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Analysis of Technology Acceptance Model for Implementation of Sustainable Construction Water Resources Project in Kediri City

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ABSTRACT

Water resource projects in Kediri include various initiatives aimed at improving the quality of life of the community and preserving the environment. This study identifies factors that influence the acceptance of environmentally friendly technologies in sustainable water resource projects in Kediri City, such as the construction of Embung Kalipang, Ngrayut, Dhoho Airport, water source conservation in Sumber Dadapan, and the development of Sumber Banteng. The installation of Automatic Water Level Recorder (AWLR) also helps in real-time monitoring of water levels for flood mitigation. Using the Technology Acceptance Model (TAM) approach, this study analyzes two main variables, namely perceived ease of use (PEOU) and perceived usefulness (PU) of green technology. The survey data collected were analyzed using the Partial Least Squares (PLS) method, which revealed that perceptions of ease of use and benefits of technology influence attitudes and intentions to adopt technology in construction. Although the potential for adoption is high, challenges such as lack of knowledge and implementation costs are major barriers. These findings provide insights for formulating policies that support the implementation of environmentally friendly technologies and become the basis for developing sustainable projects in Kediri in the future.

Keywords: *Technology Acceptance, Environmentally Friendly Construction, Water Resources, TAM, Kediri.*

INTRODUCTION

Water resource projects in Kediri include various initiatives aimed at improving the quality of life of the community and preserving the environment. Some of the main projects include the construction of Embung Kalipang and Ngrayut for irrigation, fisheries, and tourism; the development of Dhoho Kediri International Airport which is expected to support the regional economy; water resource conservation through reforestation in Sumber Dadapan; and the development of Sumber Banteng as an irrigation and tourism destination. In addition, the installation of Automatic Water Level Recorders (AWLR) at several points allows real-time monitoring of river water levels, assisting in water resource management and flood mitigation. These efforts demonstrate Kediri's strong commitment to sustainable and environmentally friendly water resource management.[1][2][3][4].

Water resources projects play a crucial role in meeting community needs and improving quality of life. However, this sector is also a significant contributor to environmental issues, given the large number of non-renewable resources used in the construction process. These construction materials often have a negative impact on the environment, so the Indonesian government has established a green construction policy to minimize this impact. In Kediri, several water resources projects, such as Embung Kalipang, Embung Ngrayut, and Dhoho Airport, are proof of the region's commitment to supporting sustainable development.[3][4].

The concept of green construction includes planning and managing construction projects with an approach that aims to minimize negative impacts on the environment. According to the US Environmental Protection Agency (2013), green construction ensures resource efficiency throughout the life cycle of a building, from planning, construction, to demolition. The construction of reservoirs in Kediri, for example, aims to conserve water while meeting irrigation needs and opening up tourism opportunities. In addition, the installation of Automatic Water Level Recorders (AWLR) at several important points helps in real-time monitoring of water levels, supporting more effective flood mitigation efforts.[5].

At the regulatory level, Indonesia has implemented various regulations that support the implementation of sustainable construction, including Law No. 28 of 2002 concerning Building Construction and Regulation of the Minister of Environment No. 8 of 2010 concerning certification of environmentally friendly buildings. In Kediri, the implementation of this regulation is an initial step followed by the principles of reduce, reuse, and recycle in construction activities. ISO 14000s and OHSAS certification are now used as benchmarks for sustainability and operational standards for environmentally friendly projects, strengthening the sustainability aspect in project implementation in this area.[6][7].

As part of Agenda 21, the government emphasizes the active role of contractors in implementing green construction. In Kediri, the development of water sources, such as Sumber Banteng, is a real example of the construction sector's contribution to sustainability. This water source not only supports agricultural irrigation but is also developed as an environmentally friendly tourist destination. In addition, the local government encourages the community to be actively involved in environmental conservation, such as through greening activities around water sources.

The implementation of green construction requires the support of human resources who are able to adopt environmentally friendly technology. In this context, the Technology Acceptance Model (TAM) according to Davis, 1989 is a common approach used to evaluate the acceptance of new technology in the construction sector. With a combination of the Partial Least Square (PLS) method, the study can identify the main factors that influence the success of technology adoption in sustainable water resource projects in Kediri. This analysis is the basis for the government and industry players in designing effective strategies and policies to overcome obstacles and facilitate the adoption of more sustainable technology.[8] [9][10].

