1. DMAIC technique analyses operational problems by assessing them in the following phases (1) Define; (2) Measure; (3) Analyze; (4) Improve and (6) Control.

(1) Define the problem, project goals and customer requirements: Poor quality leading to erosion of clientele.

Customers feedback indicates that product quality requires improvement. Dis-satisfaction is reflected in the form of sale returns and warranty claims. Competitors have no sale returns on account of poor quality as well as no warranty claims on its products. Hence, in an environment where 100% quality can be achieved, DFS is facing quality issues. This is the problem to be addressed. Failure to do so would result in loss of clientele, leading to a possibility of going out of business. The goal of the project is to identify what is the sigma level at which the company is operating and to suggest improvements to the production process it achieve 6σ level of operations.

(2) Measure current performance: Indicators of poor quality to find out what is the sigma level of the current operations?

Current performance focusing on quality can be determined based on the cost incurred in the following phases:

(a) Sale returns: Sale returns are 1% of total sales. Gross sales are 25,000 units per annum at selling price of Rs.20,000 each, therefore having a value of Rs.50,00,00,000. Sales returns @1% amount to Rs.50,00,00,000 that represent the return of 250 units per annum. The cost of poor quality on account of these sale returns is the variable cost of the product Rs. 12,500 per unit. This is an avoidable cost amounting to Rs.31,25,000 per annum that is 0.63% of sales (Rs.31,25,000/Rs. 50,00,00,000).

(b) Warranty claims: Warranty is an undertaking given by the company to repair the electronic component free of cost if defect occurs within a specific period of time. Hence, when the customer files a claim that is accepted by the company, it means that there has been an issue with the quality of the product. This is a liability / cost that should ideally be kept minimum, if not nil like DFS’s competitors.

Warranty for the product is for one year from the date of sale. Warranty claims this year is Rs.30,00,000, which is given to be representative of the average yearly warranty cost. Therefore, currently this cost amount to 0.60% of sales (Rs.30,00,000/ Rs.50,00,00,000).

Summarizing sale returns and warranty claims alone represent 1.23% of current sales. Considering the current percentage of deficiency, the company is operating between 3σ and 4σ level. The rest of the industry is able to achieve 6σ level of operations. At zero defective production, there are no sale returns on account of quality and no warranty claim costs. Therefore, is tremendous scope for improvement in DFS’s operations.

(3) Analyze: What is the cause of poor quality? What is the cost of resources focused on quality?

Six sigma team studied the production process in detail. Replicating the issues detailed in the given problem:

(a) Problem 1: Assembly line workers, including new hires, learnt on the job as to how to assemble the input material to produce the final electronic component. This lead to many
errors due to lack of proper standardized training. Therefore, on account of these errors, the entire electronic component has to assembled again.

(b) Problem 2: Sub-standard quality of raw material is detected on inspection only at the assembly line. Inspection leads to 10% rejection of units. By this time, the defective material is already fitted into the final electronic component. Therefore, to entire component has to be reworked upon to replace the defective raw material input.

(c) Problem 3: Machines are outdated and are not entirely suitable for the current production methodology.

The above factors result in rework on products, an internal failure cost, that lead to wastage of material, resources and capacity.

Two costs incurred to focus on quality are cost of inspection and cost of rework,

2,525 units are reworked upon. Time required to rework 2,525 units per year = 2,525 units / 5 units per hour = 505 hours per year. Cost of rework is given to be Rs.6,250 per hour. Therefore, total cost of rework per year = Rs.31,56,250.

Inspection cost for 2,000 hours at the assembly line is given to be Rs.10,00,000 per annum.

Therefore, total cost of resources currently incurred for quality = Rs.41,56,250 per annum.

(4) Improve: Reduce errors and improve quality of the product

While cost of resources currently incurred for quality is only 0.83% of sales (Rs.41,56,250/Rs.50,00,00,000), a detailed analysis brings forth many qualitative aspects that DFS needs to be address. If its competitors are able to achieve excellence in quality, so must DFS, in order to remain in business. Therefore, following are the proposals that can provide solutions to the problems referred to above:

(a) Solution to Problem 1: Periodic training sessions to educate new hires and update workers in the assembly line on the latest techniques in production. Standardized and informed working will lead to lower errors and thereby improving product quality. Cost per year = 5,000 hours yearly training × Rs.1,000 per hour = Rs.50,00,000.

(b) Solution to Problem 2: Delay in detection of poor quality input can be resolved by streamlining the work flow. New function for quality planning and improvement, at the beginning of the process helps in early detection, without wastage of resources. Cost per year for introducing this functionality = Rs.1,50,00,000.

(c) Solution to Problem 3: Replace old machines with newer ones. Machine upgrade will align the resource with the production requirements. This reduce chances of errors in the production process.

Cost of procurement: Rs.3,60,00,000 has a life of 3 years. Therefore, annual depreciation is Rs.1,20,00,000.

