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Insights on Garment Workers in Bangladesh

EBTM 881 CAPSTONE PROJECT

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Supply Chain Management

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1. Introduction & Problem Motivation

As a Supply Chain student, I aim to explore and predict the productivity of garment workers in Bangladesh, a densely populated and underdeveloped South Asian country. Bangladesh's population density is so high that it surpasses the total population of Russia, the largest country in the world by land area. Despite its economic challenges, Bangladesh is a global leader in textile and garment exports, which serve as the backbone of its economy.

The textile and garment industries are the primary drivers of Bangladesh's economy, contributing significantly to foreign exchange earnings. These industries are labor-intensive, relying heavily on the productivity of their workforce. Understanding employee productivity is crucial for maintaining the industry's competitive edge in the global market. Without consistent and optimized productivity, the industry risks falling behind competitors in both efficiency and profitability.

One of the biggest challenges faced by the garment industry is balancing employee wages with sustainable productivity levels. This delicate balance often determines the long-term viability of the sector. Motivated by these challenges, I embarked on a research project to analyze and predict employee productivity in this critical industry.

Although my research utilized a relatively small dataset, it provided valuable insights into workforce dynamics and productivity trends. This analysis offers a foundation for understanding the broader implications of employee performance and highlights the need for data-driven approaches to improve productivity in the garment industry. Through this project, I aim to contribute to the sustainable growth and competitiveness of Bangladesh's textile and garment sector.

2. Problem Statement

The garment and textile industry are a vital contributor to Bangladesh's economy, serving as a major source of employment and foreign exchange. However, the industry faces persistent challenges in maintaining and improving employee productivity, which directly impacts operational efficiency, profitability, and long-term sustainability. Despite its significance, there is limited research exploring the key factors influencing productivity and their interdependencies within the garment sector.

Available data on garment worker productivity presents an opportunity to analyze various attributes, including working hours, incentives, style changes, idle time, and team dynamics. Preliminary observations reveal intriguing trends, such as consistently high productivity despite low financial incentives, suggesting underlying socio-economic factors. These trends demand a deeper, data-driven investigation to identify actionable insights.

This study aims to address the following critical problems:

1. A lack of understanding of how productivity varies across teams, departments, and quarters.
2. How do incentive differences between Bangladesh and other competitive countries vary? The absence of data-driven strategies to enhance employee well-being and optimize operational efficiency.

Without addressing these challenges, the garment industry risks inefficiencies, worker dissatisfaction, and a decline in global competitiveness. This research seeks to fill these gaps by leveraging Python-based analytics and visualization techniques to uncover patterns, relationships, and insights from productivity data. The findings aim to inform policies and strategies that improve workforce management and drive sustainable growth in Bangladesh’s garment sector.

3. Background

The garment and textile industry is the backbone of Bangladesh's economy, accounting for a significant share of the nation's export earnings and employing millions of workers. This labor-intensive sector serves as a primary source of income for many Bangladeshi families and remains a critical driver of economic development. Bangladesh is one of the world's largest exporters of readymade garments, making productivity within this sector crucial for maintaining its competitiveness in the global market. Despite its significance, challenges such as low wages, high work pressure, and socio-economic issues like poverty and unemployment continue to affect worker productivity.

Productivity, as a measure of efficiency, is essential for determining the profitability and operational success of the garment sector. Understanding the factors influencing productivity, including the work environment, task complexity, and incentives, is crucial for optimizing operations and improving worker well-being. In developing countries like Bangladesh, where labor is abundant, but resources are constrained, the interplay of these factors is often underexplored.

This study is enriched with real-world data collected from **Aman Graphics & Designs Ltd.**, one of Bangladesh's leading garment manufacturers. The company operates 12 factories employing over 11,000 workers and ships 24 million products globally each year. Productivity data were sourced from the company's Human Resources department, providing insights into the yearly working percentage of employees. The dataset includes information about two primary teams within the company: **sewing** and **finishing** departments. These data points allow for an in-depth analysis of employee productivity and the operational dynamics within a large-scale garment manufacturer.

The study leverages Python programming for data manipulation and visualization to uncover patterns and insights from the dataset. By employing advanced data analysis techniques, this research aims to predict productivity levels of garment employees and provide actionable recommendations for stakeholders. This work not only sheds light on the systemic issues within Bangladesh's garment industry but also identifies strategies to enhance efficiency and worker well-being.

4. Literature Review

Research on productivity in the garment sector has largely focused on operational efficiency, labor management, and the socio-economic conditions affecting workers. Several key studies and insights are relevant to understanding this topic:

1. **Labor-Intensive Nature of the Industry:**
    - Studies indicate that garment manufacturing is inherently labor-intensive, with productivity heavily dependent on worker engagement and task allocation (Rahman & Bari, 2018). Factors like overtime, task repetition, and worker fatigue are often cited as critical influencers of productivity.
2. **Impact of Financial Incentives:**
    - Research highlights that financial incentives play a significant role in motivating workers (Islam et al., 2019). However, in countries like Bangladesh, low incentives are common due to high labor supply, resulting in a productivity paradox where workers deliver high output despite minimal financial rewards.

3. **Task Complexity and Time Allocation:**
    - Standard Minute Value (SMV), representing the allocated time for a task, is a widely used metric to assess task complexity (Haque et al., 2020). Lower SMV tasks are associated with higher productivity, while higher SMV tasks often lead to unpredictability in performance.
4. **Socio-Economic Pressures:**
    - Poverty and unemployment drive workers to maintain high productivity levels regardless of workplace conditions (Khan & Akhtar, 2017). This highlights the critical role of socio-economic context in influencing labor efficiency in developing nations.
5. **Use of Data Analytics in Productivity Studies:**
    - The adoption of data-driven approaches in analyzing garment worker productivity is growing. Python programming and visualization tools like Matplotlib and Pandas are increasingly used to generate insights from datasets, enabling researchers to identify trends and optimize workflows (Mahalakshmi, 2024).
6. **Team Dynamics and Workflow Management:**
    - Team-based approaches in garment manufacturing have been studied to improve efficiency and reduce idle time (Ahmed et al., 2021). The balance of workload, team size, and coordination significantly impacts productivity metrics.

5. Data Model & Analysis:

Data visuals are inevitable for comprehending and drawing plausible conclusions from any given dataset. Here, I have created emblazoning visuals through Python Programming, a fabulous data visualization tool for predicting the trends in any dataset.

My goal is to unveil insights that can assist us in constructing precise productivity prediction models. Throughout this journey, we will consider factors such as team dynamics, standard minute values (SMV), work in progress (WIP), overtime hours, and more.