The study entitled "Analysis of Technology Acceptance Model for the Implementation of Sustainable Construction Water Resources Projects in Kediri City" is very important because it can identify factors that influence the adoption of environmentally friendly technology in construction, especially in water resources projects. By using the Technology Acceptance Model (TAM), this study can evaluate aspects such as the perception of ease and benefits of technology that influence the readiness of construction actors in implementing sustainable technology. This study is also expected to provide insight for the government and contractors regarding the policies and human resource training needed to support green construction in Kediri. The results of this study will be useful in optimizing the implementation of green construction, as well as being a guide for other regions that want to follow Kediri's steps in

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realizing environmentally friendly development.

METHOD

This study aims to examine the factors that influence the acceptance of the implementation of sustainable water resources projects in the construction sector through a perception survey of construction industry players. This survey measures the responses of contractors, consultants, and academics related to the implementation of sustainable construction projects in Kediri. The approach used is confirmatory research, which is a type of research that aims to prove or test existing theories, so that it can provide a basis for researchers in formulating subsequent strategies.

This study adopts the Technology Acceptance Model (TAM) as the main analytical framework, by assessing key factors such as perceived ease of use (Perceived Ease of Use), perceived usefulness (Perceived Usefulness), attitude toward using (Attitude Toward Using), intention to use (Behavioral Intention), and actual usage (Actual Usage). This model also involves additional variables such as subjective influence (Subjective Norm), job relevance (Job Relevance), output quality (Output Quality), and ease of demonstration of results (Result Demonstration). Each variable and its indicators aim to measure the extent to which sustainable construction technology is accepted and implemented.

Data collection was conducted using a questionnaire instrument designed based on TAM variable indicators. Each respondent was asked to rate each indicator using a Likert scale designed to measure their perceptions regarding the use of green technology in construction projects. The use of this scale makes it easier to analyze the level of acceptance of industry players towards sustainable water resource projects in Kediri.

The collected data were analyzed using the Partial Least Square (PLS) approach, which allows researchers to test the relationship between variables in the TAM model efficiently. PLS was chosen because this method is oriented towards prediction, making it suitable for evaluating the direct and indirect effects of each variable on technology acceptance. This technique also allows for the analysis of more complex data and models involving multiple constructs.

Descriptive statistical approach is also used to provide an overview of the characteristics of respondents and their perceptions of the variables in the study. With this descriptive statistics, the study can display the general profile of respondents, for example their level of understanding of the concept of sustainable construction, as well as the factors that most influence the acceptance of technology in the implementation of green construction. In this study, the validity and reliability of the instrument were tested to ensure that the data produced was accurate and consistent. Validity testing was conducted to ensure that the instrument actually measured the intended variables, while reliability testing ensured the consistency of respondents' answers to the same indicators. This is important so that the research results can be relied on and are able to reflect the actual conditions.

The results of this study are expected to identify the factors that most influence the acceptance of sustainable technology in the construction sector. These findings are expected to provide recommendations for industry players and the government in designing relevant policies and training to increase the adoption of green construction in Indonesia, especially in Kediri City.

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RESULTS AND DISCUSSION

This study begins with a focus on the application of technology in sustainable construction water resources projects in Kediri City. Using the Technology Acceptance Model (TAM) and the Smart PLS analysis method, this study aims to analyze the factors that influence technology acceptance. Before selecting the outer loading, the model will be built and its reliability validated through the outer loading test to ensure that the constructs used in the model are valid and reliable in describing the research variables, as seen below.

