows that provide immediate operational benefits, and increasing Technology Self-Efficacy and Perceived Enjoyment through onboarding, training, and design programs for more enjoyable user experiences.

Based on these findings, heavy equipment companies such as PT United Tractors are recommended to:

(a) simplify UT Connect main pipelines;
(b) ensure easily accessible UT Connect Support Services;
(c) integrate UT Connect Digital Services;
(d) implement a Gamified Engagement Module in UT Connect;
(e) create a more engaging UT Connect Main Dashboard visualization; and
(f) develop the UT Connect Onboarding & Training Program.

This strategy will increase the adoption rate from the current 8.3% Monthly Active User (MAU) to optimal utilization, while making UT Connect a digital operational standard in the heavy equipment industry. Overall, the study not only validates the effectiveness of TRAM in explaining the adoption of CMA, but also provides practical guidance for the management of digital technologies in the heavy equipment sector—insights that can be replicated in similar monitoring applications..

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