The given dataset measures the productivity of the employees of garment industries in Bangladesh in the year 2024 through fifteen different attributes/features. The given dataset has 1379 instances. For better comprehension of the readers, I would like to explain each of the 15 features or columns here:

- date - Date in MM-DD-YYYY format (The data were obtained in the year 2021-2024)
- day - Day of the Week
- quarter - A portion of the month. A month was divided into five quarters
- department - Associated department with the instance. There are only two departments in the dataset - sewing department and finishing department
- team_no - Associated team number with the instance
- no_of_workers - Number of workers in each team
- no_of_style_change - Number of changes in the style of a particular product
- targeted_productivity - Targeted productivity set by the Authority for each team for each day
- smv - Standard Minute Value, it is the allocated time for a task
- wip - Work in progress. Includes the number of unfinished items for products
- Over_time - Represents the amount of overtime by each team in minutes
- Incentive - Represents the amount of financial incentive (in BDT - Bangladeshi Taka) that enables or motivates a particular course of action

- idle_time - The amount of time when the production was interrupted due to several reasons
- idle_men - The number of workers who were idle due to production interruption
- actual_productivity - The actual percentage of productivity that was delivered by the workers. It ranges from 0-1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	date	quarter	department	day	team	targeted_productiv	smv	wip	over_time	incentive	idle_time	idle_men	no_of_style_change	no_of_workers	actual_productivity	
2	1/1/24	Quarter1	sweing	Thursday	8	0.8	26.16	1108	7080	98	0	0	0	59	0.94072542	
3	1/2/24	Quarter1	finishing	Thursday	1	0.75	3.94	1108	960	0	0	0	0	8	0.8865	
4	1/3/24	Quarter1	sweing	Thursday	11	0.8	11.41	968	3660	50	0	0	0	30.5	0.80057049	
5	1/4/24	Quarter1	sweing	Thursday	12	0.8	11.41	968	3660	50	0	0	0	30.5	0.80057049	
6	1/5/24	Quarter1	sweing	Thursday	6	0.8	25.9	1170	1920	50	0	0	0	56	0.80038194	
7	1/6/24	Quarter1	sweing	Thursday	7	0.8	25.9	984	6720	38	0	0	0	56	0.800125	
8	1/7/24	Quarter1	finishing	Thursday	2	0.75	3.94	984	960	0	0	0	0	8	0.75516667	
9	1/8/24	Quarter1	sweing	Thursday	3	0.75	28.08	795	6900	45	0	0	0	57.5	0.75368348	
10	1/9/24	Quarter1	sweing	Thursday	2	0.75	19.87	733	6000	34	0	0	0	55	0.75309753	

1.1 First Few Rows of the Dataset

In Python Programming, to analyze and manipulate the data, we need to import pandas. To create emblazoning visuals, the foremost thing that we should do in Python is importing 'matplotlib', a comprehensive library for creating static, animated and interactive visuals.

Hence, in the Python notebook, I have first imported pandas and matplotlib to analyze the given dataset and to create beautiful visuals, like, histograms, bar charts, scatter plots, box plots etc. from the given dataset.

The given dataset was then loaded into the Python notebook. To understand the numbers and the names of the features in the given dataset, the first few rows of the dataset are viewed in the Python notebook through the following code:

```
import pandas as pd

import matplotlib.pyplot as plt
```

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	date	quarter	department	day	team	targeted_productiv	smv	wip	over_time	incentive	idle_time	idle_men	no_of_style_change	no_of_workers	actual_productivity	
2	1/1/24	Quarter1	sweing	Thursday	8	0.8	26.16	1108	7080	98	0	0	0	59	0.94072542	
3	1/2/24	Quarter1	finishing	Thursday	1	0.75	3.94	1108	960	0	0	0	0	8	0.8865	
4	1/3/24	Quarter1	sweing	Thursday	11	0.8	11.41	968	3660	50	0	0	0	30.5	0.80057049	
5	1/4/24	Quarter1	sweing	Thursday	12	0.8	11.41	968	3660	50	0	0	0	30.5	0.80057049	
6	1/5/24	Quarter1	sweing	Thursday	6	0.8	25.9	1170	1920	50	0	0	0	56	0.80038194	
7	1/6/24	Quarter1	sweing	Thursday	7	0.8	25.9	984	6720	38	0	0	0	56	0.800125	
8	1/7/24	Quarter1	finishing	Thursday	2	0.75	3.94	984	960	0	0	0	0	8	0.75516667	
9	1/8/24	Quarter1	sweing	Thursday	3	0.75	28.08	795	6900	45	0	0	0	57.5	0.75368348	
10	1/9/24	Quarter1	sweing	Thursday	2	0.75	19.87	733	6000	34	0	0	0	55	0.75309753	

1.2 First Few Rows of the Dataset in Python

To understand the type of data, that is, whether the data in each column are integers or strings or floats (decimal values), I obtained the summary of the data by using the following code in Python:

```
# Check the result

print(data_cleaned.info())
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 1379 entries, 0 to 1379
Data columns (total 15 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   date                     1379 non-null   object 
 1   quarter                  1379 non-null   object 
 2   department               1379 non-null   object 
 3   day                      1379 non-null   object 
 4   team                     1379 non-null   float64
 5   targeted_productivity    1379 non-null   float64
 6   smv                      1379 non-null   float64
 7   wip                      810 non-null    float64
 8   over_time                1379 non-null   float64
 9   incentive                1379 non-null   float64
 10  idle_time                1379 non-null   float64
 11  idle_men                 1379 non-null   float64
 12  no_of_style_change       1379 non-null   float64
 13  no_of_workers            1379 non-null   float64
 14  actual_productivity      1379 non-null   float64
dtypes: float64(11), object(4)
memory usage: 172.4+ KB
```

1.3 Summary Information - Describing the Data Type of Each Column

To understand whether any inputs are missing and to understand the maximum and minimum values in each column and to extract some other information on descriptive statistics, like, mean, standard deviation etc., I obtained the summary statistics of all the features or attributes. The summary statistics was obtained as follows:

```
# Get Summary Statistics from the Data
print(data_cleaned.describe())
```

```
              team  targeted_productivity          smv           wip  \
count  1379.000000            1379.000000  1379.000000    810.000000   
mean      6.452502               0.732175    15.136998   1147.197531   
std       3.459871               0.094225    10.949696   1704.697281   
min       1.000000               0.070000     2.900000      7.000000   
25%       3.000000               0.700000     3.940000    750.250000   
50%       7.000000               0.750000    15.260000   1025.500000   
75%       9.000000               0.800000    24.785000   1227.000000   
max      12.000000               0.800000    54.560000  23122.000000   

          over_time    incentive    idle_time     idle_men  \
count   1379.000000  1379.000000  1379.000000  1379.000000   
mean    4469.035533    36.002175     0.664249     0.472806   
std     3264.790162   149.598299    11.849077     3.667585   
min        0.000000     0.000000     0.000000     0.000000   
25%     1440.000000     0.000000     0.000000     0.000000   
50%     3960.000000     0.000000     0.000000     0.000000   
75%     6900.000000    50.000000     0.000000     0.000000   
max    25920.000000  3600.000000   300.000000    45.000000   

       no_of_style_change  no_of_workers  actual_productivity  
count         1379.000000    1379.000000          1379.000000  
mean             0.180566      34.670051             0.732412  
std              0.469721      22.153859             0.173811  
min              0.000000       2.000000             0.233705  
25%              0.000000       9.000000             0.650417  
50%              0.000000      34.000000             0.758229  
75%              0.000000      57.000000             0.850125  
max              2.000000      89.000000             1.120437  
```