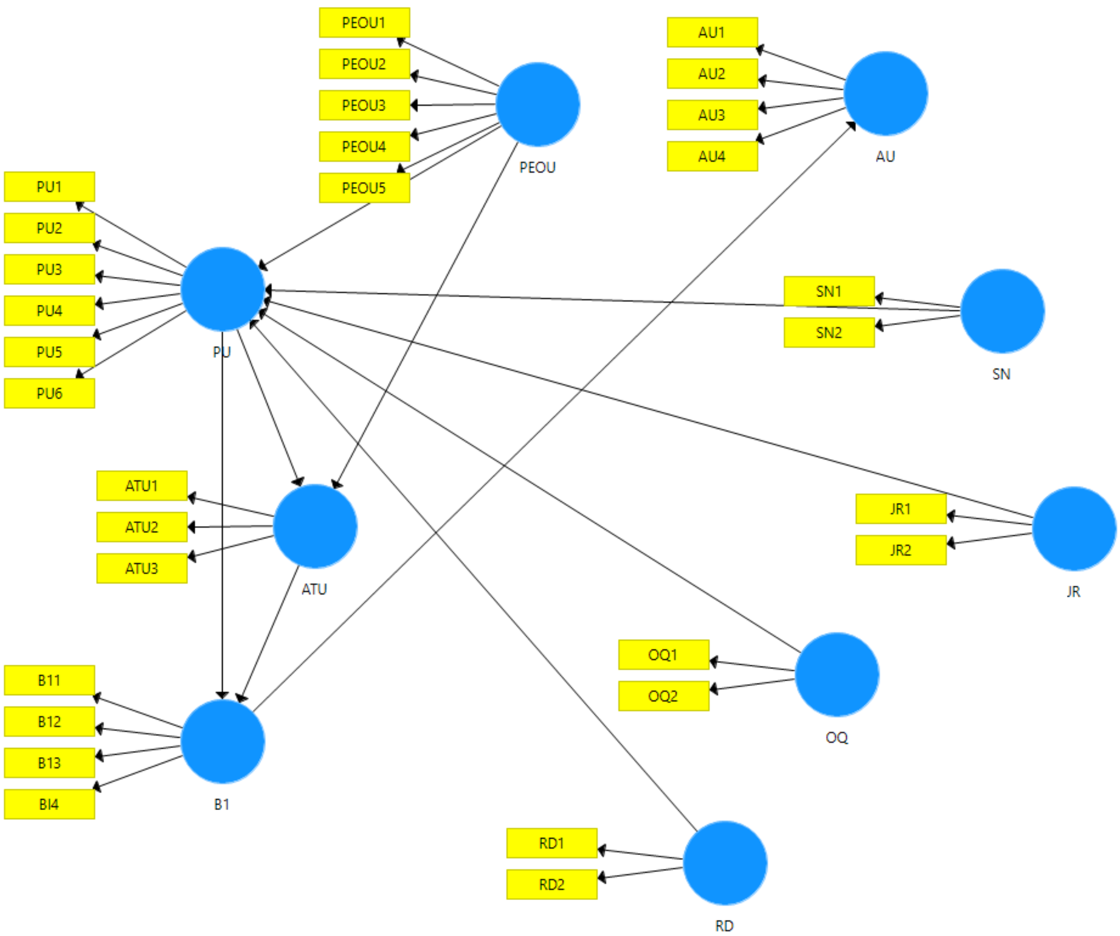

Figure 1. Beginning Before Outer Loading

Before processing this research, it is necessary to provide a clear picture of the data structure, so that it is easier to analyze further using statistical software, such as Smart PLS. Initial information regarding delimiters, encoding, sample size, number formats, and number of indicators is the first step to ensure that the data is read correctly. This understanding is important so that the analysis process, such as reliability testing and construct validity, can run effectively and produce accurate results. The data presented are as follows:

Table 1. Depiction of Questionnaire Results

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	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
PEOU1	1,000	0.000	3.303	3,000	2,000	4,000	0.577	-0.494	-0.148
PEOU2	2,000	0.000	3.364	3,000	3,000	4,000	0.481	-1,757	0.594
PEOU3	3,000	0.000	3.152	3,000	2,000	4,000	0.609	-0.287	-0.096
PEOU4	4,000	0.000	2,606	3,000	2,000	3,000	0.489	-1,913	-0.455
PEOU5	5,000	0.000	4.212	4,000	4,000	5,000	0.409	0.187	1,476
PU1	6,000	0.000	3,667	4,000	3,000	4,000	0.471	-1,548	-0.741
PU2	7,000	0.000	4.485	5,000	3,000	5,000	0.557	-0.769	-0.489
PU3	8,000	0.000	4,576	5,000	4,000	5,000	0.494	-2.023	-0.321
PU4	9,000	0.000	4,545	5,000	4,000	5,000	0.498	-2.094	-0.191
PU5	10,000	0.000	3.364	3,000	3,000	4,000	0.481	-1,757	0.594
PU6	11,000	0.000	4,879	5,000	4,000	5,000	0.326	4.170	-2.433
ATU1	12,000	0.000	4.788	5,000	4,000	5,000	0.409	0.187	-1.476
ATU2	13,000	0.000	4,848	5,000	4,000	5,000	0.359	2.287	-2,038
ATU3	14,000	0.000	4.424	4,000	4,000	5,000	0.494	-2.023	0.321
B11	15,000	0.000	3.606	4,000	3,000	4,000	0.489	-1,913	-0.455
B12	16,000	0.000	3,758	4,000	3,000	4,000	0.429	-0.443	-1.260
B13	17,000	0.000	3.636	4,000	3,000	4,000	0.481	-1,757	-0.594
BI4	18,000	0.000	3.485	3,000	3,000	4,000	0.500	-2.129	0.064
AU1	19,000	0.000	2,758	3,000	2,000	3,000	0.429	-0.443	-1.260
AU2	20,000	0.000	3.273	3,000	3,000	4,000	0.445	-0.915	1,070
AU3	21,000	0.000	2,848	3,000	2,000	4,000	0.557	0.168	-0.042
AU4	22,000	0.000	2,788	3,000	2,000	3,000	0.409	0.187	-1.476
SN1	23,000	0.000	2.242	2,000	2,000	3,000	0.429	-0.443	1,260
SN2	24,000	0.000	2,848	3,000	2,000	3,000	0.359	2.287	-2,038
JR1	25,000	0.000	2,697	3,000	2,000	3,000	0.460	-1.274	-0.899
JR2	26,000	0.000	2,848	3,000	2,000	3,000	0.359	2.287	-2,038
OQ1	27,000	0.000	2,576	3,000	2,000	3,000	0.494	-2.023	-0.321
OQ2	28,000	0.000	1,545	2,000	1,000	3,000	0.555	-0.855	0.368
RD1	29,000	0.000	1,000	1,000	1,000	1,000	0.000	n/a	n/a
RD2	30,000	0.000	1,000	1,000	1,000	1,000	0.000	n/a	n/a

The image above is the data presented as the result of descriptive statistical analysis of various items that measure two main constructs, namely Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). Each item is analyzed using statistical measures such as mean, median, standard deviation, min (minimum), and max (maximum). The average provides an overview of the tendency of respondents' assessments, for example, PEOU5 has an average of 4.212 which indicates a high assessment from most respondents. In addition, the standard deviation describes the extent to which the data is spread out, with lower values indicating more centralized data. For example, item PEOU5 has a low standard deviation (0.409), indicating that respondents tend to give similar assessments.

In addition, this statistical analysis also includes kurtosis and skewness, which each provide insight into the shape of the data distribution. Kurtosis measures how steep or flat the data

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distribution is compared to a normal distribution, with negative values indicating a flatter distribution, as seen in PEOU4 (-1.913). Meanwhile, skewness indicates whether the data distribution is skewed to the left or right; items such as PEOU5 with positive skewness (1.476) indicate a distribution of data that is more at high values. Overall, this analysis provides a deeper understanding of how respondents rated each item, as well as the distribution and tendency of their assessments of the construct being measured. Furthermore, the validation data can be generated as follows:

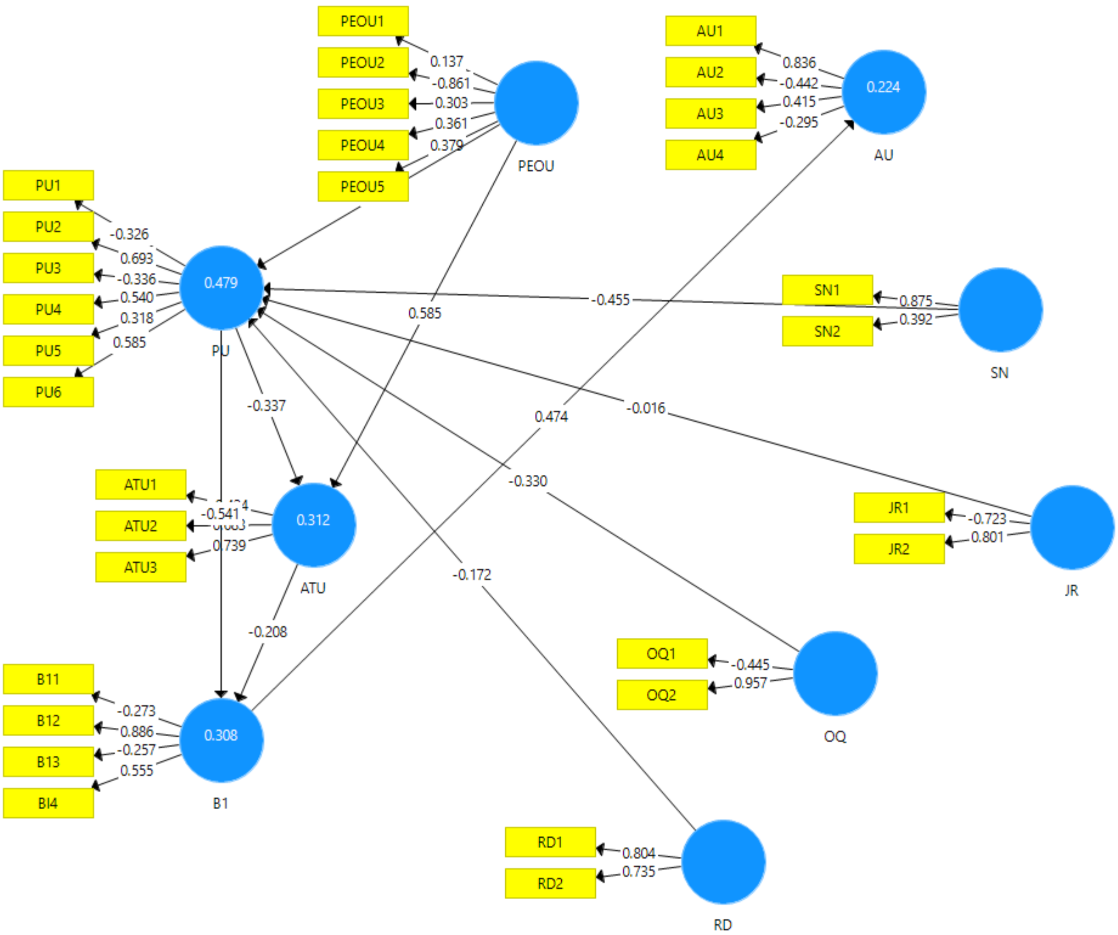

Figure 2. Initial Outer Loading

The outer loading requirement in Smart PLS analysis stipulates that the outer loading value should ideally be above 0.7 for the indicator to be considered valid and reliable in explaining the construct. If the outer loading value is between 0.5 and 0.7, the indicator can still be considered, especially if the removal of the indicator can reduce the overall reliability of the construct. However, if the outer loading value is below 0.4, the indicator should generally be removed because its contribution to the construct is considered weak. Furthermore, the outer loading results are sorted as follows;

