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Analysis of The EwacsPro Auto Dispatch System in XYZ Company Using Technology Readiness Level (TRL) and Technology Acceptance Model 2 (TAM2) Adoption

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ABSTRACT

Fleet Management System (FMS) is a system that quite good to manage the haul cycle and can be useful for reducing the idle time of the conveyance. The development of an FMS with an Auto Dispatch System (ADS) that utilizes digital information technology can make management easier. ADS is the system which has assignment logic systems for transport equipment, either directly suggesting to the operator through computerized systems or through dispatchers. XYZ Company developed its own ADS, called Early Warning & Control System Pro (EwacsPro), which has been tested on 1 of 4 total pits they have in ABC jobsite, using the LTE Communication network, which is the first in Indonesia. The problem behind this research is that the system has never been tested for readiness. This research aims to analyze, evaluate and explore the level of readiness of the EwacsPro system using the Technology Readiness Level (TRL) method and also analyze the level of operator acceptance of the use of the EwacsPro system adopting Technology Accetance Model 2 (TAM2) using Structural Equation Modeling (SEM) analysis. The research will provide recommendations to the XYZ management for improvements related to EwacsPro at ABC Jobsite so that it can provide benefits according to the technological design which has been made, using Business Model Canvas (BMC) tool. The EwacsPro system reached level 9 TRL with a fulfillment rate of 80%. There are 7 variables that significantly influence EwacsPro's Usage Behavior directly and 1 variable that significantly influences using 2 influencing moderator variables of the TAM2 analysis. The R-square test also shows that all values are above 0.75, which means that there is a strong influence from the measurement of the exogenous latent variable on the endogenous latent variable.

1. Introduction

Mining activities are highly complex, particularly in transportation within open-pit mining areas. The open-pit mining process begins with exploration activities to gather data related to natural resources in the mining location and ends with shipping and delivery of coal to consumers. This study focuses on activities related to overburden excavation and transportation. Overburden refers to the rock layer or covering that overlays the ore body.

For mining service companies, obtaining overburden must be optimized according to targets. However, the process to obtain it must be carried out efficiently because the use of heavy equipment entails significant costs. In terms of derived activity costs, hauling cost and loading cost become the most expensive parameters [1]. Therefore, it is essential to achieve efficiency in both planning and execution to control loading equipment and dump trucks (transportation equipment). The adjustment made between loading equipment and transportation equipment must be balanced to prevent wastage from both the loading and transportation sides.

XYZ Company has eighteen jobsites as areas for doing the project, with ABC as the biggest jobsites. It has four relatively large open pits with more than a thousand hectares total area. Currently, there are 35 loading units which have a varying number of dump trucks, ranging from 5 to 12 units. The distance from the loading point to the dumping area is between 5 to 9 kilometers. Therefore, conventional supervision is not suitable for implementation at the jobsite, considering the extensive coverage area, a large number of units, and the complexity of issues that may arise, both at the loading points, on the roads, and at the dumping locations.

To effectively and efficiently monitor all load-haul-dump activities, the development of an Auto Dispatch System (ADS) is essential. XYZ Company has decided to independently develop ADS at ABC Jobsite, leveraging its capabilities and experience in utilizing ADS at other jobsites. The system is named EwacsPro, utilizing LTE communication networks, making it the first of its kind used in open-pit mining in Indonesia.

The operator is key to the success of the EwacsPro implementation, as they play a crucial role in providing input for performance analysis through the status update reports they input. The background issue of this research is that the readiness of this system has never been tested.

The research assesses the Technology Readiness Level (TRL) of EwacsPro to determine the technology's readiness for mass implementation. It also identifies the level of operator acceptance to use the EwacsPro system using the Technology Acceptance Model 2 (TAM2) analysis. Then at the end of study, it formulates recommendations for improvement to ensure the smooth operation of EwacsPro, utilizing the Business Model Canvas (BMC).

2. Literature Review

2.1 Auto Dispatch System in Mining Industry

Essentially, dispatch systems are divided into three types: manual dispatch system, semi-automatic dispatch system, and auto dispatch system. The manual dispatch system is carried out manually between production supervisors and heavy equipment operators through two-way radio communication. Semi and auto dispatch systems have assignment logic systems for transport equipment, either directly suggesting to the operator through computerized systems or through dispatchers [2].

Investing in semi and auto dispatch systems can quickly recoup costs by improving productivity in large-scale mining operations but may not be economically justified for small to medium-sized operations [2].

The transport equipment will be assigned to approach the loading equipment for the loading process, with priority given to the loading equipment that has been waiting the longest (not yet visited by the transport equipment) or is estimated to be idle next.