1.4 Summary Statistic

The summary statistics was of great help in better predicting the trends in the given dataset. Through the summary statistics, I understood that only the column of wip (work in progress - refers to the number of unfinished items for products) has missing values. However, Python has a special code for identifying missing values in each column, which I used as follows:

```
# Identify Missing Values in the Dataset
print(data_cleaned.isnull().sum())
```

```
date                       0
quarter                    0
department                 0
day                        0
team                       0
targeted_productivity      0
smv                        0
wip                      569
over_time                  0
incentive                  0
idle_time                  0
idle_men                   0
no_of_style_change         0
no_of_workers              0
actual_productivity        0
dtype: int64
```

1.5 Python has identified the numbers of missing values in each column.

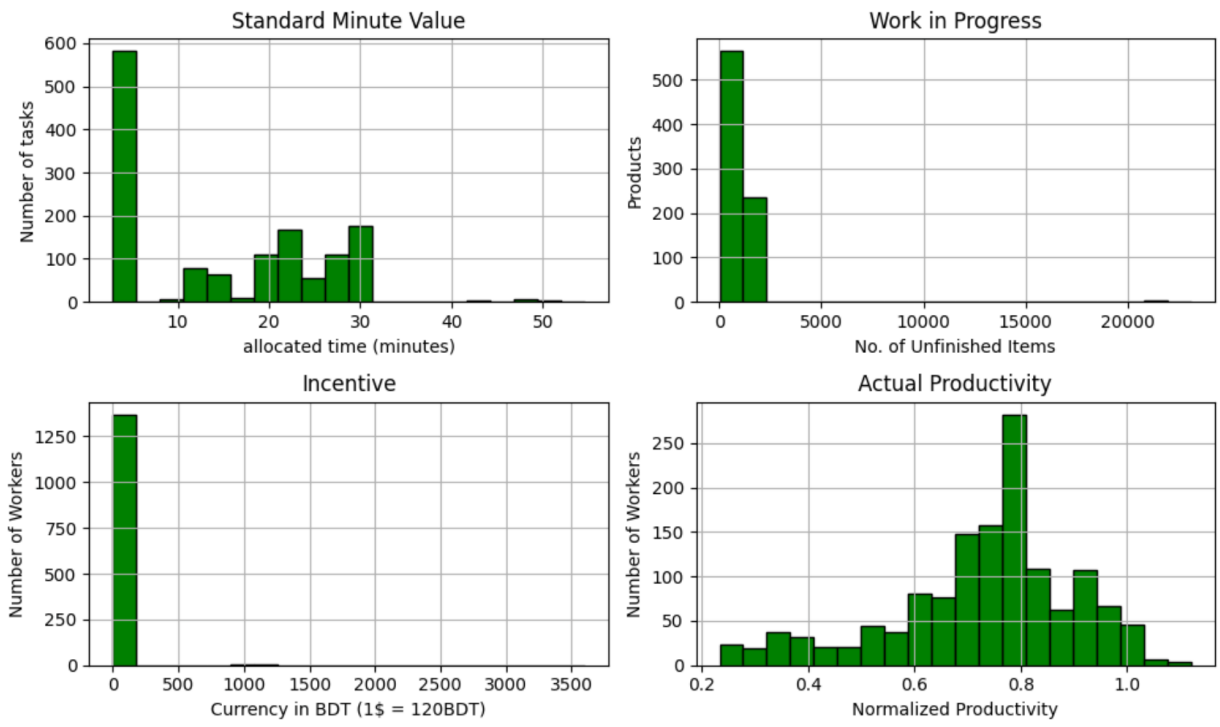
From the given dataset, using Python coding I built visuals, like, histograms, bar graphs, scatter plots, box plots to draw profound insights and eventual conclusions on the productivity of the employees in the garment industries of Bangladesh.

Let us see the inferences that I drew from each visual:

5.1 Histograms:

Histograms are visual tools that show how numerical data is distributed. They help us understand the probability of different values for a continuous variable. Using Python, I created histograms for four attributes: smv, wip, incentive, and actual productivity, which provide valuable insights into the data.

```
# Histograms

numerical_cols = ['smv', 'wip', 'incentive', 'actual_productivity']

data_cleaned[numerical_cols].hist(figsize= (10,6), bins=20)
```



1.6 Histograms of smv, wip, incentive and actual productivity

The histograms show that the **SMV (Standard Minute Value)** for most tasks is under five minutes. Only a few tasks take 10-30 minutes, and almost none take more than 30 minutes. This means garment workers need to be quick and complete tasks efficiently within five minutes to avoid backlogs and unfinished work. This observation aligns with the **WIP (Work in Progress)** histogram, which supports the importance of worker agility and productivity.

The **WIP (Work in Progress)** measures the number of unfinished items. The histogram shows that the total number of unfinished items is usually below 2500, which is impressive given the large number of tasks in the garment industry. This, along with the **SMV** histogram, highlights the speed and productivity of garment workers in Bangladesh.

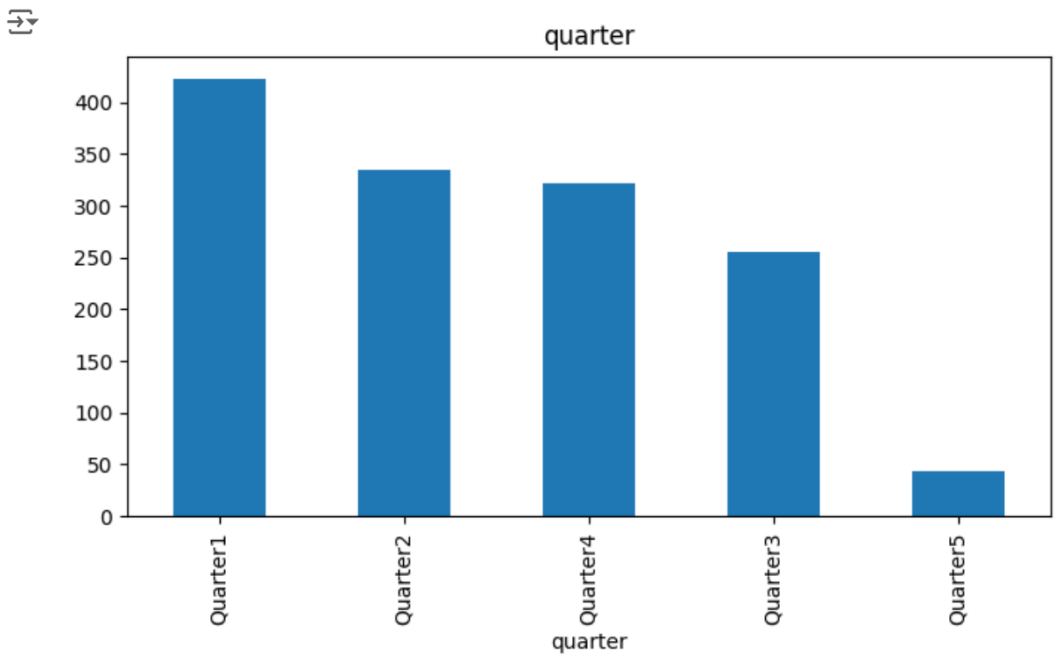
The **actual_productivity** shows how productive garment workers are, with values ranging from 0 to 1. A value of 0 means no productivity, while 1 means 100% productivity. The histogram and summary statistics show that the average productivity is **73.5%** (mean: 0.735), with a small variation (standard deviation: 0.174). A very small number of workers even exceed 100% productivity (maximum: 1.12). Productivity drops occasionally, which could be due to challenges like frequent power outages, health issues, or the spread of contagious diseases in Bangladesh.

