JURNAL AR RO'IS MANDALIKA (ARMADA)
Journal website: https://ojs.cahayamandalika.com/index.php/armada

ISSN: 2774-8499 Vol. 6 No. 3 (2026)

Research Article

The Influence of Technology and Human Resource Competence on Work Productivity at PT. TMMIN

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Abstract

This research is motivated by the phenomenon of productivity efficiency in the department of Welding Body Production Plant 1 PT TMMIN Karawang in 2023 which decreased to 98.79 (from the target of 99.6%). If calculated by annual production, an average of 65 units of cars per month must be outlined, from a total production of 5723 units (period of 2023). The purpose of this study is to determine how much influence technology and HR competencies on work productivity. This type of research quantitative, with data analysis techniques using Microsoft Excel and SPSS 20. The data collection technique is conducting field observations, distributing questionnaires, and documentation. The population in this study is the department of Welding Body Production Plant 1 PT TMMIN which was sampled using multistage cluster sampling technique, totaling 95 respondents. Research results the correlation coefficient of the technology variable (X1) has an R value of 0.434 which means a positive relationship with a moderate interpretation of work productivity. And the coefficient correlation of the HR competency variable (X2) has an R value of 0.306 which means positive relationship with low interpretation of work productivity. And simultaneously, the R2 value is 0.191 which means that technology and HR competencies have a significant effect on work productivity by 19,1%. It can be concluded, the better between technology and competence of human resources, the more work productivity will increase.

Keywords: Technology, Human Resource Competence, Work Productivity.

INTRODUCTION

In the modern era, one of the sectors that significantly contributes to economic growth in Indonesia is the manufacturing industry. The manufacturing industry is a sector that processes raw materials into finished goods that are ready for use, supported by effective human resource management. Companies are required to compete competitively in order to generate profits and ensure economic sustainability. To achieve this, companies must manage their resources effectively and efficiently so that maximum productivity can be attained. High productivity is one of the key factors determining a company's success in maintaining its economic continuity.

Along with the development of time, trade in the manufacturing sector has undergone very rapid changes. Initially, company management and production processes relied on human mechanical labor, which was later assisted by electrical power in the early 20th century. Subsequently, humans developed machines that replaced human labor with computer- and robot-based systems, enabling machines to operate automatically. This evolution has led to the current trend of automation, where mass production is supported by a combination of automation technology and cyber technology, commonly referred to as the Industrial Revolution 4.0 (Wijoyo et al., 2020).

Technology and digitalization now dominate the global trade sector, compelling companies to continuously improve productivity by producing high-quality outputs at affordable prices. Not only technology and digital companies benefit from these developments, but manufacturing companies also increasingly utilize advanced and easily accessible technologies. Significant progress in the industrial sector can be observed through the development of new sensors that enhance the effectiveness of robots and computers used in production processes. In addition, digitalization has enabled the utilization of cloud computing, where complex calculations no longer require advanced computers on-site, as data can be processed remotely through internet connectivity rather than solely within the factory environment (Wijoyo et al., 2020).

Behind the rapid advancement of technology and digitalization, there are several factors that manage and operate these sophisticated systems. In management terms, these are often referred to as the "6 Ms": man, money, methods, materials, machines, and market. Human creativity (man) plays a central role in innovation and in utilizing technological developments (machines) to enable companies to adapt to technological advancements with the ultimate goal of achieving maximum profit (Noor et al., 2023).

To generate profits from the products produced, companies must operate

effectively and efficiently. As companies are required to adapt swiftly to increasingly competitive business environments in order to produce high-quality outputs at affordable prices, work productivity has become increasingly important in the modern era. High work productivity provides a competitive advantage in intense business competition, whereas low productivity can lead to resource waste, declining product or service quality, and reduced company competitiveness. Technology and human resource competence are among the key factors influencing work productivity. Businesses can utilize technology to enhance productivity, while skilled employees with strong motivation, skills, and knowledge also play a critical role in determining productivity outcomes. Companies with competent and talented human resources are more likely to achieve optimal productivity and maximize profits.

