(RESEARCH ARTICLE)

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Improving environmental performance: Analyzing hazardous waste processing in public hospitals of Manokwari Regency

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Abstract

This study aims to investigate the relationship between Leadership Transformation Style, organizational commitment, and the environmental performance of hospitals in managing hazardous waste. The study uses Structural Equation Modeling with a Partial Least Square approach (SEM-PLS) to analyze the data. The study focuses on the Civil Servants, Honorary Employees, and Contracted Health Workers at the Government General Hospital in Manokwari Regency as the research subjects. The dimensions of Transformation Leadership Variable are measured using 4 dimensions consisting of 37 indicators, while the dimensions of Organizational Commitment Variables are measured by 3 dimensions with 16 indicators. The measurement of Environmental Performance Variables consists of 13 indicators. Hypothesis tests I and II demonstrate a positive correlation between transformational leadership and Hospital Environmental Performance, with path coefficients of 0.364 and p-values of 0.009 (<0.05). Additionally, the study shows that there is a significant relationship between organizational commitment and the environmental performance of hospitals, with a path coefficient of 0.483 and a p-value less than 0.05. Both hypothesis tests I and II confirmed the positive association between transformational leadership and Hospital Environmental Performance with path coefficients of 0.364 and p-values of 0.009 (<0.05). The study evaluates the PLS Predict test of the Structural Equation Modeling with Partial Least Square method (SEM-PLS) and suggests that the PLS model has medium predictive power.

1. Introduction

Hospitals are healthcare institutions for communities. They are always influenced by scientific and technological developments as well as the community's socio-economic conditions. Providing health services is the primary function of hospitals, which makes them a meeting place for people of diverse age groups, social strata, and interests. If hospitals do not manage their environmental sanitation conditions effectively, the interaction between community groups can lead to the spread of diseases and health problems. Health service activities in hospitals typically generate waste that may contain infectious germs and hazardous waste in solid, liquid, or gas form. In Indonesia, hazardous waste is called hazardous and toxic waste or "limbah B3".

Environmental pollution occurs when human activities introduce living things, substances, energy, or other components into the environment that causes its quality to fall to a level that prevents it from functioning as intended.(1) Indonesia is facing environmental challenges from the new industrial boom and needs to develop approaches to monitor, remediate and manage polluted sites. For example, the flow of tailings from PT Freeport Indonesia, which flows down the Ajkwa and Mimika Rivers in Papua. To restore a ravaged ecological system that spans 43,500 hectares, funding of 7.5 billion US dollars (Rp 67.8 trillion) is required (Sulistyani, R. 2007, p. 23).

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The distribution of hazardous waste production in Indonesia according to data from the Directorate of Performance Assessment of Hazardous and Non-Hazardous Waste Management - Ministry of Environment and Forestry as of June 2021 is 70.45 tonnes per day, and there are 112 waste management permits. Hazardous waste management in Indonesia is governed by Government Regulation No. 101 of 2014 Regarding Hazardous Waste Management. The results of the West Papua Health Service publication showed that during the Covid-19 pandemic in March and April 2020, there were 8.2 tonnes of Covid-19 hazardouse waste that was not disposed of properly. The main problem is that there is no incinerator in West Papua, so it is still being disposed of by burning.