The histogram on **incentive** shows that most garment workers receive only 50 BDT (.45$ cents) as an incentive, which is very low. Despite this, productivity remains high, reflecting the severe unemployment and poverty in Bangladesh. Workers are forced to work hard for minimal pay due to widespread poverty and low living standards. Bangladesh's large population also makes access to cheap labor easier, contributing to this scenario.

5.2 Bar Graphs:

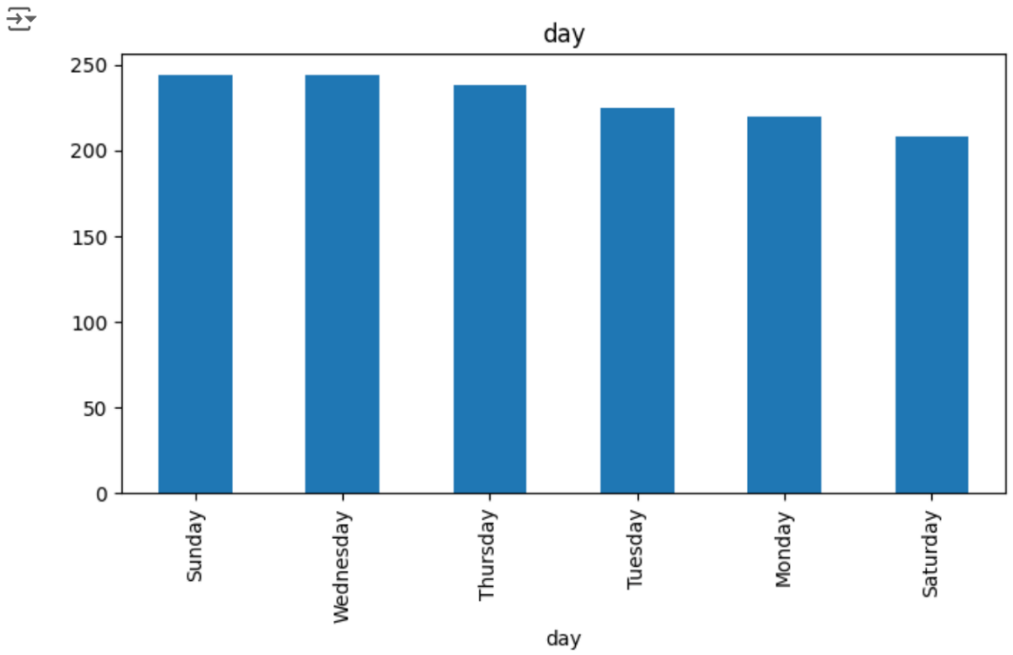
```
# Bar Graphs

categorical_cols = ['quarter', 'department', 'day', 'idle_time',
'idle_men']

for col in categorical_cols:

  data_cleaned[col].value_counts().plot(kind='bar', figsize=(8,4))
```

Let us infer more from the following bar graphs. The bar graphs were created for five different attributes/features, namely, quarter, department, day, idle_time, idle men using the following code:



1.7 Bar Graph of the Five Quarters

In the dataset, a month is divided into five quarters. The bar graph shows that productivity is highest in the first two quarters but decreases in the last three. The fifth quarter has the lowest productivity, while the fourth quarter is slightly more productive than the third.

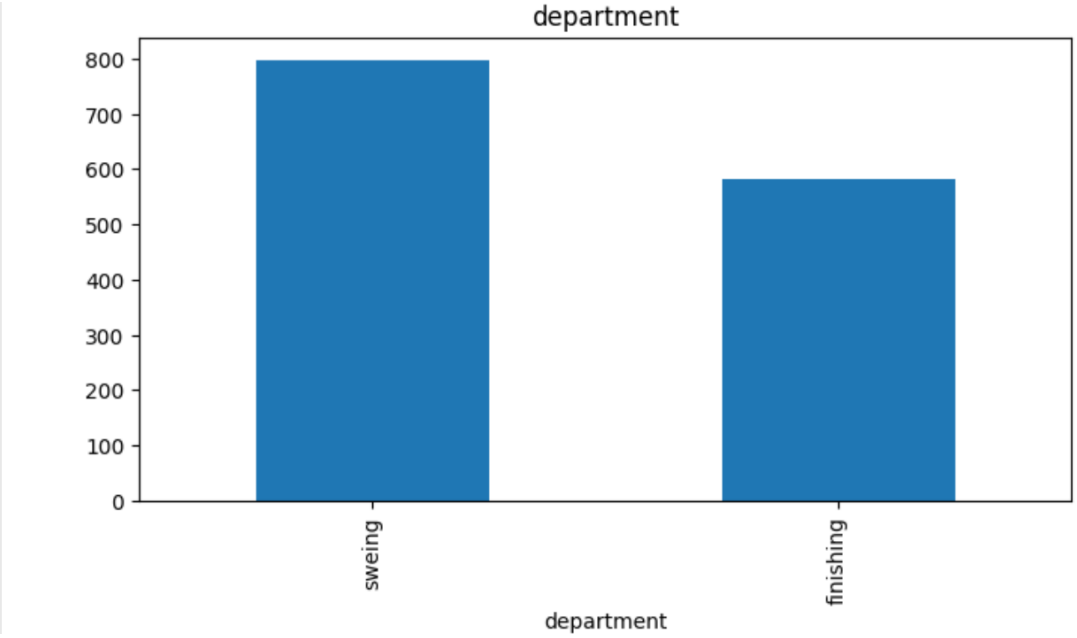


1.8 Bar Graph of the Days

In many Islamic countries, Fridays are observed as holidays, and Bangladesh, being an Islamic country, follows this tradition. As a result, garment factories typically remain closed on Fridays, operating on the other six days of the week. From the data, we observe that employee productivity is consistent across most working days, with one notable exception: **Saturdays**.

