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Introduction

The report delves into the impact of machine implementation on overtime, comparing averages before and after. It further scrutinizes average daily productivity across workers and conducts regression analysis to decipher vital variables influencing employee productivity. The t-test analysis seeks to uncover potential changes in overtime post-implementation. Meanwhile, assessing average productivity by day aims to unveil any workforce variations. The subsequent regression analysis endeavors to identify key factors significantly impacting employee productivity. This comprehensive study explores the effects of machine implementation on overtime, evaluates daily productivity trends, and uncovers pivotal variables influencing employee efficiency.

Descriptive Statistics

Variable	Mean	Standard Deviation
team	6.52	3.45
targeted_productivity	0.72	0.10
Smv	23.24	6.97
Wip	1190.46	1837.45
over_time	6508.20	2864.50
incentive	44.48	27.59
idle_time	1.26	16.71
idle_men	0.63	4.28
no_of_style_change	0.26	0.53
no_of_workers	52.44	9.41
actual_productivity	0.72	0.15

Table 1. Descriptive Statistics

Interpretation: The descriptive statistics in Table 1 reveal key insights into various variables related to productivity in the garment manufacturing dataset. Variables such as 'team' demonstrate an average of approximately 6.52 (M = 6.52, SD = 3.46), while 'targeted_productivity' stands at an average of 0.72 (M = 0.72, SD = 0.10). 'SMV' averages 23.25 (M = 23.25, SD = 6.98), 'WIP' averages 1190.47 (M = 1190.47, SD = 1837.46), and 'over_time' shows an average of 6508.21 (M = 6508.21, SD = 2864.51). Moreover, 'incentive' averages 44.48 (M = 44.48, SD = 27.60), while 'idle_time' and 'idle_men' demonstrate means of 1.26 (M = 1.26, SD = 16.71) and 0.64 (M = 0.64, SD = 4.28) respectively. Additionally, 'no_of_style_change' and 'no_of_workers' display means of 0.26 (M = 0.26, SD = 0.54) and 52.45 (M = 52.45, SD = 9.42) correspondingly. Lastly, 'actual_productivity' shows an average of 0.72 (M = 0.72, SD = 0.15).

Inferential Statistics

The company believes in implementing new machines, which would reduce the average overtime (in minutes) that the workers will do, which will lead to a cost reduction in the end. They tried it in a group of 200 workers, which shows an average overtime of 6300 minutes. Can we say that the company is right? Formulate an appropriate hypothesis and justify your answer. [0 – 30%].

Hypothesis Formulation:

Null Hypothesis (H_0): The new machines implemented do not reduce the average overtime of the workers.

Alternative Hypothesis (H_1): The new machines implemented reduce the average overtime of the workers.

Test Statistics	**Value**
Population mean overtime	6508.2
Sample mean overtime for 200 workers	6300
T-statistic	1.91
P-value	0.05

Table 2. T-test

Interpretation: The one-sample t-test results (t (200) = 1.91, p = 0.056) indicated that there was no significant evidence to support the claim that the implementation of new machines reduced the average overtime (M = 6300 minutes) of the workers (M = 6508.21 minutes, p = 0.056). Consequently, the null hypothesis suggesting no reduction in average overtime was retained. Therefore, based on this analysis, there isn't enough statistical evidence to conclude that the new machines have led to a decrease in workers' average overtime at a significance level of 0.05.

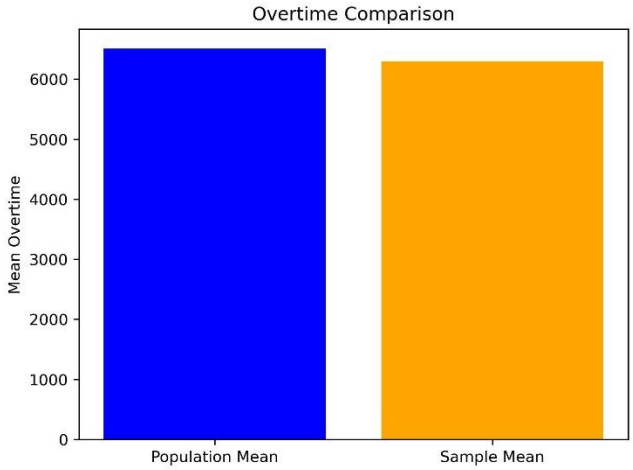

Figure 1. Bar Graph

Formulate an appropriate analysis to determine the real average productivity of these workers each day of the week. Is there any difference between the days? Along with your results, provide a possible explanation of the outcome. [0-30%]

Hypothesis Formulation:

Null Hypothesis (H_0): There is no significant difference in the average productivity among workers across different days of the week.

Alternative Hypothesis (H_1): There is a significant difference in the average productivity among workers across different days of the week.