2. Research Gap

This study is based on theoretical and empirical findings from previous studies on the Role of Environmental Accounting and hazardouse Waste. One of the limiting factors is weak legal sanctions in the country. Research has found a negative relationship between mandatory environmental disclosure legal sanctions and regulatory deviations carried out by companies.(2) Firstly, Environmental management is the main factor that affects the implementation of environmental accounting. Secondly, the Statement of accounting standards, and thirdly, the size of the organization have no significant impact on the implementation of environmental accounting.(3) Company size does not significantly affect the company's social and environmental disclosure (4) Organizational size and environmental management do not affect the implementation of environmental accounting.(5) Instead, the implementation of environmental accounting is affected by the statement of accounting standards. Additionally, the production of solid medical waste containing hazardous and toxic materials of hazardouse waste originates from eight health services, which include inpatient services, outpatient services (polyclinics), hemodialysis services, chemotherapy services, pharmaceutical services, emergency installation services (IGD), laboratory services, and surgical installation services. The types of hazardous and toxic solid medical hazardouse waste include disposable masks, disposable gloves, syringes, contaminated gauze/cotton, plabots, infusion hoses, alcohol swabs, catheters, medicine bottles, drug residues, contaminated aprons, used pads, vials, body tissues, tool wrappers, urine bags, hoses, HD jerry cans, and testers. The amount of hazardous and toxic solid medical hazardouse waste produced was 2553. The weight is 34 kg, with an average of 82.37 kg per day. During the storage phase, most of the waste has met the requirements stated in the Minister of Environment and Forestry Regulation No. 56 of 2015, except for some issues. These issues include rooms that can be accessed by insects, compaction of waste in a single bag, non-use of double plastic bags on leaky waste, negligence in using complete Personal Protective Equipment (PPE), and sub-optimal cleaning of the TPS hazardouse waste and waste storage containers after their transportation to third parties. During the transportation phase, most of the waste has met the requirements stated in the same regulation, except for some issues, such as lack of special paths, mistakes in tying the waste, and negligence in using complete PPE. However, some issues persist, such as a lack of a special path, tying errors, and negligence in using complete PPE. The fifth evaluation of hazardouse waste solid medical waste management at Tk.II Hospital dr. Soedjono Magelang has yielded a 76.39% score, which indicates that it still does not meet the requirements stated in the Minister of Environment and Forestry Regulation No. 56 of 2015. According to Wawuru's findings, Firstly, Doctor Kariadi Hospital Semarang's management system for medical solid waste currently utilizes an End of Pipe Treatment (EOP) System.

On a daily basis, the amount of medical solid waste generated is 536.5 kg, whereas domestic solid waste amounts to 1655.3 kg, which is three times higher than medical solid waste. In addition, improving the solid waste management system at RSUP Doctor Kariadi Semarang can involve a reduction in waste generation of 2.96% by rationalizing the use of medical materials; domestic waste can also be reduced by Reuse of 5%; dry leaves can be used as compost to Recycle 25% of the solid waste, whereas wood waste from felled trees in the hospital area can be used to Recycle 10%. Furthermore, the solid waste housekeeping procedure at Doctor Kariadi Hospital Semarang is considered satisfactory because it abides by the relevant laws and regulations. (6) In a prior study, Rachmawati (2009) revealed that performance is significantly influenced by organizational commitment, work motivation, and leadership style. Organizational culture, organizational commitment, and public accountability had a simultaneous positive and significant effect on Regional Hospital performance in the strong category. Organizational culture and organizational commitment had a partially positive effect in the low and significant category on Regional Hospital performance. Public accountability had a positive effect in the low category but not significantly on Regional Hospital performance. Organizational commitment, internal control, and the application of good corporate governance principles had a simultaneous positive and significant effect on Regional Hospital performance. Partial organizational commitment, internal control, and the application of good corporate governance principles have a positive but insignificant effect on Regional Hospital performance (7) Variable of transformational leadership has a direct effect on environmental performance through green creativity (8)

2.1. Research Question

This study is based on the Gap Research above, and the questions it addresses are as follows: What is the impact of Transformation leadership style and organization's commitment in hazardous waste management on the environmental performance of the hospital?

3. Material and methods

3.1. Research Design

This study involves testing a hypothesis and will be analyzed using a quantitative approach based on correlational inference statistics. The research focuses on civil servants, Honorary Employees, and Contract Health Workers at the Government General Hospital in Manokwari Regency who are the subject of the study. The overall population is 235 individuals, and a sample of 100 has been obtained using Stratified Random Sampling. This study uses primary data obtained through the distribution of questionnaires via Google Forms and field surveys as its data sources. The exogenous variables analyzed in this study are Leadership, Transformation, and Organizational Commitment, while the endogenous variable is Hospital Environmental Performance. The entire concept in the study refers to a measurement model that relies on reflective techniques and measures its items on a ten-point Likert scale. The Variable Dimension of Transformational Leadership is measured by four dimensions, consisting of 37 indicators, a three-dimensional organizational committee with 16 additional indicators for Environmental Performance.

