

The Influence of Human Resources on Supply Chain Optimization in Sustainable Road Construction Projects

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Abstract

Construction sector road is main driver growth economy national , but faced with obstacles low growth productivity and high challenge sustainability environment study This aim For analyze influence management Human Resources (HR) – which includes Competence & Managerial (X1), Training & Development (X2), Motivation Work (X3), and Team Collaboration (X4) – towards optimization chain supply construction projects road measured sustainability through Efficiency Cost (Y1) and Sustainable Performance (Y2). Case study of road construction Palembang – Betung (Paltung) toll road Sections 1 & 2 managed by PT. WaskitaKarya (Persero) Tbk . Research method use approach descriptive quantified qualitative in a way numeric through analysis multiple linear regression and SPSS hypothesis testing with involving sample of 44 respondents sources consisting of from team management projects, subcontractors , suppliers and labor work . Research results show that human resource variables in general simultaneous influential significant to Efficiency Cost ($R^2 = 0.641$) and Sustainable Performance ($R^2 = 0.785$) , In general partial , Competence & Managerial ($t = 5.592$, $p < 0.001$) , as well Motivation Work ($t = 2.076$, $p = 0.045$) influential dominant to Efficiency Cost , whereas Team Collaboration ($t = 3.730$) , $p < 0.01$) become the strongest determinant in driving Sustainable Performance . These results confirm importance strengthening strategic human resource capacity for optimize chain supply construction road sustainable.

Keywords: Human Resource Management, Supply Chain, Cost Efficiency, Toll Road Construction, Sustainable Performance.

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I. INTRODUCTION

Infrastructure development road highway , road toll roads and bridges is sector strategic national holding vital role in push equality economy interregional . However , the industry construction globally faced with low level productivity that only grow by 1% in two decades final consequence slowness adoption digital technology and reliance on methods traditional . The demands of the modern era require shift paradigm going to development construction road sustainable road construction, which takes into account economic , environmental and social pillars in a way balanced .

Management project construction often experience constraint classic Triple Constraint (cost, time, and quality). According to the Project Management Institute (PMI), the constraints the expanding covers quality, source power, communication, risk, satisfaction stake-holder interests and planning holistic. One of the key success overcome obstacle material delivery and inefficiencies operational is management chain effective supply chain management. Human resource management holds role crucial as driving force main chain supply, start from coordination supplier, execution field , until integration practice friendly environment .

Study This focuses on the Palembang – Betung(Paltung) Toll Road Construction Project Section 1 & 2 implemented by PT. WaskitaKarya (Persero) Tbk . The formulation problem in study This focused on: (1) How role of service HR construction in optimize chain supply project ? and (2) How implementation human resource management in face demands efficiency cost as well as practice performance sustainable ?

II. MATERIAL AND METHODS

Study was carried out at PT. Waskita Karya (Persero) Tbk on the Palembang – Betung(Paltung) Toll Road Construction Project Sections 1 & 2, with The site office location of the Citra Grand City (CGC) Complex is Jalan Amanzy Waterpark, Block D47 No. 02-03 , Alang- alang Lebar District , Palembang City, South Sumatra, as shown in Figure 1.



Figure 1: Research location

2.1 Population and Sample

Population study covers team management projects , subcontractors , suppliers , labor Work field , and stakeholders interest related with the total population identified $N = 80$. Size sample determined use Slovin's formula with tolerance limits error $\epsilon = 0.10$ (level 90% confidence):

$$n = \frac{N}{1 + N(\epsilon)^2} = \frac{80}{1 + 80(0.10)^2} = \frac{80}{1.8} = 44.4 \rightarrow n = 44 \text{ Respondents}$$

Sampling techniques used combine criteria representative from contractor main ($n = 34$), owner/Hutama Karya ($n = 2$), consultant supervisors ($n = 2$), and subcontractors /vendors ($n = 5$).

2.2 Operationalization Variables

Study This involving four variables independent and two variables measured dependent using a 5- level Likert Scale (1 = Strongly Disagree) up to 5 = Strongly Agree):

1. Variables Independent (X): Competence & Managerial (X_1), Training & Development (X_2), Motivation Work (X_3), and Team Collaboration (X_4).
2. Variables Dependent (Y): Efficiency Cost (Y_1) and Sustainable Performance (Y_2).