(d) Consequences of implementing these proposals, as given in the problem, can result in the following improvements:

(i) Rework of products can be entirely eliminated.

(ii) Sale returns will reduce from 1% to 0% due to better quality of products.

(iii) Yearly Warranty claims will reduce from Rs.30,00,000 to nil per annum.

(iv) With the introduction of the new facility, time required for inspection at the assembly line would reduce from 2,000 hours to 1,200 hours. Cost of inspection at the assembly line would reduce from Rs.10,00,000 per annum to Rs.8,00,000 per annum.
(v) Due to better quality, DFS can build better reputation with the customers which can further yield additional sales of 5,000 units per year.

When the company is capable to achieve points (i), (ii) and (iii) milestones, it would have achieved 6 σ operational level. The cost of quality report summarizes the above discussion:

**Cost of Quality Report**

<table>
<thead>
<tr>
<th>Cost of Quality Component</th>
<th>Before Improvements</th>
<th>After Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Cost Rs.</td>
<td>% of Sales</td>
</tr>
<tr>
<td>Preventive Cost</td>
<td>xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Training</td>
<td>xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Quality Planning and Improvement</td>
<td>xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Appraisal Cost</td>
<td>xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Inspection Cost</td>
<td>10,00,000</td>
<td>0.20%</td>
</tr>
<tr>
<td>Internal Failure Cost</td>
<td>xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Rework</td>
<td>31,56,250</td>
<td>0.63%</td>
</tr>
<tr>
<td>External Failure Cost</td>
<td>xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Sale Returns</td>
<td>31,25,000</td>
<td>0.63%</td>
</tr>
<tr>
<td>Warranty Claims</td>
<td>30,00,000</td>
<td>0.60%</td>
</tr>
<tr>
<td>Total Cost of Quality</td>
<td>1,02,81,250</td>
<td>2.06%</td>
</tr>
<tr>
<td>Yearly Sales</td>
<td>50,00,00,000</td>
<td></td>
</tr>
<tr>
<td>Total Cost of Quality / Sales (%)</td>
<td>2.06%</td>
<td></td>
</tr>
</tbody>
</table>

(e) Cost of quality is 2.06% of sales of which 1.23% alone is external failure cost. This has an impact on the customer experience and can erode customer base. By implementing the six sigma team’s proposal, this external failure cost on account of sale returns and warranty costs, can completely eliminated. Internal failure cost can also be eliminated. The increase in cost of quality proposed to be made would be a preventive cost to avoid failure of quality. The company should focus on preventing the error such that it ensures that product is of good quality when it reaches the customer at the very first instance. This enhances the customer experience and therefore eliminating the scope for external failures like sales returns and warranty claims. Better quality can yield further sales of 5,000 units per year. Therefore, an increase in spending on quality measures is justified since it not only yields significant improvements to quality but also brings in more sales orders.

Improvement to the financial position of the firm is summarized below:

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved Contribution Margin (Ref. note 1)</td>
<td>3,75,00,000</td>
</tr>
<tr>
<td>Elimination of Goods Replacement</td>
<td>31,25,000</td>
</tr>
<tr>
<td>Elimination of Warranty Claims</td>
<td>30,00,000</td>
</tr>
</tbody>
</table>
Elimination of Rework 31,56,250
Savings in Inspection Cost 4,00,000
Total Benefit ...(A) 4,71,81,250
Additional Costs Incurred
Training 50,00,000
Quality Planning and Improvement 1,50,00,000
Increase in Fixed Cost (Yearly Depreciation of Upgraded Machines) 1,20,00,000
Total Additional Cost ...(B) 3,20,00,000
Net Benefit ...(A) - (B) 1,51,81,250

Note 1: Incremental Contribution:
Sales have increased by 5,000 units. Selling Price is Rs.20,000 per unit while variable cost is Rs.12,500 per unit. Contribution is Rs.7,500 per unit.

Conclusion: Six Sigma team’s proposals are focused on preventing the error from occurring. Consequently, quality improves, sale improves and thereby can yield a net benefit of Rs.1,51,81,250 per year to the company.

(5) Control: Maintain quality at 6σ level and keep the production facilities updated.
(i) Training sessions with workers can serve as two way communication platform to detect other problems that can be resolved in more timely manner. Inputs received can also be used to improve the production work flow as well.
(ii) New function of quality planning and improvement can help the company be better informed about the latest production methodologies.
(iii) Updated machines are better equipped to handled changes in the production process since they are built with the latest technology. DFS should do a continuous assessment of the state of its machines and upgrade them when necessary.