Quick and accurate decisions are necessary for every operational activity in coal mining. This can be achieved through a Fleet Management System (FMS). Hauling costs in open-pit mines constitute the most expensive component, ranging from 45 to 60 percent of the total mining operation costs [3]. Therefore, this forms a crucial foundation for the need to optimize the use of heavy equipment, especially coal mining transport vehicles.

Table 1. The Difference Between Fleets Using and Without FMS Optimization

Without FMS Optimization	*Using FMS Optimization*
Sometimes, there is a queue of transport vehicles piling up at the loading point, while at other times, there are no transport vehicles available at all.	There is one transport vehicle currently undergoing loading, and one transport vehicle in queue ready for loading.
There is fuel wastage due to transport vehicles queuing for loading or loading equipment waiting for transport vehicles to arrive.	Fuel usage will be optimized as the unit productivity.
Production is disrupted due to an imbalance in the productivity of transport vehicles and loading equipment.	The productivity of both loading equipment and transport vehicles is maintained, ensuring optimal production.

Source: [1]

2.2 Business Model Canvas (BMC)

The Business Model describes the rational relationship of how a company creates, delivers, and captures value [4]. This model serves as a fairly efficient guide for discovering ways to create value, identifying customer needs, leveraging external opportunities, identifying required resources, understanding how to generate revenue, as well as providing short-term and long-term projections [5].

The Business Model Canvas (BMC) has several blocks that depict the logic of thinking related to how an organization creates money, consisting of four main business areas: customers, infrastructure, value proposition, and financial sustainability aspects [4].

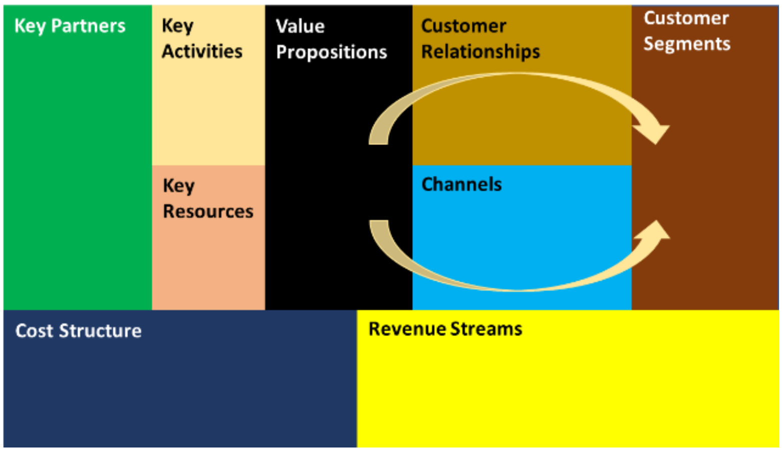

Figure 1. Business Model Template [4]

2.3 Technology Readiness Level (TRL)

The readiness of technology can be understood as how prepared a technology is for implementation according to its intended function [6]. Technology Readiness Level is perceived as a system for assessing the maturity level of a technology for mass deployment.

In the NASA concept, as a pioneer in the development of the TRL concept in the 1980s, the readiness level of technology is detailed into 9 position levels, where TRL 1 is the lowest level, and TRL 9 is the highest level. The TRL concept explains that the readiness of technology is a crucial parameter in the success of developing a system or product. The higher the TRL value, the greater the likelihood of success for a system or product in achieving its development goals.

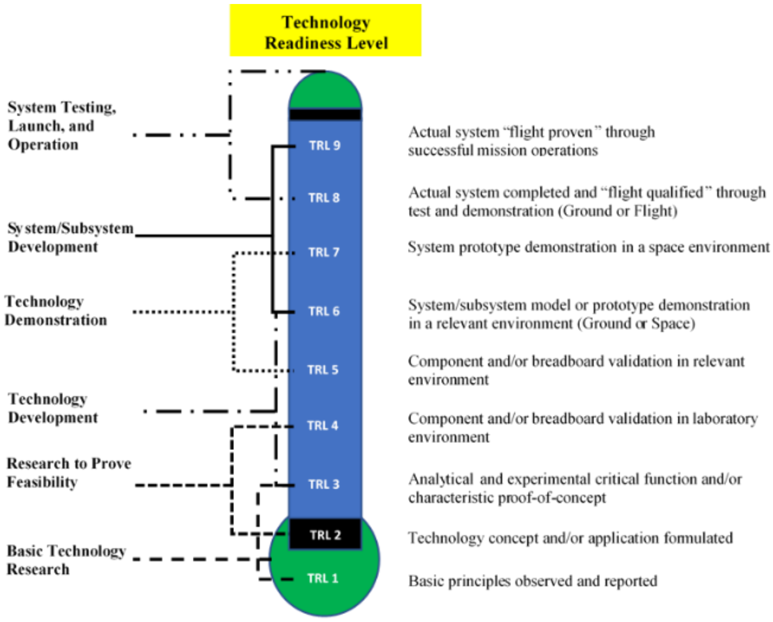

Figure 2. NASA Technology Readiness Level [6]