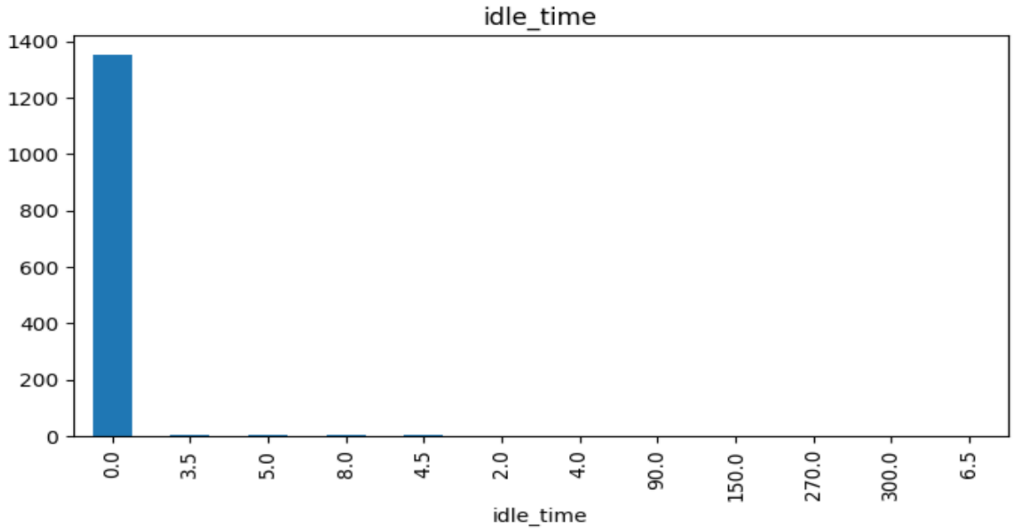
On Saturdays, there is a slight drop in productivity. This decline can be attributed to the natural human tendency to feel less energetic and more sluggish when returning to work after a day of rest. The Friday break allows employees to unwind, but resuming work on Saturday often requires readjusting to the routine, leading to a marginal decrease in efficiency. This pattern is common in many workplaces, where employees need time to regain their momentum after a holiday.

Although the drop in productivity on Saturdays is not drastic, it highlights the importance of understanding worker behavior and motivation. Addressing this slight dip, perhaps through morale-boosting activities or optimizing workloads, could help maintain steady productivity throughout the week. This insight is particularly important in labor-intensive industries like garment manufacturing, where consistent performance is critical to meeting production targets and maintaining competitiveness.



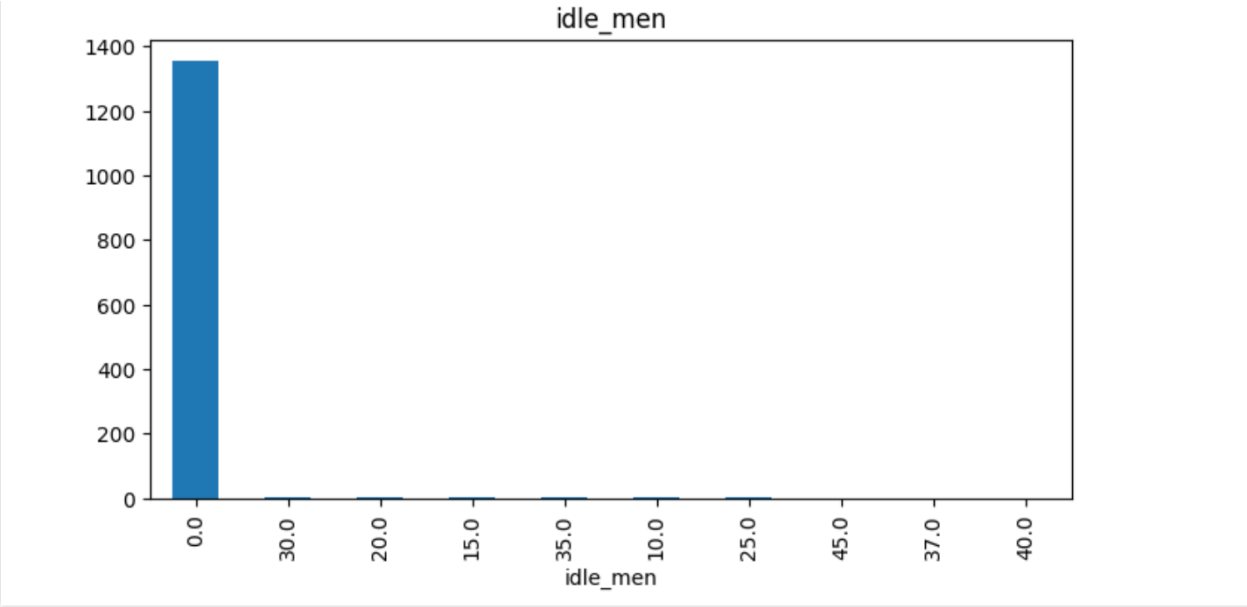
1.9 Bar Graph of the Department

From the bar graph of the department, we understand that there were only two departments in the garment industries, namely, the sewing and the finishing departments. We infer that the sewing department is labour intensive and has many tasks compared to the finishing department.



2.0 Bar Graph of Idle Time

The bar graph on idle time tells us that there is hardly any idle time for the employees. The bar graph yet again corroborates the high degree of productivity of the garment employees.



2.1 Bar Graph of Idle Men

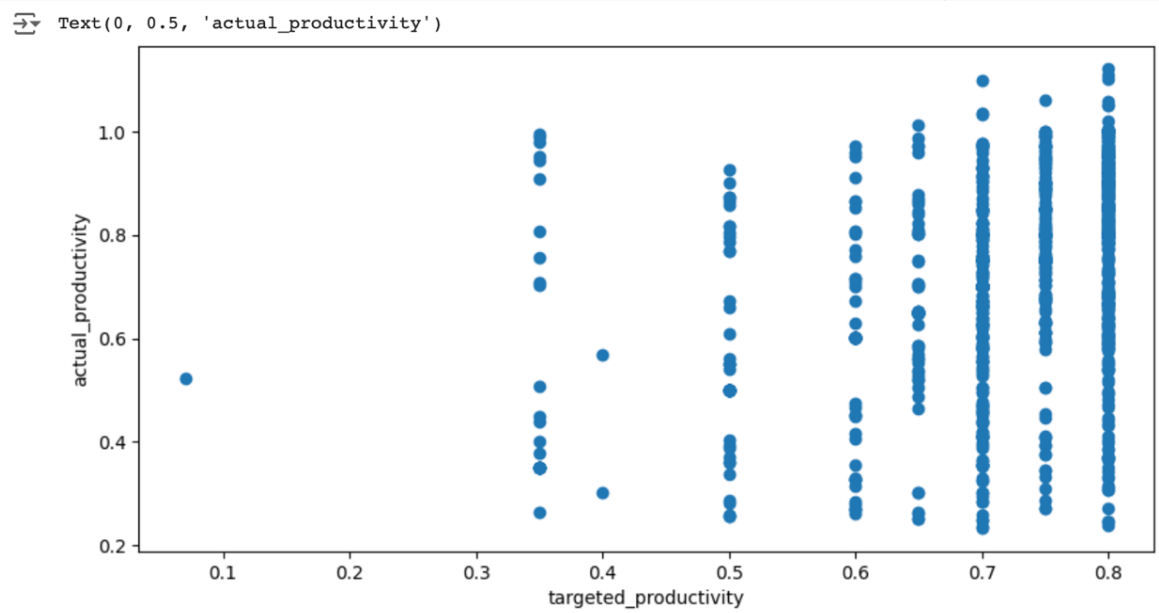
The bar graph of idle men clearly indicates that there were hardly any employees that remained idle for whatsoever reasons. This corroborates the fact how labour intensive the garment industries are.