3.2. Data Analysis Techniques

The technique used in this study is multiple linear regression analysis, specifically SEM-PLS. The PLS-SEM (Partial Least Squares-Structural Equation Modeling) technique used in this study focuses on the interaction between prediction and theory testing. As it is a variance-based SEM analysis that aims to test model theory, several measures were employed to declare the proposed model acceptable such as R Square, SRMR, and PLS Predict. It is essential to validate the results (9) Partial least squares (PLS) is a variance-based structural equation modeling analysis method designed to test model theories that emphasize prediction studies. As a result, various measures such as R Squared, Standardized Root Mean Square Residual (SRMR), and PLS Predict have been developed to establish the proposed model's acceptability.(10), The evaluation methods employed include the Goodness of Fit Index (GoF Index)(11), To overcome the data solution, outliers need to be removed, and bootstrapping needs to be performed. (12) . SEM-PLS is used as an alternative in this study because it possesses full statistical power and does not require certain assumptions such as normally distributed data. The measurement model used in this study comprises of both reflective and formative measurements of the variables of leadership, transformation, and organizational commitment, with the latter being evaluated by the significance of outer weight(13) The reflective measurement model is evaluated based on a loading factor of ≥ 0.70, average variance extracted (AVE) of ≥ 0.50, Heterotrait Monotrait Ratio (HTMT) below 0.90, as well as formel and lacker criterion to assess for discriminant validity. The formative measurement model is evaluated based on the significance of outer weight, with no multicollinearity between measurement items observed from the outer VIF > 5.(14)

4. Results

4.1. Outer Model Test

Results from the first stage of the Outer Model showed that out of the 37 Transformation Leadership Variable indicators, three had Factor loading values < 70. Similarly, from the 17 Organizational Commitment Variability indicators, five had Factor loading values < 70; hence, they were excluded from the model. Upon removal of the low loading factor value from the model, the first stage of model testing revealed that all Composite Reliability values > 0.8 (0.8 > 0.7). Additionally, all Average Variance values extracted AVE > 0.5 and the Cronbach's Alpha value was dominated with a value of > 0.8. We conclude that the first stage of the evaluation of the reflective measurement model has been met.
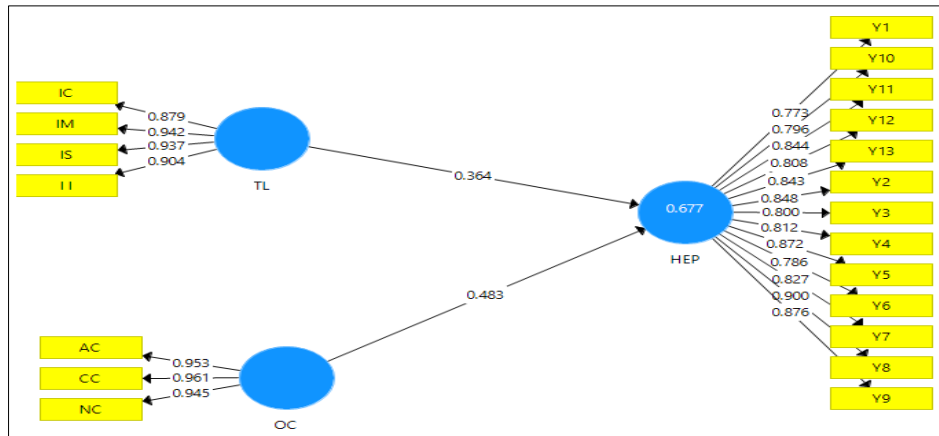
Figure 1 Test Results: Outer Model

The test results in Figure 1 show that the loading factor values of the dimensions of transformational leadership, organisational commitment and hospital environmental performance are > 0.5, so it can be concluded that the measurement items are valid and feasible as a test tool. The next step is to test validity by looking at the composite reliability and AVE results ;

Table 1 Contruct Reliability Test

Dimensions	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Transformation Leadership (TL)	0.936	0.939	0.954	0.839
Organizational Commitment (OC)	0.949	0.951	0.967	0.689
Hospital Environmental Performance (HEP)	0.962	0.963	0.966	0.689

The results indicate that the Cronbach's alpha value was > 0.7 and composite reliability was > 0.7, implying that all variables were reliable (15) In the AVE column, all values were > 0.5. Therefore, it can be concluded that the validity and reflective reliability tests were fulfilled .