2.4 Technology Acceptance Model 2 (TAM2)

TAM (Technology Acceptance Model) is a derivative model that adapts the Theory of Reasoned Action [7], linking attitudes, beliefs, and behaviors to the desires and willingness of users in using a product or system. The most fundamental goal of TAM is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions [8].

The TAM model has two crucial instruments for analyzing the level of user motivation in the context of accepting a system or product. The first point is Perceived Usefulness (PU), which can be interpreted as an individual's level of confidence in using a system to enhance job performance [9]. Perceived Ease of Use (PEOU), on the other hand, refers to an individual's belief regarding the ease of using the system without much effort [9].

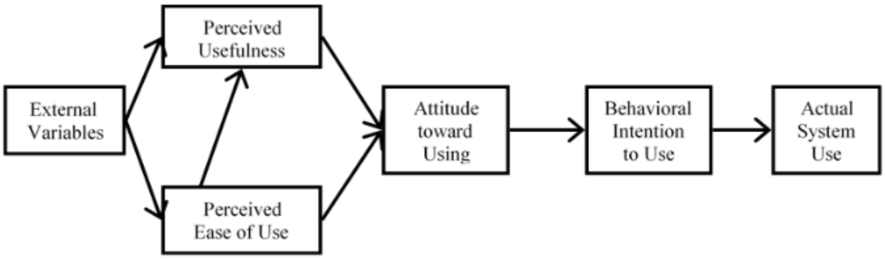

Figure 3. Technology Acceptance Model [8]

Following the TAM theory, a more detailed model was developed to analyze users' system usage, known as TAM2. This model integrates two processes: social influence and instrumental cognitive processes [10]. Venkatesh and Davies (2000) studied and designed the TAM2 model with the aim of adding indicators related to the social impact and cognitive instrumental processes that affect perceived usefulness and intention to use [11]. Subjective Norm, Image, and Voluntariness are part of the social influence process, while Job Relevant, Output Quality, Result Demonstrability, and perceived ease of use are part of the instrumental cognitive process or system characteristics [12]. However, one criticism of this model is the excessive variables and relationships between them, which might not be appropriate for testing information systems in government institutions due to concerns of non-validity and reliability arising from the model's complexity [13].

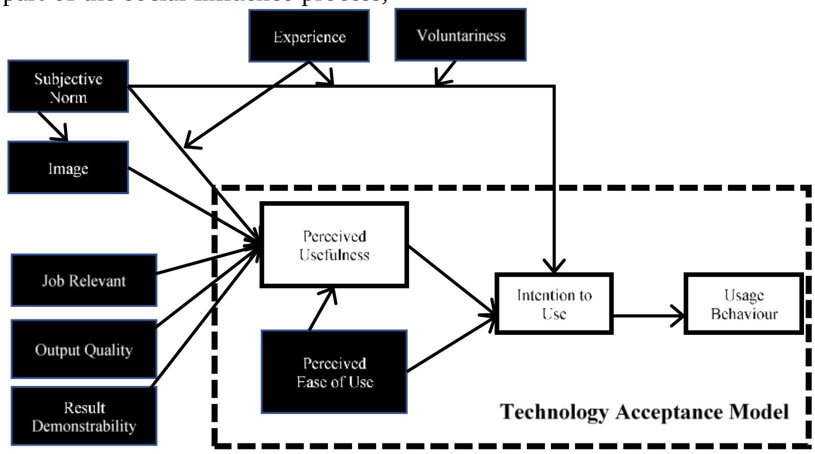

Figure 4. Technology Acceptance Model 2 [12]

2.5 Structural Equation Modeling (SEM)

SEM (Structural Equation Modeling) is a second-generation multivariate analysis technique that allows researchers to model and estimate complex relationships between various dependent and independent variables simultaneously [14]. There are two popular methods of SEM used worldwide, the PLS-SEM method will be employed in this research.

The analysis of SEM is divided into two main stages, namely the measurement model and the structural model. In the measurement model analysis, the goal is to understand how well manifest variables describe each exogenous and endogenous latent variable. Each latent variable has several manifest variables (indicators) that reflect on each respective latent variable [15].