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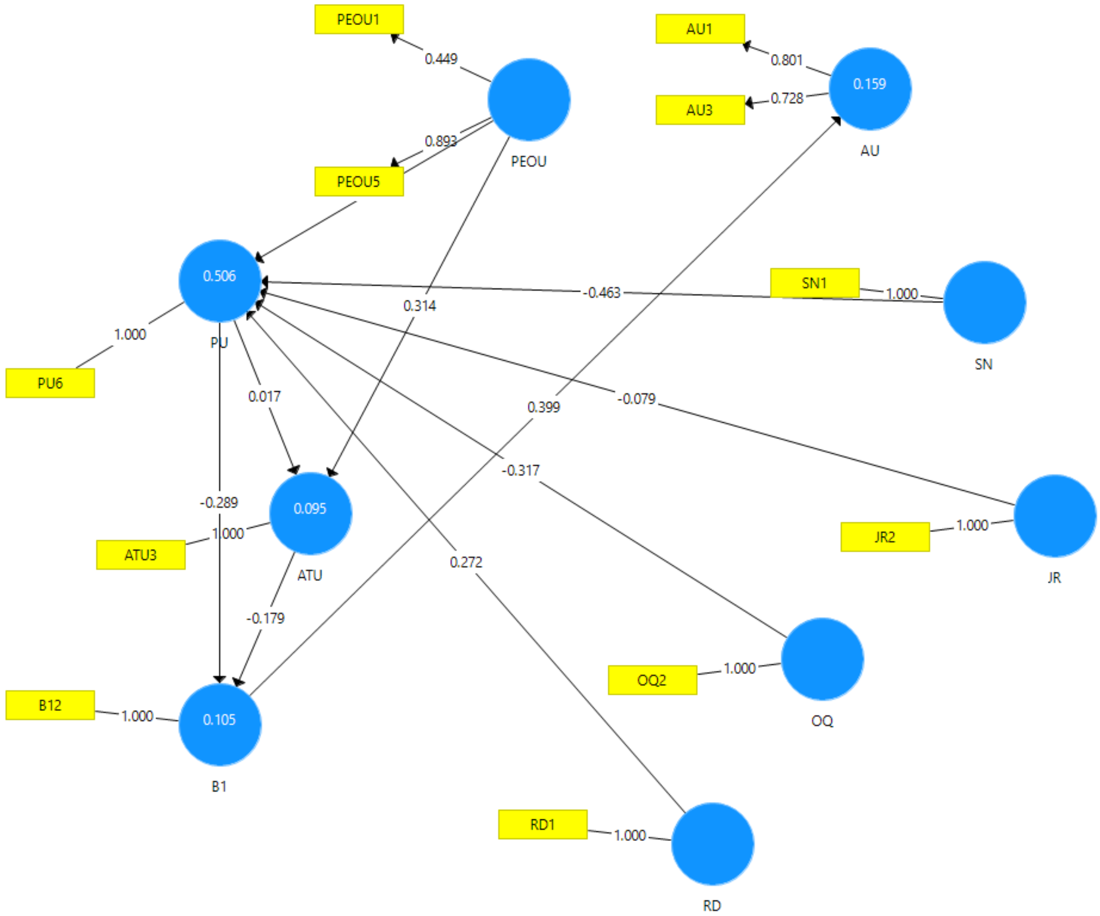

Figure 3. Image after Outer Loading sorting

The results of the studySmart PLS analysis is required, the value R Square**e**and R Square Adjusted is used to measure how much the independent variable is able to explain the dependent variable in the model, where R Square Adjusted provides adjustments to make the results more accurate, especially in models with many indicators.

Table 2. R Square Table

	R Square	**R Square Adjusted**
ATU	0.095	0.034
AU	0.159	0.132
B1	0.105	0.046
PU	0.506	0.414

The table shows the regression results for the variables ATU, AU, B1, and PU, with valuesR SquareAndAdjusted R Square. MarkR Squaredescribes the percentage of variability of the dependent variable explained by the model, where PU has the highest value (0.506), indicating good explanatory power.Adjusted R Squarecorrecting R Square to consider the number of variables and samples, so that it is more accurate. With the highest Adjusted R Square value in PU (0.414), this model is considered the strongest compared to other variables.

Table 3. f squares

	ATU	**AU**	**B1**	**JR**	**OQ**	**PEOU**	**PU**	**RD**	**SN**
ATU			0.035						
AU									
B1		0.190							
JR							0.011		
OQ							0.192		
PEOU	0.094						0.149		
PU	0.000		0.092						
RD							0.147		
SN							0.404		

This table shows the correlation coefficients between several variables, such as ATU, AU, B1, JR, OQ, PEOU, PU, RD, and SN. The correlation value reflects the strength and direction of the relationship between pairs of variables; values close to 1 indicate a strong correlation, while values close to 0 indicate a weak correlation or almost no relationship. For example, the correlation between SN andOQis 0.404, indicating a relatively stronger positive relationship compared to other pairs of variables. On the other hand, variables such asATUAndPEOUhas a correlation of only 0.094, which indicates a very weak relationship. Overall, the low correlation value in this table indicates that most of the variables do not have a strong relationship with each other, so they tend to stand alone in their respective influences. Next, the validity and reliability are processed

Table 4. Validity and reliability

	Cronbach's Alpha	**rho_A**	**Composite Reliability**	**Average Variance Extracted (AVE)**
ATU	1,000	1,000	1,000	1,000
AU	0.294	0.298	0.738	0.586
B1	1,000	1,000	1,000	1,000
JR	1,000	1,000	1,000	1,000
OQ	1,000	1,000	1,000	1,000
PEOU		-0.000	0.643	0.500
PU	1,000	1,000	1,000	1,000
RD	1,000	1,000	1,000	1,000
SN	1,000	1,000	1,000	1,000