2.3 Data Analysis Techniques

Data collected through observation , interview in-depth , questionnaires , and SMK documents . Data analysis was carried out with testing data quality (Product Moment Validity Test and Cronbach's Alpha Reliability Test), Assumption Test Classical (Kolmogorov-Smirnov Normality , VIF Multicollinearity , and Heteroscedasticity) Glejser), as well as Multiple Linear Regression Test and t-Test (partial) using SPSS software.

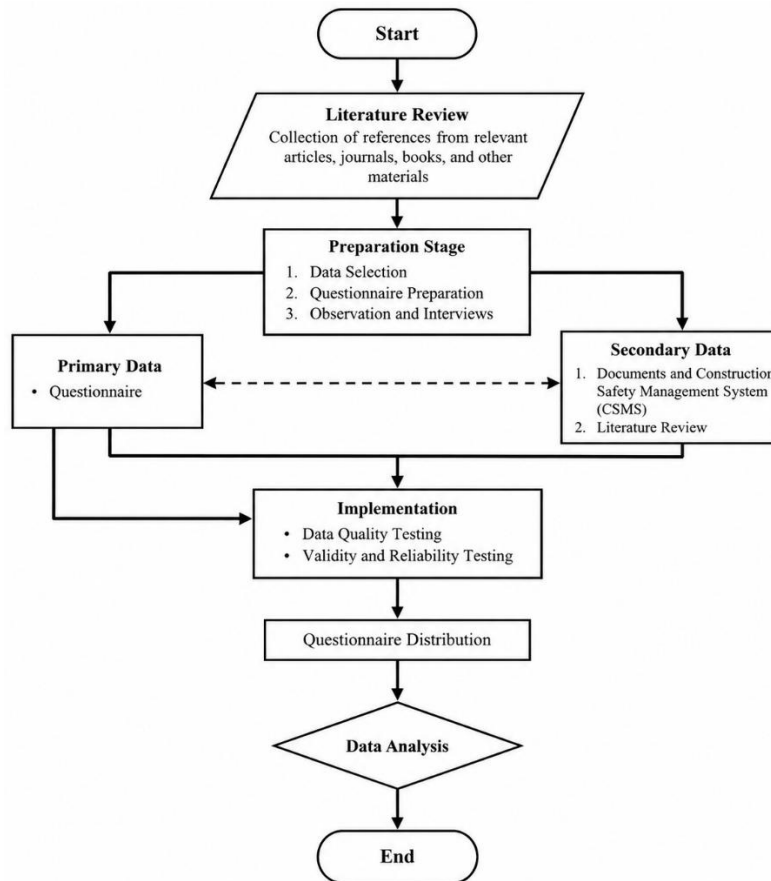


Figure 2: Flowchart

III. RESULTS AND DISCUSSION

3.1 Validity and Reliability Test Instrument

validity test $n = 44$ ($df = 42$, $r_{table} = 0.304$) show all over grains statements on variables X_1 , X_2 , X_3 , X_4 , Y_1 , and Y_2 have mark $r_{hitung} > 0.304$ with level significance $p < 0.01$, so all over instrument declared valid. Reliability test show Cronbach's Alpha coefficient > 0.60 in all construct (HR $X = 0.925$; Efficiency Cost $Y_1 = 0.821$; Sustainable Performance $Y_2 = 0.829$), verifying that the instrument is very consistent and reliable .

3.2 Analysis Descriptive and Ranking of Risk/HR Factors

Based on processing average value (Mean), item Y_{15} (" Maintaining Health and Safety workers in the field ") achieve score highest of 4.64 (Very High), followed by X_{44} (" Increasing contribution management & employees ") with score of 4.50. This is indicates that K3 compliance and encouragement collaborative become the most dominant factor in perception respondents .