The initial stages of analysis using the SEM method involve creating a path diagram to interpret the relationships between latent variables and indicators in PLS software. The analysis then proceeds to the measurement model analysis (outer model) to evaluate the relationships between latent constructs and their manifest indicators by examining the values of outer loadings.

In the second stage, the analysis moves on to the structural model analysis (inner model) by examining bootstrap values to assess the estimated path coefficient parameters and their significance levels. This two-stage process helps researchers understand and interpret the relationships between latent variables and indicators and assess the overall structural model in terms of its explanatory power and significance.

2.6 Sample

In the implementation of surveys, there are two main types of samples: probability samples and nonprobability samples. The first type, probability samples, is characterized by every element in the population having a known and non-zero probability of being selected. On the other hand, nonprobability samples are based on a sampling plan that lacks this feature [16].

In this research, the minimum number of respondents can be calculated using the formula proposed by Lemeshow et al. (1990):

$$n = \frac{{Z_{1-\alpha/2}}^2\ p(1-p)}{d^2}$$

N = Nominal of Sampel

$Z_{1-\alpha/2}$ = Confidence Level (Z=1.96 for α= 0.05)

p = Population Proportion

d = the desired margin of error

3. Methods

3.1 Research Design

This research employs a quantitative method to assess the level of technological readiness of the ADS EwacsPro at XYZ Company. It utilizes a quantitative descriptive research method involving the distribution of questionnaires to obtain accurate primary data. Primary data is collected directly by the researcher during the research through the system, interviews, discussions, surveys, or questionnaires distributed and filled out by the respondents.

3.2 Sampling

This research requires respondents to investigate the Technology Readiness Level (TRL), specifically involving key stakeholders involved in the development of ADS EwacsPro at XYZ Company. These stakeholders include the System Development Manager and Experts.

The distribution of TAM2 questionnaires requires the selection of respondents from heavy equipment operators at Open Pit A in XYZ Company, who are the actual primary users of the system. This research adopts a confidence level of 95%, with a margin of error of 5%, and a proportion value of 0.5 to determine the maximum sample size. The study involves a total of 460 respondents who are heavy equipment operators.

3.3 TRL Data Collection

Data for the first research related to Technology Readiness Level were obtained using a discussion concept with parties directly involved with EwacsPro to acquire primary data for the analysis of the Technology Readiness Level. The TRL research was conducted using Tekno-meter version 2.5 based on Microsoft Excel, developed by BPPT Indonesia. The assessment was conducted collaboratively through a brainstorming discussion system with respondents to evaluate the system's position at each TRL level. The assessment involved assigning values to each parameter within a range of 0-5.

Table 2. Value Range in TRL Criteria

Value	*Criteria*
0	Not Eligible
1	20%
2	40%
3	60%
4	80%

3.4 TAM2 Data Collection

Data related to TAM2 analysis were obtained by distributing questionnaires and implementing the concept of questionnaire distribution to heavy equipment operators at Open Pit A in XYZ Company, who were the primary target for the implementation of EwacsPro. The construction of the TAM2 questionnaire focused on 10 variables with 32 question indicators, namely usage behavior, intention to use, perceived usefulness, perceived ease of use, subjective norm, experience, voluntariness, job relevance, output quality, and result demonstrability. The variable "image" is not within the research focus because the selection of the jobsite and the open pit area using ADS EwacsPro has been determined by the company, thus having no influence on the operator's social status. The questionnaire was filled out using a Likert scale ranging from 1 to 5. Structural Equation Model (SEM) will be used as data analytical method.

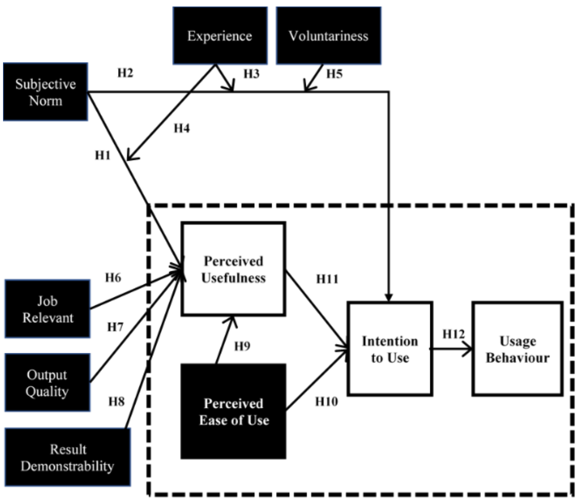

Figure 5. Technology Acceptance Model 2 Hypothesis Model

4. Results and Discussions

4.1 Result of the TRL

In the company's interest, with a compliance standard of 80%, the measurement indicates a TRL level of 9, which means the technology has been thoroughly tested/proven with operational success. The TRL testing results show that the system has been technically tested and is suitable for mass production internally within the company. Additionally, considering the differentiation from other third-party auto dispatch systems, the implementation of the EwacsPro technology has broadly aligned with the expected plan. However, continuous refinement of the application is necessary to elevate the service level from basic standards to more advanced levels.