Table 2 Fornell dan Lacker

Dimension	Transformation Leadership	Hospital Environmental Performance	Organizational Commitment
Transformation Leadership	0.916		
Hospital Environmental Performance	0.790	0.830	
Organizational Commitment	0.881	0.804	0.953

According to the test results conducted by Fornell and Lacker, the AVE root of Transformation Leadership Variability is 0.916, which is higher than the correlation with Hospital Environmental Performance at 0.790. Additionally, Hospital Environmental Performance has a higher correlation with organizational commitment at 0.830. Therefore, the discriminant validity of Transformation Leadership and Hospital Environmental Performance variables has been confirmed. The evaluation of discriminant validity based on measurement dimensions indicated that each item/dimension of measurement has a high correlation with the corresponding variability it measures. The discriminant validity evaluation was performed using the HTMT method, and the results show that the HTMT value of each variable pair is below 0.90, which can be accepted.

4.2. Model Feasibility Test

Prior to hypothesis testing, a multicollinearity test was conducted by examining the Inner VIF values of Transformational Leadership with a value of 0.092 and Organizational Commitment with a value of 0.161. Overall, the study is free of multicollinear symptoms with an inner VIF value of less than 5. This result supports the robustness (impartiality) of parameter estimation in SEM PLS. Furthermore, the model's feasibility was assessed by analyzing the R^2 value obtained. The R^2 value for this study was 67.6% (see table 4). This illustrates that the variation in variables for Hospital Environmental Performance is explainable by the Transformational Leadership and Organizational Commitment variables indicates a significant influence.

Table 3 Hypothesis Testing –Path Coeficient

Hypothesis	Path Coefficient	p-value	90 % Confidence Interval		f-Square
			Lower Limit (2,5%)	Upper Limit (97,5%)	
Transformation Leadership -> Hospital Environmental Performance	0.364	0.009	0.081	0.623	0.092
Organizational Commitment -> Hospital Environmental Performance	0.483	0.000	0.230	0.753	0.161

Based on the test results, it was found the first hypothesis (H1) is accepted where there is a significant influence of Transformation Leadership on hospital environmental performance with path coefficients (0.364) and p-values (0.009 < 0.05). The second hypothesis (H2) is accepted, where there is a significant influence of organizational commitment to hospital environmental performance with path coefficients (0.483) and p-value (0.000<0.05).

Table 4 Compilation R-Square, Gof Index & SRMR

Average Score	Total Score	Squart	GOF Index	SRMR
Comunality	0,7522436	0,8673	0,59	0.075
R-Square	0,677			

The results of the GoF and Standardized Root Mean Square Residual (SRMR) tests indicated that the influence of Leadership Transformation and Organizational Commitment was high, with a magnitude of 0.67.7%. The SRMR value is 0.075 <0.10, which is acceptable and shows an acceptable model fit, proving that the empirical data can explain the influence between the variables in the model (16). The GoF value of the index evaluates both the overall measurement model and the Structural model. The calculation results demonstrate that the model's GoF value is 0.59, indicating that empirical data can explain the measurement model and demonstrating a high level of match rate. By using this estimate as input, the blindfolding procedure predicts deleted data points for all variables. A minimal discrepancy between the predicted and original values results in a higher Q^2 value, indicating a higher level of prediction accuracy. Q^2 values should be greater than zero for any endogenous construct, indicating the structural model's predictive accuracy for that specific construct. Q^2 values of 0, 0.25, and 0.50 correspond to small, medium, and small large PLS models (11).