3.3 Assumption Test Classic

1. Normality Test : The Asymp . Sig. (2-tailed) Kolmogorov-Smirnov values for the residuals of the $X \rightarrow Y_1$ model ($p = 0.004$) and $X \rightarrow Y_2$ ($p = 0.012$) meet the normal linear distribution good on PP Plot.
2. Multicollinearity Test : All over variables free own mark $Tolerance > 0.10$ (ranging from 0.363 - 0.394\$) and VIF value < 10 (2.537 - 2.754), confirms No occurrence symptom multicollinearity between variables free .
3. Heteroscedasticity Test :Glejser Test produce mark significance > 0.05 for all variables ($p = 0.086$ to 0.676) and graphs *scatterplot* show distribution point random above and below number 0 on the Y axis .

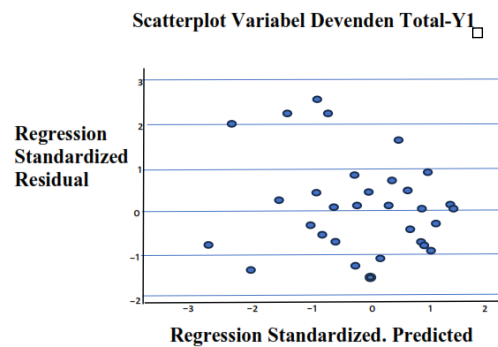


Figure 3.1 Distribution Results Distribution Efficiency Cost (Y1)

Explanation analysis residual graph , as following :

- 1) Spread dot random is data points are spread out in a way random above and below number 0 on the Y axis (Regression Standardized Residual).
- 2) Does not form pattern , no seen form pattern clear geometric , such as pattern widen / narrow or pattern consistent waves .
- 3) Based on results residual scatterplot graph assumptions homoscedasticity and linearity in the regression model Already fulfilled and can used in analysis more carry on .

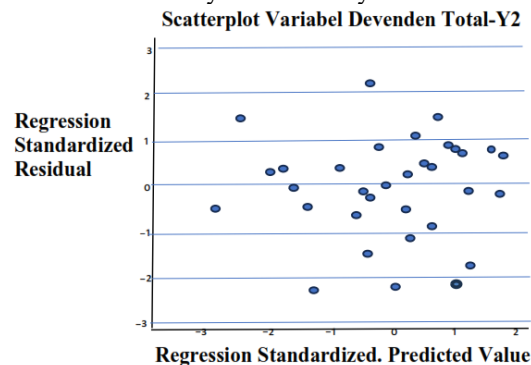


Figure 3.2 Distribution Results Distribution Continuous Performance (Y2)

Explanation analysis residual graph , as following :

- 1) The data points are spread out in a way random above and below number 0 on the Y axis (Standardized Regression Residual).
- 2) Does not form pattern , no seen form pattern certain , such as funnel or cone , no There is pattern clear curve
- 3) Regression model This worthy used Because variance the residual constant (homoscedasticity).

3.4 Multiple Linear Regression Test and t-Test (Partial)

Equality multiple linear regression generated For second variables dependent served as following :

Table 3.1 Summary of Multiple Linear Regression Test Results

Model	Unstantiated Coefficients	R. Square	t	Sig.
	B			
(Constans)Y1	4,142	0.641	2,287	0.028
X1	0,64		5,592	< 001
X2	-0,172		-1,232	0.025
X3	0,234		2,076	0.045
X4	0.128		1,206	0.235
(Constant)Y2	4,436	0.785	1,179	0.083
X1	0,365		2,484	0.017
X2	-0,172		-0.894	0.377

X3	0,045		0.290	0.773
X4	0,547		3,73	< 0,01

Formula Equation: $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$

Where: Y = Dividend variable

X = Independent variable

α = Constant

β = Regression coefficient (magnitude of influence)

+/- = Direction of relationship

Sig = Significant level of influence

Following is formula variables Efficiency Cost (Y1)

$$Y_1 (\text{Efficiency Cost}) = 4.142 + 0.640 X_1 - 0.172 X_2 + 0.234 X_3 + 0.128 X_4$$