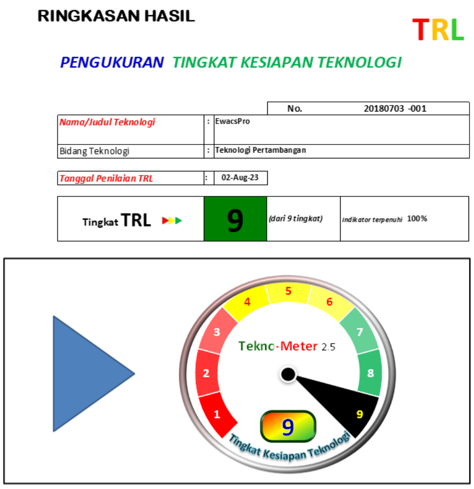

Figure 6. Result of Technology Readiness Level

4.2 Result of the TAM2

The analysis was conducted to examine the dataset using descriptive techniques on the gathered data set. Questionnaires were distributed to 460 heavy equipment operators at PT XYZ's jobsite ABC, but only 412 operators provided complete responses.

Table 3. Characteristics of TAM2 Respondents

No	*Characteristics*	*Nominal*	*Percentage*
1	Gender		
	a. Male	a. 412	a. 100%
	b. Female	b. 0	b. 0%
2	Responsibility		
	a. Hauler Operator	a. 357	a. 87%
	b. Loader Operator	b. 55	b. 13%
3	Work Experience		
	a. 0 - 12 Months	a. 73	a. 18%
	b. 1 - 3 Years	b. 99	b. 24%
	c. 4 - 5 Years	c. 12	c. 3%
	d. 6 - 10 Years	d. 47	d. 11%
	e. > 10 Years	e. 181	e. 44%

The measurement testing is conducted using the SmartPLS application. This testing aims to calculate the outer model values, namely: convergent validity, discriminant validity, and composite reliability. The purpose of this testing is to substantiate that statements related to each variable can be understood by respondents as expected by the researcher. It also validates the accuracy, consistency, and precision of the instrument in measuring constructs.

The first process involves testing convergent validity, which is executed by assessing loading factors and Average Variance Extracted (AVE). The evaluation of loading factors is confirmatory research, with an indicator considered valid if it has a value greater than 0.70. The results, almost all indicators are valid, with loading factor values very high, above 0.88.

The next step involves the second convergent validity test, which is the Average Variance Extracted (AVE). If the AVE has a value equal to or greater than 0.5, it is considered valid or acceptable. The larger the value, the higher its ability to explain the level of variation in a construct gathered from its indicators.

Table 4. Testing AVE of TAM2 EwacsPro

	AVE
Experience (EX)	0.931
Intetion to Use (ITU)	0.881
Job Relevant (JR)	0.938
Output Quality (OQ)	0.918
Perceived Ease of Use (PEOU)	0.825
Perceived Usefulness (PU)	0.917
Result Demonstrability (RD)	0.932
Subjective Norm (SN)	0.958
Usage Behaviour (UB)	0.966
Voluntariness (VO)	1.000
EX * SN to ITU	1.000
EX * SN to PU	1.000
VO * SN to ITU	1.000

In the AVE testing in the SEM (Structural Equation Modeling) test for the TAM2 EwacsPro system, all indicators show values above 0.8, indicating that the testing of the indicators is acceptable. The ability to explain the level of variation in a construct gathered from its indicators is very high.

The next step involves discriminant validity testing by measuring the loading factor values of each indicator against their cross-loading values (correlation between latent constructs). The test results indicate that all loading factor values are greater than their cross-loading values. This can be interpreted as the latent constructs (latent variables) predicting the measurement of indicators in their respective blocks better than the measurements in other blocks. Thus, it is concluded that the data meets the criteria for discriminant validity testing with an evaluation of cross-loading values.