Table 5 Q^2 Value

Total	SSO	SSE	$Q^2 = (=1-SSE/SS0$
Transformation Leadership	400.000	400.000	
Hospital Environmental Performance	1.300.000	707.793	0,456
Organizational Commitment	300.000	300.000	

The analysis shows that the Q^2 value of 0.456 indicates the model's relevant predictive power. Therefore, changes in the hospital's environmental performance can be forecasted using the variables of leadership, transformation, and organizational commitment.

4.3. PLS Predict

Partial Least Squares (PLS) is an analytical technique used for prediction purposes. To assess the predictive performance of a proposed PLS model, it is necessary to develop a measure of the goodness of fit of the model. The PLS Predict algorithm serves as a validation tool to test the strength of PLS prediction models. The PLS model's predictive power can be determined by comparing its RMSE or MAE values to those of a linear regression model. If the PLS-SEM analysis produces a higher predictive error in terms of RMSE or MAE for all indicators when compared to the linear regression model, it indicates that the model lacks predictive power. If the majority of dependent construct indicators in PLS-SEM analysis produce higher prediction errors compared to LM benchmarks, it indicates that the model has low predictive power. If a minority (or equal number) of indicators in the PLS-SEM analysis produce higher prediction errors compared to the LM benchmark, it indicates moderate predictive power. If none of the indicators in the PLS-SEM analysis have a higher RMSE or MAE value compared to the LM benchmark, the model has high predictive power" (11).

Table 6 PLS Predict

Measurement Item	PLS		LM	
	RMSE	MAE	RMSE	MAE
Y1	1,257	0,955	1,263	0,933
Y2	1,183	0,795	1,263	0,861
Y3	1,461	1,096	1,382	1,03
Y4	1,508	0,857	1,448	0,808
Y5	1,641	0,925	1,629	0,947
Y6	1,068	0,759	1,175	0,819
Y7	1,579	0,910	1,638	1,079
Y8	1,072	0,833	1,063	0,841
Y9	1,236	0,816	1,33	0,841
Y10	1,327	0,864	1,382	0,882
Y11	1,363	0,968	1,332	0,968
Y12	1,191	0,883	1,369	1,001
Y13	1,168	0,923	1,185	0,964

Based on the results of processing 26 observations of root mean square error (RMSE) and mean absolute error (MAE) values for partial least squares (PLS) models, there are 17 models higher than the linear regression (LM) model, which is only 9 models. This indicates that the proposed PLS model has moderate predictive power, meaning that every change in the exogenous variable can predict the strength of changes in endogenous variables.

4.4. Robustness Chek- Measurement of Non-Linear Relationships

To assess the nonlinear relationship of the quadratic effects between each pair of constructs, a two-step approach with standardization was used. This analysis was conducted to check whether the evidence provided in terms of the robustness of linear effects.

Followed step of Ken analys 2019 (17), the result are, QE1 TL→HEP row, the resulting P value is 0.385, QE2 OC→HEP is 0.675, which is greater than our significance level of 0.05. As a result, we accept the null hypothesis that TL and HEP have no significant nonlinear quadratic effect. In the QE1 TL→HEP row, the value zero falls between the lower bound of 0.078 and the upper bound of 0.192. Based on the 95% bias-corrected confidence interval, we can again conclude that the non-linear quadratic effect of QE1 TL→HEP on HEP is insignificant. The quadratic term QE1 TL has an f effect size of 0.007, QE2 OC is 0.002, which is smaller than the lower limit of 0.02. The small f^2 effect size, combined with the

insignificance of the quadratic effect, clearly indicates that transformational leadership, organizational commitment, and hospital environmental performance have a linear relationship in our data set.

Tabel 7 Robustness Chek

Quadratic Effect (QE)	P Values	Confidance Intervals Bias Corelation		f Square
		2.5%	97.5%	
OC → HEP	0.001	0.218	0.766	0.155
QE1 TL→HEP	**0.385**	**-0.078**	**0.192**	**0.007**
QE2 OC→HEP	**0.675**	**-0.098**	**0.208**	**0.002**
TL_→ HEP	0.023	0.009	0.599	0.080

5. Discussion

Based on the test results of the first hypothesis built "The better the practice of transformational leadership with its influence, inspirational motivation, intellectual stimulation and individual consideration has a positive impact on the environmental performance of the hospital" is accepted, this indicates that any change in transformational leadership will improve the environmental performance of the hospital with a confidence interval of 97.5% the influence of transformational leadership in improving the environmental performance of the hospital lies between 0.081% to 0.623%. However, the transformational leadership style in improving environmental performance at the structural level is moderate (*F-square* = 0.092). Overall, the results showed that transformational leadership has a positive effect on the hospital's environmental performance.

