

# Manufacturing & Business Data Management Case Study – Report

## Data Sources

### 1. Data Sheets:

- Data – Gear Assembly production and sales data
- Cost – Cost details per Gear Assembly

### 2. Operational Sheets:

- Shift\_Running – Shift status for the production line
- Actual\_Output – Actual parts produced per shift
- Scrap – Scrap units per shift

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## New Columns Created for Analysis

1. **Unit Overall Product Cost:** Calculated by combining **Direct Materials, Direct Labour, Production Overhead, G&A Overhead, and Finance Costs.**
2. **Unit Margin:** Difference between Price and Unit Overall Product Cost.

$$\text{Unit Margin} = \text{Price} - \text{Unit Overall Product Cost}$$

3. **Percentage Unit Margin:**

$$\% \text{Unit Margin} = \frac{\text{Unit Margin}}{\text{Unit Overall Product Cost}} \times 100$$

4. **Quarter+Year:** Concatenation of Quarter and Fiscal Year to track periods.
  - Example: Q32020-21
5. **Revenue:** Calculated as Sales Quantity × Price for analyzing growth.
6. **Shift Availability:** Binary column for OEE calculation: 1 if operational, 0 otherwise.

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## Analysis & Results

### 1. Maximum Q1 Sales – BS4 Gear Assembly

- **Gear Assembly: Gear Assembly 1 (BS4)**

- **Analysis:** Pivoted Q1 sales data for all BS4-only gear assemblies and identified the highest cumulative sales.
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## 2. Gear Assembly with Maximum Net Loss

- **Gear Assembly:** Gear Assembly 3 (BS4/6)
  - **Analysis:** Calculated **Unit Margin** across fiscal years and summed over months to identify the most negative net margin.
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## 3. Gear Assembly with Highest Percentage Unit Margin

- **Gear Assembly:** Gear Assembly 2 (BS4)
  - **Analysis:** Calculated **% Unit Margin** per assembly and averaged across months to determine the highest efficiency per unit sold.
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## 4. Period with Least Ending Inventory (Volume)

- **Period:** Q32020-21
  - **Analysis:** Created a **Quarter+Year** column and summed ending inventory volumes per period to identify the minimum.
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## 5. Gear Assembly with Maximum Revenue Growth (2019-20 → 2020-21)

- **Gear Assembly:** Gear Assembly 3 (BS4/6)
  - **Analysis:** Calculated revenue for each fiscal year (Sales Qty × Price) and computed the percentage change.
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## 6. Overall Equipment Effectiveness (OEE) – Week 1

- **OEE:** 0.90
- **Analysis:** Calculated for 01-04-2022 to 07-04-2022 using:

$$\text{OEE} = \text{Availability} \times \text{Performance} \times \text{Quality}$$

- **Notes:** Non-operational shifts counted as 0.
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## 7. Overall Quality – Fortnight

- **Quality: 0.99**
- **Analysis:**

$$\text{Quality} = \frac{\text{Accepted Units}}{\text{Actual Output}}$$

- Excluded non-production shifts.
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## 8. Performance – Week 2

- **Performance: 0.77**
- **Analysis:**

$$\text{Performance} = \frac{\text{Actual Output}}{\text{Rated Output}}$$

- Rated Output assumed 4000 units per shift.
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## 9. Average Number of Parts Manufactured per Hour – Fortnight

- **Average Parts per Hour: 507**
  - **Analysis:** Total actual output over 14 days divided by total operational hours (8 hours × number of shifts).
  - Rounded down to nearest integer.
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## 10. Shift with Maximum Process Variability (MAPE)

- **Shift: Shift 3**
- **Analysis:** Calculated **MAPE** across all operational days for each shift. Shift 3 exhibited the highest deviation from rated output.