Table 5. Testing loading factors against cross-loading

	EX	ITU	JR	OQ	PEOU	PU	RD	SN	UB	VO
EX1	**0.962**	0.77	0.854	0.806	0.866	0.838	0.892	0.858	0.758	0.845
EX2	**0.968**	0.832	0.929	0.701	0.824	0.907	0.938	0.916	0.822	0.889
ITU1	0.747	**0.932**	0.762	0.496	0.673	0.817	0.748	0.783	0.909	0.751
ITU2	0.743	**0.927**	0.768	0.504	0.671	0.82	0.744	0.778	0.873	0.755
ITU3	0.795	**0.929**	0.817	0.605	0.747	0.866	0.798	0.828	0.867	0.791
ITU4	0.78	**0.946**	0.797	0.562	0.716	0.842	0.781	0.804	0.866	0.764
ITU5	0.799	**0.938**	0.828	0.579	0.746	0.855	0.799	0.816	0.862	0.787
ITU6	0.803	**0.957**	0.83	0.574	0.741	0.87	0.808	0.824	0.901	0.792
ITU7	0.792	**0.941**	0.818	0.567	0.739	0.867	0.795	0.806	0.863	0.783
JR1	0.901	0.815	**0.967**	0.715	0.849	0.906	0.922	0.913	0.788	0.858
JR2	0.887	0.832	**0.968**	0.69	0.82	0.905	0.902	0.892	0.806	0.86
JR3	0.898	0.838	**0.97**	0.68	0.819	0.902	0.913	0.902	0.815	0.854
OQ1	0.671	0.499	0.624	**0.949**	0.752	0.573	0.662	0.613	0.469	0.605
OQ2	0.807	0.622	0.74	**0.968**	0.818	0.717	0.769	0.746	0.587	0.721
PEOU1	0.699	0.587	0.676	0.773	**0.9**	0.676	0.693	0.684	0.56	0.637
PEOU2	0.681	0.547	0.658	0.781	**0.882**	0.65	0.67	0.663	0.525	0.614
PEOU3	0.878	0.785	0.874	0.719	**0.925**	0.877	0.87	0.869	0.765	0.834
PEOU4	0.873	0.803	0.853	0.739	**0.926**	0.879	0.863	0.873	0.793	0.824
PU1	0.848	0.882	0.867	0.646	0.823	**0.952**	0.858	0.879	0.849	0.812
PU2	0.879	0.864	0.898	0.666	0.843	**0.97**	0.882	0.894	0.843	0.829
PU3	0.882	0.863	0.908	0.643	0.833	**0.964**	0.897	0.899	0.841	0.848
PU4	0.88	0.876	0.917	0.648	0.819	**0.96**	0.893	0.891	0.856	0.842
PU5	0.843	0.84	0.878	0.654	0.817	**0.94**	0.844	0.87	0.819	0.803
RD1	0.937	0.82	0.925	0.713	0.836	0.901	**0.962**	0.904	0.811	0.876
RD2	0.909	0.797	0.901	0.726	0.833	0.873	**0.968**	0.89	0.766	0.836
RD3	0.901	0.804	0.904	0.723	0.831	0.873	**0.969**	0.889	0.789	0.845
RD4	0.919	0.796	0.908	0.743	0.841	0.883	**0.963**	0.895	0.77	0.867
SN1	0.898	0.849	0.906	0.69	0.837	0.915	0.898	**0.979**	0.832	0.864
SN2	0.904	0.831	0.919	0.712	0.856	0.898	0.917	**0.978**	0.806	0.858
UB1	0.806	0.912	0.815	0.55	0.736	0.866	0.796	0.824	**0.983**	0.787
UB2	0.805	0.926	0.815	0.546	0.729	0.862	0.8	0.82	**0.983**	0.797
VO1	0.899	0.825	0.886	0.698	0.815	0.864	0.887	0.88	0.806	**1**

Reliability testing is also conducted using the SmartPLS application. This testing is carried out to examine the consistency of responses to questions in the questionnaire. It is a part of composite reliability testing. Reliability testing is performed by examining the values of Cronbach's Alpha and Composite Reliability. The reliability test with Cronbach's alpha is considered satisfactory if the coefficient value is above 0.70 or close to 1. The testing on the variables under examination indicates that the results have a high level of reliability because the reliability coefficients for each tested variable are above 0.90, approaching the value of 1.

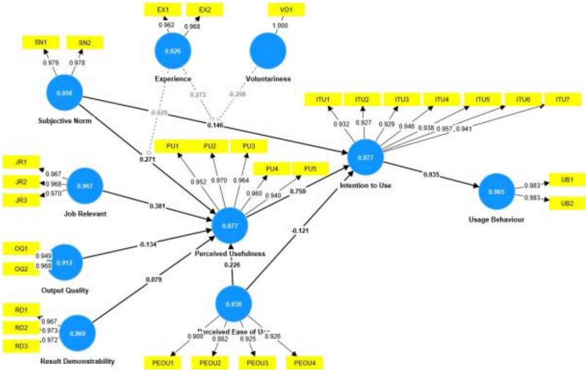

Figure 7. Cronbach Alpha Reliability Test on TAM2 Model

Furthermore, a measurement of composite reliability values is also conducted. The results indicate that all indicators have values above 0.9, exceeding the minimum standard of 0.7. This implies that the study has high consistency and reliability.