These findings confirm previous studies conducted by Rijal (2016) (18), Imran, M. K. et al. (2016) (19), Vashdi, D. R. et al. (2019) (20), Khan, H. U. R. et al. (2018) (21), Sidauruk, et al. (2022, 66) (22) and Gani (2020) (8), but not in line with Runtuwene, et al. 2022(23), who found that transformational leadership style has no significant effect on employee performance. Research proves that charismatic leaders, as motivators, can motivate and improve employees' thinking skills (intellectual stimuli) by providing appropriate challenges, so that employees or stars can develop their intellectual skills, being able to accept and take into account the considerations of employees or staff in hospital policies, Its role is achieved in the realization of the hospital institution to create a sustainable environment that is measurable through compliance with regulations stated in the ranking by the government through the Ministry of Environment (KLH) called PROPER (Company Performance Rating Assessment Program in Environmental Management and according to Regulation of the Minister of Health of the Republic of Indonesia Number 7 of 2019 concerning Hospital Environmental Health Implementation of Waste and Radiation Safety.

Based on the results of the second hypothesis test built "The higher the organizational commitment (belief and acceptance of organizational goals and values and the willingness to strive or work for the benefit of the organization and the desire to maintain loyalty to organizational membership) will have a positive impact on hospital environmental performance" is accepted. This implies that any change in organizational commitment will improve the hospital's environmental performance. In the 97.5% confidence interval, the influence of organizational commitment in improving the environmental performance of the hospital is between 0.230% and 0.753%. However, the transformational leadership style in improving environmental performance at the structural level is moderate *(F-square* = 0.161). This result is consistent with Noor (2009)(24) , Hosain 2020(25), khan (2016)(21), khaleh and naji 2016(26), ferdus and kabir 2018 (27). Thirdly, Meyer and Allen's theory (28) supports that organizational commitment consists of three dimensions, namely participation, loyalty and commitment, fourthly, O'Reilly (1989) (29). Research proves that effective commitment, sustainable commitment, and normative commitment of each employee have a very important role in the realization of the hospital institution in creating a measurable sustainable environment through compliance with regulations stated in the ranking by the government through the State Ministry of Environment (KLH) called PROPER (Company Performance Rating Assessment Program in Environmental Management and According to Regulation of the Minister of Health of the Republic of Indonesia Number 7 of 2019 concerning Hospital Environmental Health, the implementation of waste and radiation safety .

6. Conclusion

As the conclusion of this study is first, "The better the practice of transformational leadership using its individual influence, inspirational motivation, intellectual stimulation and individual considerations can appear positive on the environmental performance of the hospital", this indicates that any change in transformational leadership will improve the performance of the hospital environment in handling hazardouse waste. Second, "The higher the organizational commitment (confidence and acceptance of the goals and values of the organization and the willingness to strive or work for the benefit of the organization and the desire to maintain the loyalty of the organization's members) will appear positive for the environmental performance of the hospital", which indicates that any change in organizational commitment will improve the environmental performance of the hospital in handling hazardouse waste. The limitation of this study is that the measurement scale used is the Semantic Differential Scale numbered 10 and the sample used.

Recommendation

The advice that the author can recommend is to use a 5-point Likert scale for the measurement scale and to add the number of samples if SEM-AMOS is used, and further research can fully utilize the robustness testing procedure to test the strength of the model if using SMARTPLS.

Compliance with ethical standards

Disclosure of Conflict interest

The authors declare no conflict of interest regarding the publication of this paper

Statement of informed consent

Informed consent was obtained form all individual participants included in the study

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