	Variable	Mean	F statistic	p-value
Day	Monday	0.724169	0.3602	0.875
	Saturday	0.734080		
	Sunday	0.713549		
	Thursday	0.710772		
	Tuesday	0.728115		
	Wednesday	0.722712		

Table 3. ANOVA

Interpretation: Table 3 presents the average productivity by day, indicating slight variations across the days of the week (Monday = 0.724, Tuesday = 0.728, Wednesday = 0.723, Thursday = 0.711, Saturday = 0.734, Sunday = 0.714). The ANOVA test revealed a non-significant difference in productivity between days ($F(5, 685) = 0.360$, $p = 0.876$), suggesting no compelling evidence to support significant variations in productivity among different days of the week. Despite slight average differences, the absence of significant productivity variations across days of the week could be attributed to efficient workflow management or consistent operational strategies maintained throughout the week, contributing to the observed outcome.

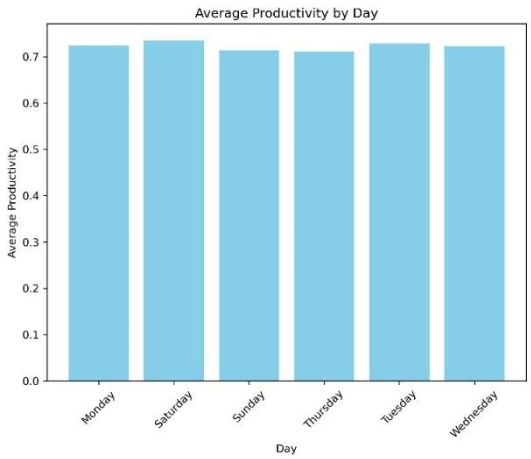

Figure 2. Bar Graph

Regression Analysis

Use some variables of the dataset to perform regression analysis. You should identify the key variables that influence employee productivity. [0 – 20%]

DV: actual_productivity						
Variables	Coefficient	S.E.	t-value	p-value	95% Conf. Interval Lower	95% Conf. Interval Upper
Constant	0.5821	0.020	29.775	0.000	0.544	0.621
no_of_workers	0.0003	0.000	0.727	0.468	-0.001	0.001
smv	-0.0014	0.001	-2.298	0.022	-0.003	-0.000
over_time	-5.94e-06	1.28e-06	-4.633	0.000	-8.46e-06	-3.42e-06
incentive	0.0044	0.000	34.613	0.000	0.004	0.005
idle_time	0.0005	0.000	2.078	0.038	2.81e-05	0.001
idle_men	-0.0053	0.001	-5.445	0.000	-0.007	-0.003
R^2	0.675					
Adj. R^2	0.672					
Table. 3 Multiple Linear Regression						

Interpretation: The multiple linear regression model evaluating employee productivity revealed several influential variables. In particular, the incentivization ($\beta = 0.0044$, $p < 0.001$) positively impacted productivity, while both overtime ($\beta = -5.94e-06$, $p < 0.001$) and idle men ($\beta = -0.0053$, $p < 0.001$) exhibited negative associations. However, the number of workers ($\beta = 0.0003$, $p = 0.468$) and standard minute value ($\beta = -0.0014$, $p = 0.022$) did not significantly predict productivity ($p > 0.05$). The model accounted for approximately 67.5% of the variance in employee productivity.

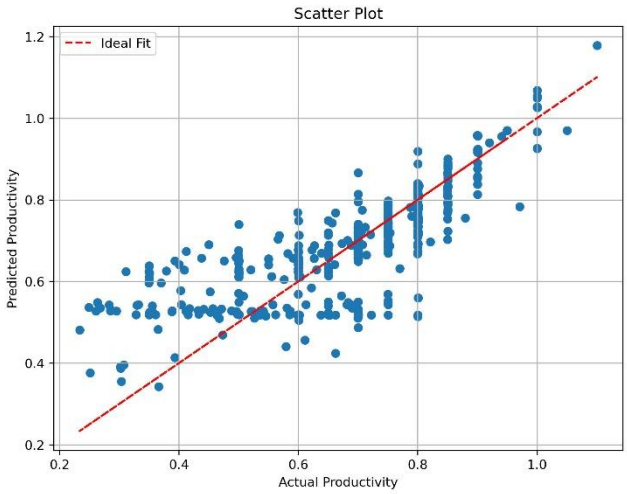

Figure 3. Scatter Plot

Limitations and Recommendation

Although this research has provided some useful insights, it does have certain drawbacks. Workers' level of experience or the details of the machinery used could be overlooked if only a small number of variables are considered. The dataset may also lack background information on manufacturing steps or external variables influencing output. Additional analysis might use a broader dataset, including qualitative data, to provide a more in-depth comprehension. The study might be fine-tuned by looking at other factors, such as task-specific metrics or staff satisfaction surveys. Time-series research of productivity changes over lengthy periods might be useful to clarify the long-term impacts further. It could be helpful to include qualitative evaluations that delve into employees' actual experiences to provide a more complete picture.

Conclusion

In conclusion, this comprehensive analysis explored the effects of machine implementation on overtime, demonstrating a non-significant result following the change. Daily productivity showed slight variations but lacked significance across different days of the week, implying consistent workflow strategies. The regression analysis unveiled impactful factors; incentivization positively influenced productivity, whereas overtime and idle men had adverse effects. Nevertheless, productivity was not substantially predicted by the total number of workers or the standard minute value. Contributing to over 67.5% of the variability in productivity in this industrial context, this study highlights the critical importance of incentives and effective resource management in raising labour efficiency.