Companies must also understand and manage various constraints that can affect employee productivity, such as technological limitations, human resource competence, work environment, leadership, compensation, and company policies. However, not all companies recognize the importance of work productivity or understand how to measure and improve it. Many companies still overlook productivity aspects, resulting in low efficiency and employee performance. Low productivity may arise from inadequate human resource planning and the performance of tasks that do not add value to the company. There are seven types of non–value-added activities, namely overprocessing, overproduction, excess inventory, unnecessary movement, defective products (requiring rework), transportation, and waiting (Aisyah, 2020).

One of the pioneer companies in the manufacturing industry is PT Toyota Motor Manufacturing Indonesia, which produces four-wheeled vehicles. Toyota is also one of the companies that has successfully leveraged technological advancements during the Industrial Revolution 4.0 by integrating technology with human resources, allowing it to maintain high productivity compared to other companies in the same sector whose products are less competitive in the Indonesian market. Despite being one of the largest manufacturing companies in the four-wheeled vehicle sector, Toyota Indonesia must continue to improve its effectiveness and efficiency, as competitors within the same industry are rapidly growing and developing. This situation poses a potential threat to Toyota Indonesia if the company fails to adapt to both domestic and international conditions. Although Toyota Indonesia's strong position in the manufacturing sector is supported by high productivity levels, the company still faces several challenges that can

lead to a decline in work productivity. The following section presents the production efficiency percentage of PT Toyota Motor Manufacturing Indonesia at the Welding Body Production Plant 1, Karawang:

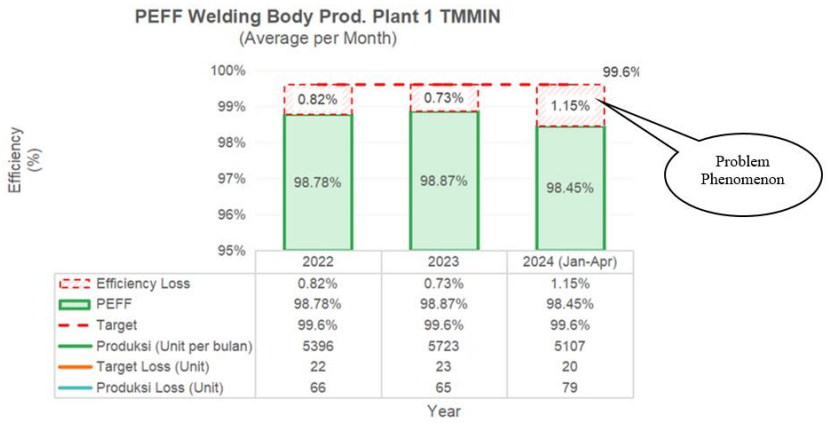

Figure 1. Production Efficiency Graph of Welding Body Production Department.

Based on the data, the most recent decline in productivity efficiency experienced by the Welding Body Production department at TMMIN occurred in 2023, amounting to 0.76%, with a total efficiency level of 98.84%, compared to the target of 99.6%. In the same year, the average number of units produced at Plant 1 Karawang reached 5,723 units. Furthermore, according to the Monthly Body Outline data, the average percentage of efficiency loss due to units requiring outline processing (vehicles removed from the production process due to quality issues) was 0.81%. When calculated, this resulted in a productivity efficiency loss equivalent to 65 units.

This condition led to additional working hours required to address the root causes of outline problems and to repair the outlined units. Consequently, overtime outside regular production hours was needed for 303 employees to ensure that production targets were met. This indicates that even a relatively small percentage of efficiency loss can have a significant impact on the overall production output of Toyota Indonesia. If products experiencing such obstacles fail to reach customers on time, it may result in customer dissatisfaction, which could ultimately lead to a decline in customer trust in the company. The potential subsequent impact includes a reduction in vehicle production volume, thereby decreasing the company's profits and threatening its long-term sustainability, or even resulting in financial losses. Therefore, achieving production targets is a crucial determinant of whether a company can sustain its

operations over time.