This table shows the results of reliability and validity testing for several variables (ATU, AU, B1, JR, OQ, PEOU, PU, RD, and SN). Cronbach's Alpha and rho_A measures the internal consistency of each variable; most variables have a value of 1.000, indicating very high reliability, except for AU which has a low value (0.294 and 0.298). Composite Reliability also shows that most variables have a very good value (1.000), but AU and PEOU have slightly lower values, namely 0.738 and 0.643. Finally, Average Variance Extracted (AVE) measures how well a variable explains its indicators, with a value above 0.5 considered adequate. Here, all variables have high AVE values, except for PEOU (0.500) and AU (0.586), which are still quite adequate. Overall, this table shows that most variables have good reliability and validity, but AU and PEOU require further attention because the results are lower than other variables. The following discussion of discriminant validity is carried out:

Table 5. Discriminant validity

	ATU	**AU**	**B1**	**JR**	**OQ**	**PEOU**	**PU**	**RD**	**SN**
ATU	1,000								
AU	0.148	0.765							
B1	-0.151	0.399	1,000						
JR	0.162	0.275	-0.241	1,000					
OQ	-0.033	0.041	0.277	-0.223	1,000				
PEOU	0.307	0.142	0.073	-0.212	0.010	0.707			
PU	-0.097	-0.309	-0.271	0.104	-0.291	-0.364	1,000		
RD	0.271	0.039	0.097	-0.056	0.078	0.058	0.256	1,000	
SN	0.210	0.333	0.155	-0.144	0.022	0.234	-0.537	-0.045	1,000

The table above is a correlation matrix showing the relationship between variables such as ATU, AU, B1, JR, OQ, PEOU, PU, RD, and SN. The correlation value ranges from -1 to 1, where a value close to 1 indicates a strong positive correlation, a value close to -1 indicates a strong negative correlation, and a value close to 0 indicates a weak correlation or no relationship at all. For example, the variables AU and B1 have a moderate positive correlation (0.399), which means that when AU increases, B1 tends to increase as well. Meanwhile, PU and SNshows a fairly strong negative correlation (-0.537), indicating that when the PU value increases, the SN value tends to decrease, and vice versa. These results provide an overview of the relationship between variables that can be the basis for further analysis.

Table 6. VIF

	VIF
ATU3	1,000
AU1	1,031
AU3	1,031
B12	1,000
JR2	1,000
OQ2	1,000
PEOU1	1,000
PEOU5	1,000
PU6	1,000
RD1	1,000
SN1	1,000

VIF (Variance Inflation Factor) measures multicollinearity in regression. A VIF value below 10 indicates no significant multicollinearity problem. In the data you provided, most variables have a VIF of 1.000, which means there is no high correlation between variables. AU1 and AU3 have a VIF of 1.031, which is still safe. Overall, this data shows no multicollinearity problem. Next, the model fit discussion is carried out as follows;

Table 7. Fit model

	Saturated Model	**Estimated Model**
SRMR	0.097	0.134
d_ULS	0.618	1.180
d_G	0.172	0.321
Chi-Square	32,492	52,604
NFI	0.565	0.295

Based on the model analysis carried out above, it can be concluded thatSaturated Modelbetter at matching data compared toModel Estimated. This can be seen from the lower SRMR value in the Saturated Model (0.097 vs 0.134), which indicates a better model fit. In addition, the valued_ULSAndd_Gis also lower in the Saturated Model, indicating a smaller difference between the estimated and actual covariance matrices. The Estimated Model shows a value ofChi-Squarehigher (52,604 vs 32,492), which means a worse model fit, as well as a lower valueNFIlower (0.295 vs 0.565), indicating that the Saturated Model is better in terms of fit to the data. Overall, the results of this evaluation indicate that the Saturated Model provides better performance and is more appropriate to the existing data compared to the Estimated Model.

This study examines technology acceptance in the implementation of sustainable water resources projects in Kediri City, which uses the Technology Acceptance Model (TAM) to evaluate the adoption of environmentally friendly technologies in the construction sector. This modeling is very relevant to the statistical analysis conducted previously, where the TAM model can be further analyzed using the Partial Least Squares (PLS) approach, which is often used to understand the relationship between more complex variables in the context of technology acceptance. Descriptive statistical analysis such as mean, median, and standard deviation used to describe respondents' perceptions of various items (e.g., Perceived Ease of Use (PEOU) and Perceived Usefulness (PU)) in the TAM provides important insights into the factors that influence technology acceptance.