➤ Interpretation Equality Regression Variables Efficiency Cost

- 1) Coefficient value constant amounting to 4,143 with mark positive , this can interpreted that with existence variables Competence & Managerial (X1), Performance Motivation (X3), Team Collaboration (X4), and without variables Training & Development (X2), variable Efficiency The cost (Y1) will be still experience improvement by 41.4%.
- 2) Beta coefficient value of the variable Competence & Managerial (X1) is 0.640, if mark other variables are constant and variable X1 experiences 1% increase , then variables Efficiency Cost (Y1) experiences improvement by 64%. And vice versa variables Efficiency The cost (Y1) will be experience decline by 64%.
- 3) Beta coefficient value of the variable Training and Development (X2) is - 0.172, if mark other variables are constant and variable X2 experiences improvement by 1%, then variables Efficiency The cost (Y1) will be experience decline by 17.2%. Increasingly increase mark variable X2 then variables Efficiency The cost (Y1) will be the more decrease .
- 4) Beta coefficient value of the variable Motivation Work (X3) is 0.234, if mark other variables are constant and variable X3 experiences 1% increase , then variables Efficiency The cost (Y1) will be experience improvement amounting to 23.4 % . and vice versa , if other variables are constant and variable X3 experiences a 1% decrease then variables Efficiency The cost (Y1) will be experience decline by 23.4%.
- 5) Beta coefficient value of the variable Team Collaboration (X4) is 0.128, if mark other variables are constant and variable X4 experiences 1% increase , then variables Efficiency The cost (Y1) will be experience improvement amounting to 12.8 % . and vice versa , if other variables are constant and variable X4 experiences a 1% decrease then variables Efficiency The cost (Y1) will be experience decline by 12.8%.

Normal P-P Plot Of Regression Std. Residual
Variabel Devenden Total_Y1

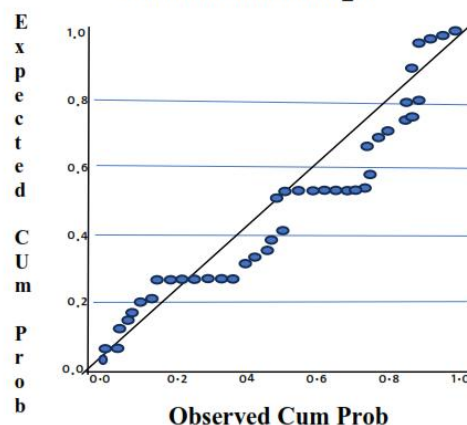


Figure 3.3 Results of Efficiency Value Distribution Cost (Y1)

➤ Coefficient Determination

Coefficient test results determination show influence management source Power human (X) against efficiency cost (Y1), amounting to 0.641. So the conclusion is is variables efficiency cost can explained that influenced variables management source Power man amounted to 64.1% and the remaining 35.9% was explained by other variables that were not There is in the research model This .

Following is formula Continuous Performance Variable (Y2)

$$Y_2 \text{ (Sustainable Performance)} = 4.436 + 0.365 X_1 - 0.172 X_2 + 0.045 X_3 + 0.547 X_4$$

➤ **Interpretation Equality Regression Continuous Performance Variables**

- 1) Coefficient value constant amounting to 4,336 with mark positive , this can interpreted that with existence variables Competence & Managerial (X1), Performance Motivation (X3), Team Collaboration (X4), and without variables Training & Development (X2), Sustainable Performance variable (Y2) will still experience improvement by 43.3%.
- 2) Beta coefficient value of the variable Competence & Managerial (X1) is 0.365, if mark other variables are constant and variable X1 experiences 1% increase , then Sustainable Performance variable (Y2) will experience improvement by 36%. And vice versa Sustainable Performance variable (Y2) will experience decline by 36%.
- 3) Beta coefficient value of the variable Training and Development (X2) is -0.172 (minus), meaning If mark other variables are constant and variable X2 experiences improvement by 1%, then variables Efficiency The cost (Y1) will be experience decline by 17.2%. Increasingly increase mark variable X2 then variables Efficiency The cost (Y1) will be the more decrease .
- 4) Beta coefficient value of the variable Motivation Work (X3) is 0.045, if mark other variables are constant and variable X3 experiences 1% increase , then Sustainable Performance variable (Y2) will experience improvement of 0.45 % . and vice versa , if other variables are constant and variable X3 experiences a 1% decrease then Sustainable Performance variable (Y2) will experience decline by 0.45%.
- 5) Beta coefficient value of the variable Team Collaboration (X4) is 0.547, if mark other variables are constant and variable X4 experiences 1% increase , then Sustainable Performance variable (Y2) will experience improvement amounting to 54.7 % . and vice versa , if other variables are constant and variable X4 experiences a 1% decrease then Sustainable Performance variable (Y2) will experience decline by 54.7%.