Research on work productivity is therefore essential to provide in-depth insights into the factors that influence productivity and the strategies that can be implemented to enhance it. With high levels of work productivity, companies can improve their overall performance and maintain competitiveness in an increasingly competitive business environment.

This study aims to analyze the use of welding technology and human resource competence and their individual and combined effects on work productivity in the Welding Body Production Department of PT TMMIN. The results are expected to contribute theoretically to human resource management studies and practically to support companies in developing effective technology and competency policies to achieve optimal productivity.

METHOD

Research Design

This study employed an explanatory quantitative research design aimed at examining the causal relationships between technology, human resource competence, and work productivity. Quantitative research emphasizes hypothesis testing through statistical analysis of numerical data (Rinaldi & Mujianto, 2017; Darwin et al., 2021).

Research Object and Time

The research was conducted at PT Toyota Motor Manufacturing Indonesia (PT TMMIN) Plant 1 Karawang from April to August 2024, focusing on employees in the Welding Body Production Department.

Research Variables

The study involved three variables: technology (X1) and human resource competence (X2) as independent variables, and work productivity (Y) as the dependent variable (Kurniawan & Puspitaningtyas, 2016).

Operationalization and Measurement of Variables

All variables were measured using a Likert scale (1–5). The indicators of technology, HR competence, and work productivity were adapted from previous studies

(Baiti et al., 2020; Wahyuni, 2023).

Population and Sample

The population consisted of 303 employees of the Welding Body Production Department. Sampling was conducted using multistage cluster sampling, resulting in 146 accessible employees. The final sample size of 95 respondents was determined using the Harry King Nomogram with a 5% error level (Sugiyono, 2024).

Data Collection Techniques

Data were collected through questionnaires as the primary data source, supported by direct observation and secondary data from company documents, books, and previous research (Darwin et al., 2021).

Data Analysis Techniques

Data analysis included descriptive statistics, instrument testing (validity and reliability), classical assumption tests (normality and heteroskedasticity), and inferential statistics, including Pearson Product Moment correlation (t-test), multiple linear regression (F-test), and the coefficient of determination (R^2) to assess the effects of technology and HR competence on work productivity (Darwin et al., 2021).

RESULT AND DISCUSSION

General Overview of the Research Object

PT Toyota Motor Manufacturing Indonesia (TMMIN) is a subsidiary of Toyota Motor Corporation and part of the Astra Group operating in the automotive manufacturing industry. Established in 1973 under the name Toyota Astra Motor, TMMIN has played an important role in the development of Indonesia's automotive industry and supporting industries. As a leading manufacturing company, TMMIN exports completely built-up vehicles, semi-knocked-down vehicles, components, and production equipment to more than 80 countries across Asia, Africa, Latin America, Australia, and Oceania. TMMIN's vision is to become the most competitive manufacturing company in Asia and a global manufacturer that continuously expands its business while leading the development of environmentally friendly vehicle

technology in Indonesia.

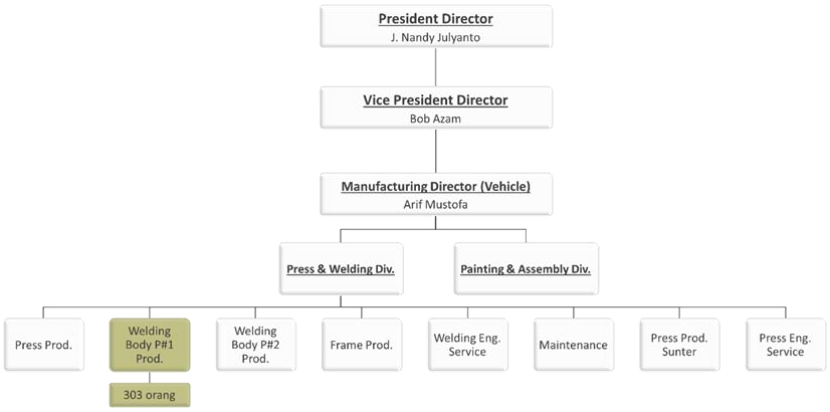

Figure 2. Organizational Structure of the Manufacturing Board of Directors of PT TMMIN