The inner model is a structural model that connects the correlation between constructs. To test the magnitude of the influence between constructs (latent variables) based on the path coefficient values, bootstrapping calculations are performed. The initial measurement in this stage is carried out by conducting R-square testing. The variation level of changes in the independent variable to the dependent variable with R-Square values of 0.75, 0.50, and 0.25 each indicates a strong, moderate, and weak model, respectively. Table 4.9 shows the results of R-square and adjusted R-square testing, where the influence on all endogenous variables has values greater than 0.75. This means that there is a strong influence from the measurement of exogenous latent variables on endogenous latent variables. ¬R-squared only provides information about the proportion of variance explained by the model, while adjusted R-squared takes into account the number of predictors (independent variables) in the model.

Table 6. The R-Square testing on TAM2 EwacsPro data processing

	R Square	*R Square Adj*
Intention to Use (ITU)	0.839	0.837
Perceived Usefulness (PU)	0.910	0.909
Usage Behaviour (UB)	0.874	0.874

A significant test is conducted. This measurement involves a significant test to observe the influence of independent variables on dependent variables. In the significance test for TAM2 EwacsPro system, a 5% error limit is used. The significance of the direction of this relationship is determined based on the t-statistic value or p-value. If the p-value is less than 0.05 or the t-statistic is greater than 1.96, it indicates a significant influence between the independent variable and the dependent variable under investigation.

Table 7. Path Coefficients – Mean, STDev, T values, P values

	Original Sample	*Sample Mean*	*STDEV*	*T statistics*	*P values*
EX -> ITO	-0.044	-0.042	0.064	0.687	0.492

EX -> PU	0.090	0.090	0.067	1.338	0.181
ITU -> UB	0.935	0.934	0.012	79.359	0.000
JR -> PU	0.373	0.378	0.080	4.670	0.000
OQ -> PU	-0.135	-0.135	0.030	4.507	0.000
PEOU -> ITU	-0.121	-0.121	0.046	2.659	0.008
PEOU -> PU	0.225	0.224	0.049	4.595	0.000
PU -> ITU	0.759	0.761	0.086	8.856	0.000
RD -> PU	0.103	0.104	0.075	1.369	0.171
SN -> ITU	0.146	0.142	0.078	1.878	0.060
SN -> PU	0.267	0.263	0.073	3.669	0.000
VO -> ITU	0.142	0.142	0.057	2.499	0.012
VO x SN -> ITU	-0.298	-0.291	0.067	4.446	0.000
EX x SN -> ITU	0.272	0.267	0.068	4.012	0.000
EX x SN -> PU	-0.030	-0.029	0.008	3.822	0.000

There are ten variables with two moderating variables: experience and voluntariness. Each variable is interconnected with the others, and each variable has indicators that have been organized.

The experience of using the EwacsPro system does not have a significant direct influence on the operator's willingness to use the system (intention to use) because the use of this system is mandatory for all operators whose heavy equipment is equipped with EwacsPro devices. This relationship has a p-value of 0.492 and a t-statistic of 0.687. Experience also does not have a direct impact on perceived usefulness, with a p-value of 0.181 and a t-statistic of 1.338.

Usage behavior is significantly influenced by Intention to use with a high positive influence coefficient, namely the original sample value or regression coefficient of 0.935 (p-value 0 and t-statistic 79.359). Strict control from the system will encourage users' behavior to become a habit. In this case, H12 is accepted, and H012 is rejected.

The relevance of features and the use of the EwacsPro system in supporting the operator's work also has a significant positive influence on the perceived usefulness of the system for users, with a regression coefficient value of 0.373. The p-value is 0, and the t-statistic is 4.670, therefore H6 is accepted, and H06 is rejected.

The perceived output quality also has a significant positive relationship with perceived usefulness, with a p-value of 0 and a t-statistic of 4.507. This indicates that H7 is accepted. However, the quality of output has a significant negative impact on perceived ease of use, with a regression coefficient value of -0.135. Bugs or errors in the device, as well as ongoing hardware issues, need to be addressed quickly and continuously.