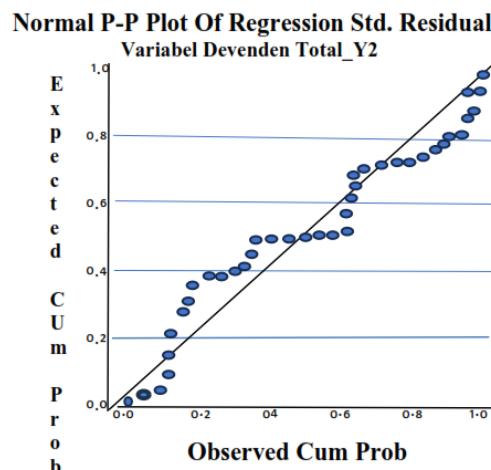


Figure 3.4 Distribution of Sustainable Performance Values (Y2)

➤ **Coefficient Determination**

Whereas coefficient test results determination influence management source Power man variable (X) against performance sustainable (Y2), amounting to 0.785. So the conclusion is is variables performance sustainable (Y2) can explained that variables management source Power man influential amounting to 78.5% and the remaining 21.5% is explained other variables that are not There is in the research model This .

➤ **T-Test Proof**

The t-test was performed aim proven in research This that the independent variable own influence on the dependent variable and compare sig. value with mark 5% significance measurement canseen in the t-test table,

The comparison method is as follows following :

- 1) If the t- value is calculated > t- table or sig. < α then Ho is rejected and Ha is accepted
- 2) If the t- value is calculated < t- table or sig > α then Ho is accepted and Ha is rejected

Table 3.2. Summary of Analysis Results Regression and Partial t-Test

DEPENDENT VARIABLE	INDEPENDENT VARIABLE	COEFFICIENT (β)	T-STATISTIC	SIG. (P-VALUE)	HYPOTHESIS DECISION
Employee Performance (Y_{1_1}) R² = 0.6418	Competence & Managerial (X _{1_1})	0.640	5.592	< 0.001	H ₀ Rejected (Significant)
	Training & Budget Support (X _{1_2})	-0.172	-1.351	0.225	H ₀ Rejected (Insignificant)
	Work Motivation (X _{1_3})	0.234	2.076	0.045	H ₀ Rejected (Significant)
	Work Environment (X _{1_4})	0.128	1.206	0.235	H ₀ Rejected (Insignificant)
Work Performance (Y_{2_2}) R² = 0.7855	Constant	4.436	1.179	0.083	H ₀ Not Rejected (Insignificant)
	Competence & Managerial (X _{2_1})	0.365	2.484	0.017	H ₀ Rejected (Significant)
	Training & Budget Support (X _{2_2})	-0.172	-0.894	0.377	H ₀ Not Rejected (Insignificant)
	Work Motivation (X _{2_3})	0.045	0.290	0.773	H ₀ Not Rejected (Insignificant)
	Work Environment (X _{2_4})	0.547	3.730	< 0.001	H ₀ Rejected (Significant)