TMMIN operates five environmentally friendly manufacturing plants located in Sunter and Karawang. Karawang Plant 1, established in 1998 and located in the Karawang International Industrial City (KIIC), produces vehicles such as the Kijang Innova and Fortuner with an annual capacity of 130,000 units. The respondents in this study were 95 male employees from the Welding Body Production Department at Plant 1, working in Red and White shifts across four production lines: underbody, side member RH, side member LH, and shellbody. Most respondents were aged 20–30 years (48.4%) and 30–40 years (36.8%), with work experience ranging from 3 to 15 years.

Descriptive Statistics

The data in this study consisted of scores for Technology (X1), Human Resource Competence (X2), and Work Productivity (Y) obtained from questionnaires completed by 95 respondents. Work productivity was treated as the dependent variable, while technology and human resource competence were the independent variables. Each variable was analyzed using descriptive statistical techniques, including minimum and maximum scores, range, mean, median, mode, standard deviation, variance, as well as frequency distribution tables and histograms to illustrate the data distribution.

Table 1. Descriptive Statistics

Statistics

		Technology	HR Competence	Work Productivity
N	Valid	95	95	95
	Missing	0	0	0
Mean		43.07	54.05	45.83
Median		43.00	53.00	46.00
Mode		50	53[a]	50
Std. Deviation		4.884	7.037	2.890
Variance		23.856	49.518	8.354
Range		16	24	11
Minimum		34	41	39
Maximum		50	65	50
a. Multiple modes exist. The smallest value is shown				

Based on the data collected from 95 respondents, no missing values were found, and all data were considered valid. For Technology (X1), the scores ranged from 34 to 50, with a mean of 43.07, a standard deviation of 4.884, and a variance of 23.856. Human Resource Competence (X2) had scores ranging from 41 to 65, with a mean of 54.05, a standard deviation of 7.037, and a variance of 49.518. Meanwhile, Work Productivity (Y) showed scores between 39 and 50, with a mean of 45.83, a standard deviation of 2.890, and a variance of 8.354.

Instrument Testing

1. Validity Test

The validity test was conducted to determine the accuracy and precision of the research instrument used in this study. The validity of each variable was examined to ensure that the questionnaire items were able to measure the intended constructs. The validity testing for the research variables was carried out using Microsoft Excel, and the results are presented in the following table.

JUMLAH	400	391	402	416	404	406	416	415	421	421
r hitung	0,701	0,715	0,735	0,676	0,704	0,673	0,645	0,726	0,651	0,588
r tabel	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698
status	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID

Figure 3. X1 Validity Test (Technology)

JUMLAH	404	415	393	405	397	401	384	392	401	375	381	390	397
r hitung	0,508	0,484	0,626	0,550	0,744	0,785	0,822	0,859	0,783	0,824	0,654	0,686	0,774
r tabel	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698
status	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID

Figure 4. X2 Validity Test (HR Competence)

JUMLAH	423	443	444	436	441	434	440	431	435	427
r hitung	0,593	0,523	0,449	0,660	0,477	0,554	0,445	0,456	0,610	0,517
r tabel	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698	0,1698
status	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID	VALID

Figure 5. Validity Test Y (Work Productivity)

Based on the validity test results for the three variables, all questionnaire items were found to be valid. The Technology (X1) variable consisted of 10 items, Human Resource Competence (X2) consisted of 13 items, and Work Productivity (Y) consisted of 10 items. All items showed r-calculated values greater than the r-table value of 0.1698 for 95 respondents, indicating that all questionnaire statements were valid.