The perceived ease of use has a significant negative impact, with a p-value of 0.008 and a t-statistic of 2.659, on the intention to use. This indicates that H10 is accepted with a regression coefficient of -0.121. Some issues with the sensitivity of the device screen are still complained about by operators, especially when facing LTE network stability issues. Although LTE network connectivity is better than other third-party auto dispatch system connection features, the operators' expectations are high for experiencing ease of use. Some areas that are still not covered by the network should also be a concern.

The perceived ease of use also has a significant positive impact on perceived usefulness by the operator. In this case, the influence of ease of use is positive with a regression coefficient of 0.225. The p-value is 0, and the t-statistic is 4.595, indicating that H9 is accepted, and H09 is rejected.

The intention to use the EwacsPro system is significantly positively influenced by the perceived usefulness, with a p-value of 0 and a t-statistic of 8.856. H11 is accepted with a regression coefficient of 0.759.

Result demonstrability related to the operator's understanding and knowledge of the use and benefits of EwacsPro does not have a significant effect on perceived usefulness. Therefore, H8 is rejected, and H08 is accepted with a p-value of 0.171 and a t-statistic of 1.369.

The p-value of subjective norm on intention to use is 0.06, and the t-statistic is 1.878. In this case, the value of H2 is rejected because the subjective norm has a less significant effect on intention to use. If further analyzed regarding the moderation variables, operator experience in using the system moderates or influences the relationship between subjective norm and intention to use, with a regression coefficient of 0.272 (H3 accepted). This relationship is also influenced by the moderating variable voluntariness with a negative regression coefficient of -0.298 (H5 accepted). This means that voluntariness can weaken the level of influence of subjective norm on the operator's willingness to use the EwacsPro system. Moderation analysis includes testing the moderating effect of a variable on the correlation between two other variables in SEM. In this case, the moderator variable plays a role in influencing the strength or direction of the relationship between independent and dependent variables. The encouragement from supervisors and management for operators to use EwacsPro should be stronger and firmer for a faster and more massive awareness of utilizing the provided technology.

Subjective norm has a direct significant positive relationship with the perceived benefits of operators using EwacsPro, with a p-value of 0 and a t-statistic of 3.669. H1 is accepted with a regression coefficient of 0.267. In addition, this relationship is also influenced by the moderating variable of experience using the EwacsPro system with a negative moderation of -0.03 (H4 accepted).

4.3 Business Model Canvas

This model is created based on the detailed observations of the researcher to serve as a guide that is quite efficient in creating value for EwacsPro, identifying the needs of operators as customers, and determining the necessary resources.

Figure 8. Business Model Canvas of EwacsPro System

From the BMC analysis, it can be concluded that EwacsPro is already able to address most customers' needs. Customer expectations for EwacsPro usage include auto dumptruck assignment, live feedback for operators, and a real-time performance dashboard for quick and precise problem-solving, even up to the prevention level. All fundamental needs are accommodated in the existing system, but there are still opportunities for improvement, development, or refinement to ensure that the system can meet all needs up to the gain level.

6. Conclusions

Internally, the Technology Readiness Level (TRL) of the company is at level 9, with 80% fulfillment condition of each indicator. EwacsPro at jobsite ABC, being the first auto dispatch system in Indonesia using LTE communication technology, has been technically tested, tested in real conditions, and is suitable for mass production within the company. Based on the analysis of the Technology Acceptance Model 2 (TAM2), the R-square testing also shows that all values are above 0.75, indicating a strong influence of the measurement of exogenous latent variables on endogenous latent variables. Intention to Use significantly influences Usage Behaviour. Intention to Use is positively influenced mainly by Perceived Usefulness, while Perceived Ease of Use has a negative impact. Voluntariness moderates the negative influence of Subjective Norm on Intention to Use, while Experience has a positive moderating effect. Perceived Usefulness is positively influenced by Perceived Ease of Use, Job Relevance, and Subjective Norm, with negative moderation by Experience, while Output Quality has a direct negative impact on Perceived Usefulness. The company addresses device and network issues through daily maintenance programs and evaluates additional coverage areas with operational mining development. The company also studies the customer empathy map to understand pain points and gains from EwacsPro users and develops reports that provide effective and efficient operational recommendations. Additionally, the company implements a refresh program for EwacsPro users to update them on every feature development.

The research has a novelty of the tested EwacsPro system readiness. However it still has opportunity to improve: the need to create a more varied questionnaire by combining positive and negative questions so that the results of respondents' responses are more accurate and also it is necessary to analyze the details by comparing each variable parameter between the EwacsPro system and other auto dispatch systems so that it can be a reference for developing EwacsPro in detail.

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