5.3 Scatter Plots

Scatter plots are the fundamental tools for visualizing the relationship between two variables.

The following six scatter plots offer us greater and better insights on the dataset by revealing the relationships between two attributes in the given dataset:

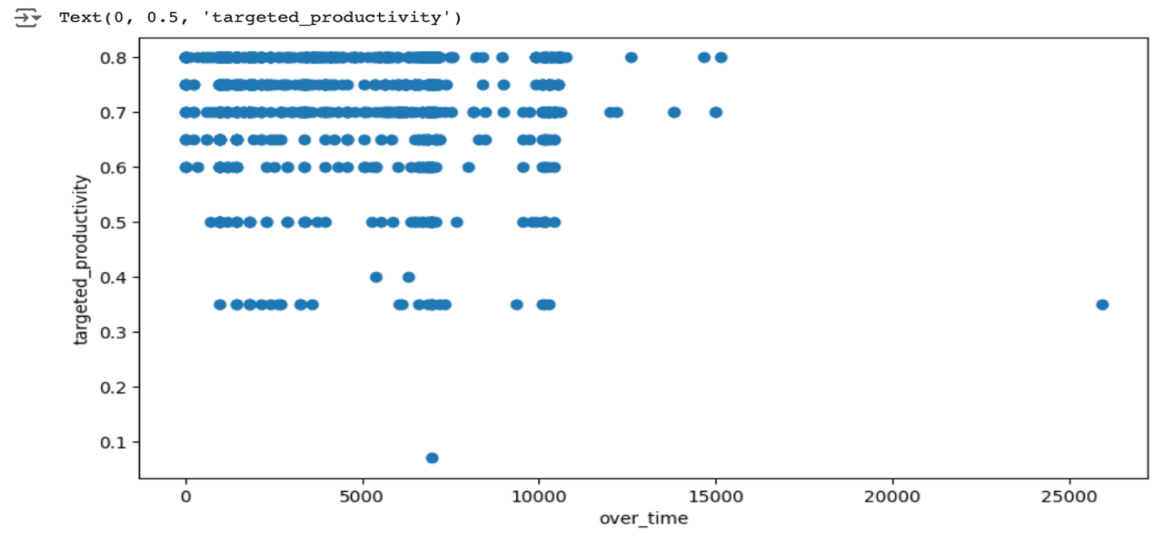
```
# Scatter Plot - 1
plt.figure(figsize=(10,5))
plt.scatter(data_cleaned['targeted_productivity'],
data_cleaned['actual_productivity'])
plt.xlabel('targeted_productivity')
```



2.2 Targeted Productivity Vs Actual Productivity

The above scatter plot clearly indicates that the actual_productivity was, indeed, better than the targeted_productivity of the garment employees. Thus, the productivity of the employees of the garment industries supersedes the expectations.

```
# Scatter Plot - 1
plt.figure(figsize=(10,5))
plt.scatter(data_cleaned['over_time'], data_cleaned['targeted_productivity'])
plt.xlabel('over_time')
plt.ylabel('targeted_productivity')
```

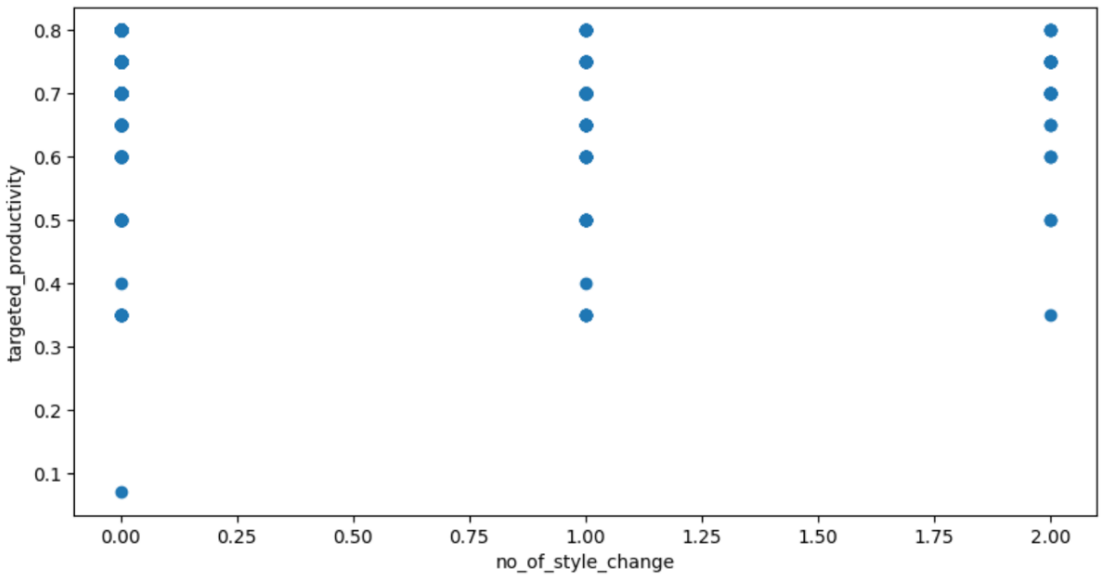


2.3 Over time Vs Targeted Productivity

The scatter plot between overtime and targeted productivity reveals that increase in over time has not affected the targeted productivity. It is yet another indicator of the deplorable living conditions and poverty prevailing in Bangladesh that force the workers to toil for low wages and incentives just to keep the wolf off the door.

```
# Scatter Plot - 1
plt.figure(figsize=(10,5))
plt.scatter(data_cleaned['no_of_style_change'],
data_cleaned['targeted_productivity'])
```