2. Reliability Test

The reliability test was conducted to assess the consistency and stability of the questionnaire items used to measure the research variables. Reliability was evaluated using Cronbach's Alpha, with the following criteria: values above 0.90 indicate excellent reliability, 0.70–0.90 high reliability, 0.50–0.70 moderate reliability, and values below 0.50 low reliability (Darwin et al., 2021, p. 145). The Cronbach's Alpha values for each variable were calculated using Microsoft Excel, and the results are presented in the following table.

Reliability Statistics

Cronbach's Alpha	N of Items
.627	10

Item Statistics

	Mean	Std. Deviation	N
X1.1	3.98	.635	95
X1.2	3.89	.765	95
X1.3	4.14	.678	95
X1.4	4.17	.724	95
X1.5	4.08	.710	95
X1.6	4.03	.676	95
X1.7	4.13	.718	95
X1.8	4.25	.684	95
X1.9	4.28	.663	95
X1.10	4.21	.667	95

Figure 6. X1 Reliability Test (Technology)

In Variable X1 (Technology), the Cronbach's alpha value was 0.627, with a moderate reliability decision. The reliability test results for each dimension, including the decision assumptions, showed that almost every dimension had a decision level between 0.60 and 0.70, with moderate reliability.

Reliability Statistics

Cronbach's Alpha	N of Items
.864	13

Item Statistics

	Mean	Std. Deviation	N
X2.1	4.13	.718	95
X2.2	4.17	.694	95
X2.3	3.97	.750	95
X2.4	4.12	.682	95
X2.5	4.02	.635	95
X2.6	4.05	.790	95
X2.7	3.83	.846	95
X2.8	3.95	.867	95
X2.9	4.06	.783	95
X2.10	3.71	.698	95
X2.11	3.83	.724	95
X2.12	3.92	.577	95
X2.13	3.98	.729	95

Figure 7. X2 Reliability Test (HR Competence)

In Variable X2 (HR Competence), the Cronbach's alpha value was 0.864, indicating high reliability. The reliability test results for each dimension, including the decision assumptions, showed that almost every dimension had a decision level between 0.50 and 0.80, indicating high reliability.

Reliability Statistics

Cronbach's Alpha	N of Items
.822	10

Item Statistics

	Mean	Std. Deviation	N
Y1	3.88	.650	95
Y2	4.09	.685	95
Y3	4.01	.676	95
Y4	3.99	.692	95
Y5	4.01	.751	95
Y6	4.01	.722	95
Y7	4.00	.786	95
Y8	4.00	.619	95
Y9	4.15	.652	95
Y10	4.01	.751	95

Figure 8. Y Reliability Test (Work Productivity)

For Variable Y (Work Productivity), the Cronbach's alpha value was 0.822, indicating high reliability. The reliability test results for each dimension, based on decision assumptions, showed that almost every dimension had a decision level between 0.60 and 0.70, indicating moderate reliability.

Classical Assumption Test

1. Normality Test

The normality test was conducted to determine whether the residual data were normally distributed. This study employed the Kolmogorov–Smirnov test, where a two-tailed significance value greater than 0.05 indicates that the data are normally distributed.

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		95
Normal Parameters[a,b]	Mean	0E-7
	Std. Deviation	2.59926032
Most Extreme Differences	Absolute	.109
	Positive	.075
	Negative	-.109
Kolmogorov-Smirnov Z		1.065
Asymp. Sig. (2-tailed)		.207

a. Test distribution is Normal.
b. Calculated from data.

Figure 9. Normality Test (Kolmogorov Smirnov)

Based on the normality test results, the Kolmogorov–Smirnov Z value was 1.065 with a significance value of 0.207, which is greater than 0.05 (0.207 > 0.05). Therefore, the residuals in this study are normally distributed.

2. Heteroskedasticity Test

The heteroskedasticity test was conducted to examine whether there is unequal variance of residuals across observations in the regression model. Heteroskedasticity was assessed using the scatter plot method and the Glejser statistical test.