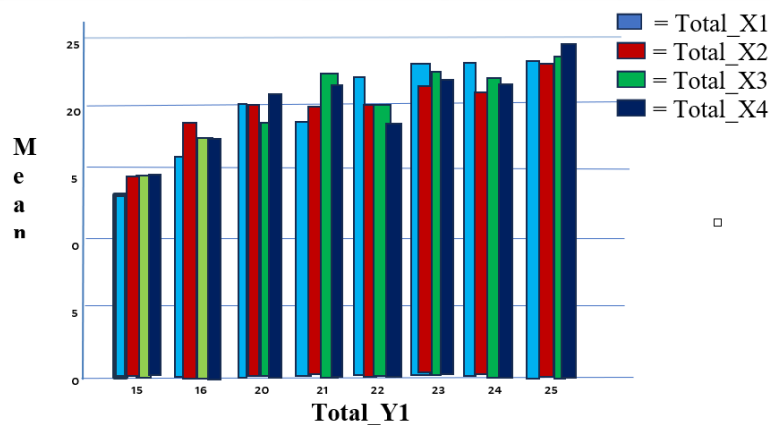


Figure 3.5 Graph of Variable Analysis Results Efficiency Cost – Y1

In the picture on show pattern distribution mark scale from 0 to 25 and what is obtained majority own concentrated value ranged from 15 to 25. In total presentative chart This show positive values tend increase .

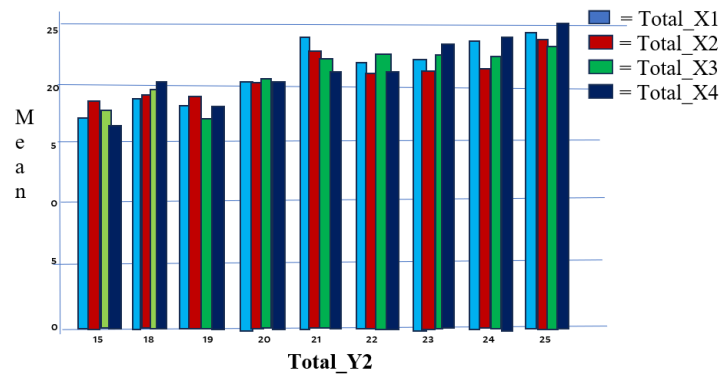


Figure 3.6 Graph of Results Analysis of Sustainable Performance Variables Y2

In a way details bar chart image variables performance sustainable (Y2) above show pattern distribution mark scale from 0 to 25 there are fluctuations variation mark Where a number of category beginning show more numbers low (around 14-15), but tend increased in category end .

3.5 Discussion

3.5.1 Influence To Efficiency Cost (Y_1):

Coefficient value determination $R^2 = 0.641$ shows that 64.1% of the variation Efficiency Cost explained by HR factors . Variables Competence and Managerial (X_1) proven become factor the most dominant driver ($\eta = 0.640$; $t = 5.592$; $p < 0.001$). Ability managerial in plan material needs in general precision and effective leadership capable reduce workmanship rework and *material* waste . Motivation Work (X_3) also gives contribution significant ($\eta = 0.234$; $p = 0.045$), confirming that giving incentives and standards clear work push discipline efficiency budget in the field .

3.5.2 Influence On Sustainable Performance (Y_2):

The value of $R^2 = 0.785$ proves that that 78.5% Sustainable Performance influenced by HR variables . Team Collaboration (X_4) becomes determinant main ($\eta = 0.547$; $t = 3.730$; $p < 0.001$). The relationship transparent and synergistic partnership between PT. WaskitaKarya, consultants , subcontractors , and suppliers makes it easier supervision waste construction , implementation of green road norms, and fulfillment timetable without sacrifice quality environment . Competence Managerial (X_1) also support achievement sustainability ($\eta = 0.365$; $p = 0.017$).

3.5.3 Findings Training & Development (X_2):

The variable X_2 gives coefficient negative No significant in both models ($\eta = -0.172$). This is indicates that implementation training term short during the project period construction walk can cause obstacle operational temporary (*downtime*) or No direct impact on efficiency cost project If module training No customized in a way direct with dynamics practical Paltung Toll Project .

IV. CONCLUSION

1. Proven HR Management hold vital and significant role in optimize chain supply Palembang – Betung Toll Road Construction Project Section 1 & 2.
2. Competence & Managerial (X_1) is factor determinant main improvement Efficiency Cost (Y_1), whereas Team Collaboration (X_4) is driving force main in realizing Sustainable Performance (Y_2).
3. In a way simultaneous , integrated HR management capable explains 64.1% of the variation efficiency operational cost and 78.5% success rate implementation principle construction road sustainable .

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