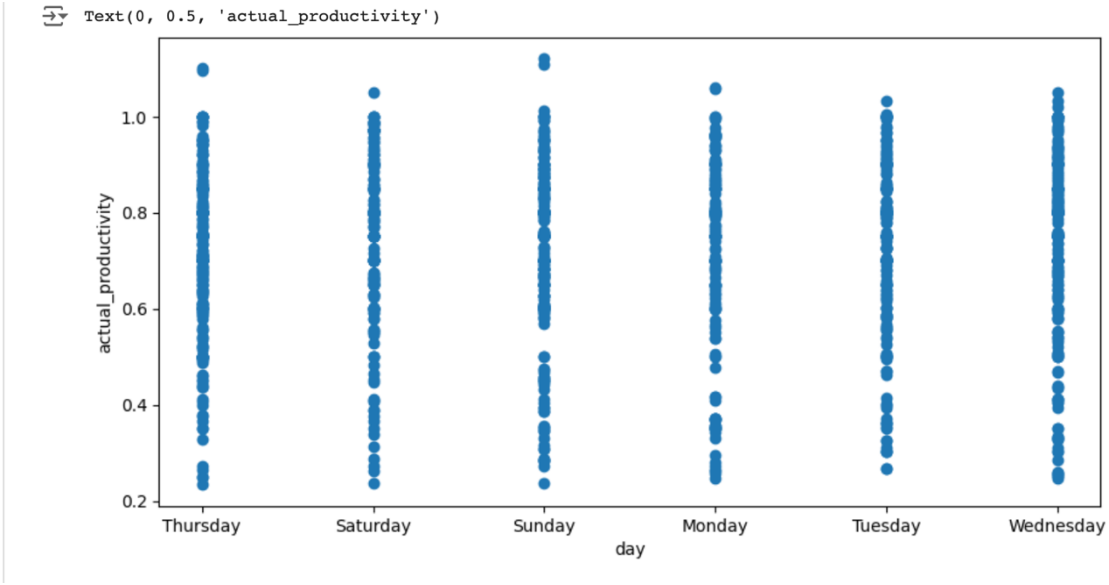
```
Text(0, 0.5, 'targeted_productivity')
```



2.4 No. of Style Change Vs Targeted Productivity

From the above scatter plot, we infer that either there was no style change at all or there were one or two style changes. The scatter plot tells us that the targeted productivity is unaffected by the numbers of style changes.

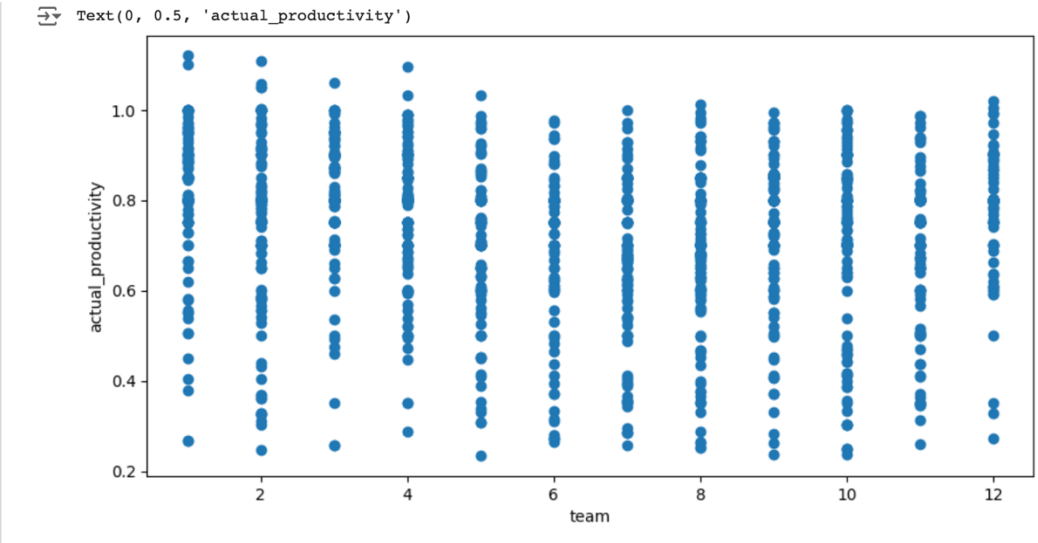
```
# Scatter Plot - 1
plt.figure(figsize=(10,5))
plt.scatter(data_cleaned['day'], data_cleaned['actual_productivity'])
plt.xlabel('day')
plt.ylabel('actual_productivity')
```



2.5 Day Vs Actual Productivity

The scatter plot between the day and actual productivity wholly agrees with the bar graph on days. Just like the bar graph, the scatter plot also reveals only a marginal drop in productivity on Saturdays.

```
# Scatter Plot - 1
plt.figure(figsize=(10,5))
plt.scatter(data_cleaned['team'], data_cleaned['actual_productivity'])
plt.xlabel('team')
plt.ylabel('actual_productivity')
```

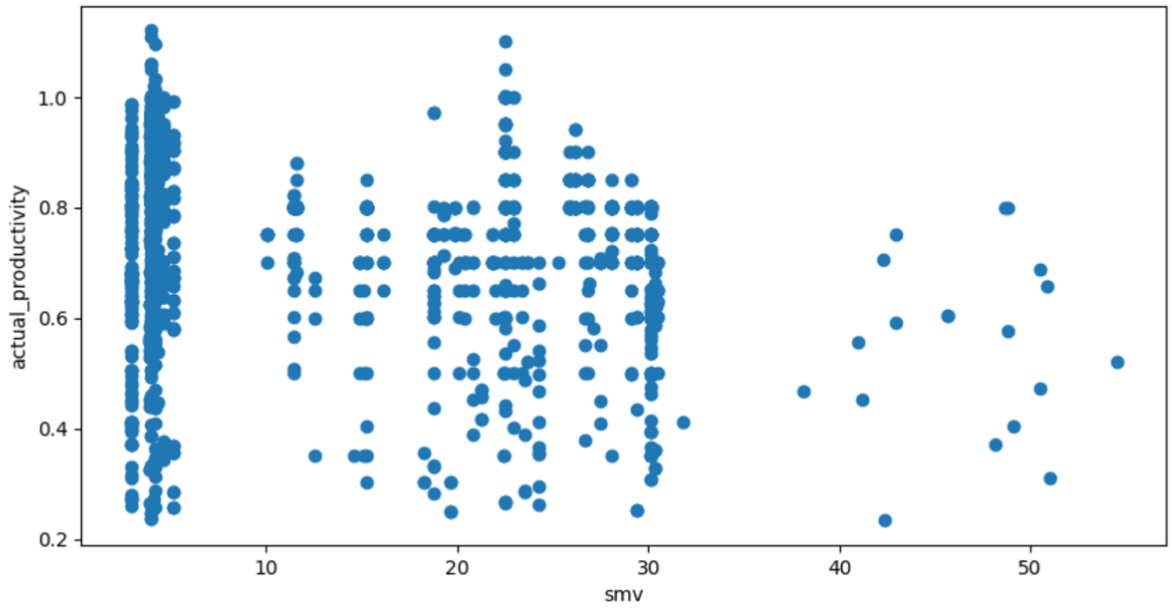


2.6 Team Vs Actual Productivity

The scatter plot between team number and actual productivity reveals some interesting facts. From the scatter plot and descriptive statistics, I inferred that there are twelve teams. There are no major differences in the productivity levels among the twelve teams. However, the scatter plot shows that the actual productivity of **team-6** is the lowest, though not significantly lower than that of the other teams. On the other hand, I observed that **team-12** has the highest average productivity.

```
# Scatter Plot - 1
plt.figure(figsize=(10,5))
plt.scatter(data_cleaned['smv'], data_cleaned['actual_productivity'])
plt.xlabel('smv')
plt.ylabel('actual_productivity')
```

```
Text(0, 0.5, 'actual_productivity')
```