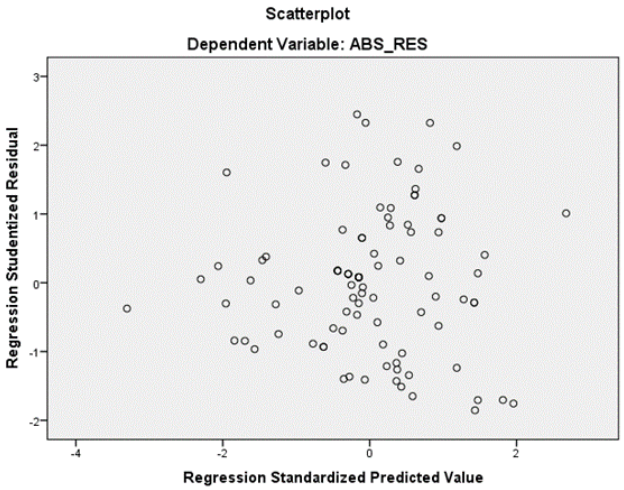

Figure 10. Heteroscedasticity Test (Scatterplot)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.939	1.330		2.211	.030
	Teknologi	-.064	.037	-.224	-1.735	.086
	Kompetensi SDM	.037	.025	.186	1.444	.152

a. Dependent Variable: ABS_RES

Figure 11. Heteroscedasticity Test (Glejser)

Based on the heteroskedasticity test results shown in the Coefficients table, with ABS_RES as the dependent variable, the significance values obtained were 0.086 and 0.152. Since both significance values are greater than 0.05, it can be concluded—according to the Glejser test criteria—that no heteroskedasticity is present in the regression model.

Hypothesis Testing

1. Partial Test (t-test)

The t-test is used to examine the extent to which each independent variable individually (partially) explains the variation in the dependent variable. The results of the data analysis were obtained using SPSS version 20.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.319	2.532		13.555	.000
	Teknologi	.233	.070	.394	3.334	.001
	Kompetensi SDM	.027	.049	.066	.563	.575

a. Dependent Variable: Produktivitas Kerja

Figure 12. Partial Test (t-Test)

The partial test results show that Technology (X1) has a significant effect on Work Productivity (Y), with $t_{calculated}$ = 3.334 > t_{table} = 1.66 and Sig. = 0.001 < 0.05; therefore, H1 is accepted. In contrast, Human Resource Competence (X2) does not have a significant partial effect on Work Productivity, as $t_{calculated}$ = 0.563 < t_{table} = 1.66 and Sig. = 0.575 > 0.05; thus, H2 is rejected.

2. Simultaneous Test (F-test).

Furthermore, to examine the combined effect of Technology and Human Resource Competence on Work Productivity, a regression analysis was conducted using SPSS version 20.

Table 2. Simultaneous Test (F-Test)

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	150.227	2	75.113	10.881	.000[b]
	Residual	635.078	92	6.903		
	Total	785.305	94			
a. Dependent Variable: Produktivitas Kerja						
b. Predictors: (Constant), HR Competence, Technology						

Based on the results, the calculated F value is 10.881, while the F table value is 1.93, with a significance level of 0.000 < 0.05. Since Fcalculated > Ftable at α = 0.05 (10.881 > 3.26), the null hypothesis (Ho) is rejected. This indicates that Technology and Human Resource Competence simultaneously have a significant effect on Work Productivity, therefore H3 is accepted.

3. Correlation Coefficient Test.

Correlation analysis is used to determine the relationship between quantitative variables. The correlation coefficients in this study were calculated using SPSS version 20, based on the established decision criteria.