In the PEOU and PU sections, items with high mean values, such as PEOU5 and PU6, indicate that most respondents have a positive view of the technology applied in water resource projects, such as the use of Automatic Water Level Recorder (AWLR) for real-time water monitoring. In contrast, more extreme skewness and excess kurtosis values in some items such as PEOU2 and PU3 indicate a more heterogeneous perception, where a small number of respondents may have difficulty or skepticism towards the technology.

The results of this modeling will help to dig deeper into how factors such as attitude toward using and subjective norms interact with the perception of ease and benefits of using technology. Therefore, by combining the results of descriptive statistics and the application of TAM, this study seeks to identify whether the perception of ease and benefits can influence the intention and attitude of construction actors in Kediri in adopting sustainable technology.
Thus, technology acceptance in sustainable water resource projects such as those conducted in Kediri can be better understood by using a combination of statistical analysis techniques presented in this modeling. These findings are valuable in designing policies and training

strategies to increase acceptance and successful implementation of green construction in the future.

This study links with previous studies that highlight the importance of green construction and environmentally friendly technologies in the construction sector. The concept of green construction aims to reduce negative impacts on the environment.[11], which is also the main focus of this study. Using the Technology Acceptance Model (TAM), this study examines the perceptions of construction actors in Kediri towards the application of environmentally friendly technologies, such as Automatic Water Level Recorder (AWLR) and the construction of reservoirs for water conservation.

In addition, this study expands on previous research that discusses the role of regulations and policies in supporting sustainable construction. As stipulated in Law No. 28 of 2002 and Regulation of the Minister of Environment No. 8 of 2010, the implementation of these policies is essential for the success of sustainable projects. This study identifies how effectively these regulations are implemented in Kediri, as well as the extent to which they influence the acceptance of green technology in water resource projects.[6][7].
Finally, this study also deepens the understanding of factors that influence the acceptance of green technologies, including ease of use, benefits, and attitudes towards the technology. Previous studies have emphasized the importance of training and education for contractors to increase the adoption of new technologies. The results of this study provide insights for designing more effective policies and strategies to support green construction in Kediri and other areas.

This study provides a new contribution by applying the Technology Acceptance Model (TAM) to analyze the adoption of green technologies in water resource construction projects in Kediri. Although the concept of green construction has been widely discussed, this study focuses on the social and psychological factors that influence the acceptance of technologies such as Automatic Water Level Recorder (AWLR) and reservoir projects. By assessing the perceived ease of use and benefits of technology, this study introduces a more holistic approach to understanding the adoption of green technologies in the construction sector.

This study also refutes the view that only focuses on technical and planning aspects in implementing green technology, as often expressed in previous studies. Instead, this study shows that human factors, such as attitudes towards technology and intention to use, play an important role in determining the success of technology adoption in sustainable construction projects. This highlights the importance of considering psychological and social aspects in designing technology implementation strategies.

Thus, this study has significant practical utility, especially for the government and contractors in formulating policies that support the implementation of green construction. Identification of factors that influence technology acceptance can be used as a basis for training and capacity building for construction industry players, as well as designing more effective adoption strategies. The results of this study are expected to support the sustainability of water resource projects in Kediri and become a guide for other regions in achieving sustainable and environmentally friendly development.

CONCLUSION

This study shows that the acceptance of environmentally friendly technology in water resource construction projects in Kediri is influenced by several main factors, such as perceived ease of use, benefits of technology, and attitudes and intentions to use the technology. Social and psychological factors, which are often overlooked in previous studies, have an important role in determining the success of technology adoption. Thus, to ensure the success of implementing environmentally friendly technology, more attention needs to be paid to the human and social aspects in the construction sector.

Based on the research results, it is recommended that the local government and contractors in Kediri strengthen training and education on environmentally friendly technologies, and integrate social and psychological aspects into technology adoption programs. In addition, there needs to be increased socialization regarding the benefits and ease of use of green technology, in order to reduce resistance and increase the intention of construction industry players to implement sustainable solutions. Given the important role of sustainability in development, this strategy can be adapted by other regions that are also committed to achieving environmentally friendly development.

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