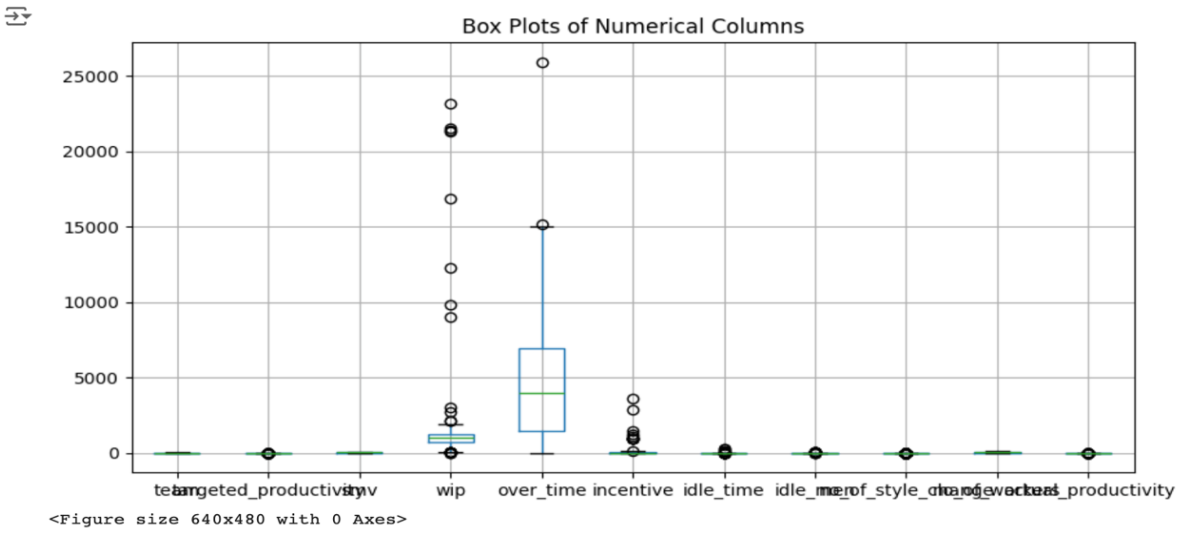
2.7 SMV Vs Actual Productivity

The smv(Standard Minute Value) of most of the tasks is less than thirty minutes. From the above scatter plot, we can infer that the actual productivity becomes unpredictable when the smv exceeds 30 minutes. However, the actual productivity is seemingly unaffected by smv, when smv was less than 10 minutes.

5.4 Box Plots

Box plots reveal the outliers in the data. Knowing the outliers in the dataset enable us validate and vitalize our conclusions from the given dataset. The following code was used to obtain the box plot:

```
# Box Plots
plt. figure(figsize= (10,5))
numerical_cols = ['smv', 'wip', 'over_time', 'incentive',
'no_of_style_change']
data_cleaned.boxplot()
plt.title('Box Plots of Numerical Columns')
plt.show()
plt.tight_layout() # Adjust the spacing between the x-axis titles
plt.show()
```



2.8 Box Plot

The above box plot clearly reveals that in most of the attributes there are barely any outliers. The attribute/feature of over_time has the largest standard deviation. Thus of the 15 features in the given dataset, over_time is the only feature with maximum outliers. It could be attributed to the individual's choice of working overtime ranging from a few minutes to several hours.

6. Results

Through the emblazoning visuals of the given dataset, I conclude the following:

- The actual productivity of the employees of the garment industries in Bangladesh supersedes the targeted productivity. In certain cases, the actual productivity even supersedes 100%
- The garment factories work six days a week, except Fridays.

- A month is divided into five quarters and the productivity massively drops in the fifth quarter. The first two quarters exhibit high productivity compared to the remaining three. The productivity of the fourth quarter is marginally higher than the productivity of the third quarter
- The financial incentives are way too low for the employees, yet their productivity remains unperturbed. It is an indicator that poverty and unemployment are ubiquitous in Bangladesh.
- There were barely any idle men and idle time. It is an indication of the pressure of work and the volume of stress that the workers have been undergoing
- There are twelve teams. Almost all the teams exhibit the same degree of productivity
- The attributes smv and wip corroborate the fact that the workers have to be agile in spite of being taxed with workload
- Absolute lack of outliers in many of the attributes indicates the reproducibility of the data
- The productivity remains the same even when the 'no_of_style_change' attribute changes. It is yet another indicator that whatever happens or arises, the employees must not breach from being productive.
- Bangladeshi workers earn 45% less than their competitors in other countries, Like: Vietnam, China.

7. Recommendations:

1. Gradually increase financial incentives to improve worker morale and reduce reliance on socio-economic pressures for productivity.
2. Encourage flexible work arrangements to maintain productivity levels throughout the month.
3. Encourage feedback from workers to identify stress points and address them proactively.
4. Share best practices from high-performing teams with other teams to promote overall improvement.
5. Monitor and manage WIP levels to prevent backlogs and ensure smoother transitions between production stages.
6. Collaborate with government and non-governmental organizations to address broader socio-economic issues.

8. Conclusion

The garment industry in Bangladesh plays a pivotal role in the country's economy, driven by a labor-intensive workforce that sustains high productivity levels despite challenging conditions. This analysis of the dataset reveals critical insights into the factors influencing productivity, including task complexity (SMV), work in progress (WIP), financial incentives, team dynamics, and socio-economic pressures.

Key findings show that while the productivity of garment employees often exceeds expectations, it comes at the cost of low wages, intense workloads, and minimal idle time. The workforce demonstrates remarkable agility and adaptability, with productivity remaining largely unaffected by variations in style changes, team structure, or overtime. However, areas such as financial incentives, fatigue management, and workflow optimization present significant opportunities for improvement.

Through targeted interventions, including enhanced financial rewards, streamlined task allocation, and investments in worker well-being, the garment sector can achieve sustainable productivity growth. Leveraging data analytics and visualization tools like Python further enables stakeholders to monitor trends, address inefficiencies, and make informed decisions.

Ultimately, by prioritizing both operational efficiency and worker welfare, the garment industry in Bangladesh can strengthen its global competitiveness while ensuring a more equitable and supportive environment for its workforce.

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