Correlations

		Teknologi	Kompetensi SDM	Produktivitas Kerja
Teknologi	Pearson Correlation	1	.608**	.434**
	Sig. (2-tailed)		.000	.000
	N	95	95	95
Kompetensi SDM	Pearson Correlation	.608**	1	.306**
	Sig. (2-tailed)	.000		.003
	N	95	95	95
Produktivitas Kerja	Pearson Correlation	.434**	.306**	1
	Sig. (2-tailed)	.000	.003	
	N	95	95	95

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 13. Correlation Coefficient Test (R)

Based on the analysis, the correlation coefficient between X1 (Technology) and Y (Work Productivity) is 0.434, indicating a moderate positive relationship, with a significance value of 0.00 < 0.05, which confirms a significant correlation. With N = 95 and a 5% significance level, the r-table value is 0.168, and since r-calculated > r-table (0.434 > 0.168), Ho is rejected and it is concluded that Technology has a significant effect on Work Productivity.

Furthermore, the correlation coefficient between X2 (Human Resource Competence) and Y (Work Productivity) is 0.306, indicating a low positive relationship, with a significance value of 0.03 < 0.05, showing a significant correlation. With r-calculated > r-table (0.306 > 0.168), Ho is rejected, and it can be concluded that Human Resource Competence has a significant effect on Work Productivity.

4. Coefficient of Determination (R^2).

The coefficient of determination (R^2) is used to measure how well the model explains the variation in the dependent variable. The R^2 results were obtained using SPSS version 20.

Table 3. Test of the Coefficient of Determination (R2)

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.437[a]	.191	.174	2.627
a. Predictors: (Constant), Kompetensi SDM, Teknologi				
b. Dependent Variable: Produktivitas Kerja				

The table shows that the R-square value is 0.191, resulting in a coefficient of determination of 19.1% (0.191 × 100%). This indicates that Technology and Human Resource Competence jointly explain 19.1% of the variation in Work Productivity, while the remaining 80.9% is influenced by other factors. Based on the Body Outline problem report, most issues originate from the welding robot process, with an OK ratio of 98.87%, below the company target of 99.6%, leaving a gap of 0.73%. Therefore, it can be concluded that technology (welding robot processes) has a substantial influence on unmet productivity targets, while human resource competence also affects productivity but with a relatively low contribution.

Discussion

Discussion of Hypothesis 1 (H1)

The effect of Technology on Work Productivity was analyzed using partial testing. The results show that tcount = 3.334 and ttable = 1.66 (tcount > ttable), with a significance value of 0.001 (Sig. < 0.05). Therefore, it can be concluded that Technology has a significant partial effect on Work Productivity, and H1 is accepted.

Discussion of Hypothesis 2 (H2)

The partial effect of Human Resource Competence on Work Productivity shows that tcount = 0.563 and ttable = 1.66 (tcount < ttable), with a significance value of 0.575 (Sig. > 0.05). Thus, it can be concluded that Human Resource Competence does not have

a significant partial effect on Work Productivity, and H2 is rejected.

Discussion of Hypothesis 3 (H3)

The simultaneous effect of Technology and Human Resource Competence on Work Productivity produced an Fcount value of 10.881, while Ftable = 1.93, with a significance value of 0.000 (< 0.05). Since Fcount > Ftable at α = 0.05, it can be concluded that Technology and Human Resource Competence simultaneously have a significant effect on Work Productivity, and H3 is accepted, while Ho is rejected.

CONCLUSION

This study concludes that Technology has a positive and moderate effect on Work Productivity (R = 0.434), indicating that better technology supports higher productivity. Human Resource Competence shows a positive but low correlation with Work Productivity (R = 0.306) and does not have a significant partial effect. Simultaneously, Technology and HR Competence explain 19.1% of the variation in Work Productivity (R^2 = 0.191), implying that improvements in technology and HR competence can increase productivity, while the remaining influence comes from other factors not examined in this study.

Recommendations

First, improve the effectiveness of process automation by reducing quality issues in welding robots so employees can focus on higher-value tasks. Second, strengthen teamwork and trust among employees by improving visualization and coordination across workstations to enhance control and risk mitigation. Third, review and discuss Standard Operating Procedures (SOPs) with all relevant parties to ensure proper implementation and prevent operational risks.

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