2. (i) Statement of ‘Expected Quality Costs’

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Current Situation (Rs.)</th>
<th>Proposed Situation (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention Costs</td>
<td>---</td>
<td>4,50,000</td>
</tr>
<tr>
<td>Appraisal Costs</td>
<td>---</td>
<td>50,000</td>
</tr>
<tr>
<td>External Failure Costs</td>
<td>3,20,000</td>
<td>2,35,120</td>
</tr>
<tr>
<td>Internal Failure Costs</td>
<td>7,55,556</td>
<td>3,91,538</td>
</tr>
<tr>
<td>Total Quality Costs</td>
<td>10,75,556</td>
<td>11,26,658</td>
</tr>
</tbody>
</table>

Workings
External Failure Cost

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Current Situation</th>
<th>Proposed Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer’s Demand</td>
<td>...(A) 28,000 units</td>
<td>28,000 units</td>
</tr>
<tr>
<td>Number of units Dispatched to Customers</td>
<td>...(B) 32,000 units</td>
<td>30,939 units</td>
</tr>
</tbody>
</table>
Number of units Replaced

\[ \frac{28,000 \text{ units}}{87.5\%} \times \left( \frac{28,000 \text{ units}}{90.5\%} \right) \]

\[
\begin{array}{l}
\text{External Failure Cost} \\
\{4,000 \text{ units} \times \text{Rs.}(35+25+15+5)\}; \\
\{2,939 \text{ units} \times \text{Rs.}(35+25+15+5)\}
\end{array}
\]

\[
\begin{array}{l}
\text{Number of units Dispatched to Customers} \\
\text{Current Situation} \\
\text{Proposed Situation}
\end{array}
\]

\[
\begin{array}{l}
\text{Number of units Produced & Rejected} \\
\{32,000 \text{ units} \times 80\%\}; \\
\{30,939 \text{ units} \times 90\%\}
\end{array}
\]

\[
\begin{array}{l}
\text{Cost of Faulty Production} \\
\{8,000 \text{ units} \times \text{Rs.}(35+25+15)\}; \\
\{3,438 \text{ units} \times \text{Rs.}(35+25+15)\}
\end{array}
\]

\[
\begin{array}{l}
\text{Material Scrapped} \\
\{40,000 \text{ units} \times 90\% \times 10\%\}; \\
\{34,377 \text{ units} \times 90\% \times 10\%\}
\end{array}
\]

\[
\begin{array}{l}
\text{Internal Failure Cost} \\
\{\text{Rs.6,00,000}\}; \\
\{\text{Rs.2,57,850}\}
\end{array}
\]

(ii) Recommendation

On purely financial grounds the company should not accept the proposal because there is an increase of Rs.51,102 in quality costs. However there may be other factors to consider as the company may enhance its reputation as a company that cares about quality products and this may increase the company’s market share.

On balance the company should accept the proposal to improve its long-term performance.

3. (i) Customer Wise Profitability Statement and Overall Profitability Statement

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{SN.} & \text{Particulars} & \text{P} & \text{M} & \text{W} & \text{Total Rs.} \\
\hline
\text{A} & \text{Sales (net proceeds) – Table 1} & 241,288 & 237,500 & 272,812 & 751,600 \\
\text{B} & \text{Variable Cost of Goods Sold} & 1,50,000 & 1,42,500 & 1,87,500 & 4,80,000 \\
\text{C} & \text{Assignable- Marketing and Administration Cost - Table 2} & & & & \\
\hline
\text{C} & \text{Order Taking and Processing} & 1,200 & 600 & 4,500 & 6,300 \\
\text{C} & \text{Sale Return Processing} & 150 & - & 1,200 & 1,350 \\
\text{C} & \text{Billing Cost} & 200 & 100 & 750 & 1,050 \\
\text{C} & \text{Customer Visit} & 800 & - & 4,000 & 4,800 \\
\hline
\end{array}
\]
Total Assignable Marketing and Administration Cost

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>M</th>
<th>W</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,350</td>
<td>700</td>
<td>10,450</td>
<td>13,500</td>
</tr>
</tbody>
</table>

D Assignable - Distribution Cost - Table 2

- Expeditied / Rush Orders
- Delivery Costs
- Inventory Carrying Cost

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>M</th>
<th>W</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250</td>
<td></td>
<td>1,250</td>
<td>1,500</td>
</tr>
<tr>
<td></td>
<td>8,000</td>
<td>4,000</td>
<td></td>
<td>12,000</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
<td>9,500</td>
<td>12,500</td>
<td>32,000</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18,250</td>
<td>13,500</td>
<td>13,750</td>
<td>45,500</td>
</tr>
</tbody>
</table>

E Non- Assignable Fixed Cost

<p>| | | | | |</p>
<table>
<thead>
<tr>
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<tbody>
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</tbody>
</table>

F Total Costs (B+C+D+E)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>170,600</td>
<td>156,700</td>
<td>211,700</td>
<td>639,000</td>
</tr>
</tbody>
</table>

G Net Profit (Step A - F)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70,688</td>
<td>80,800</td>
<td>61,112</td>
<td>112,600</td>
</tr>
</tbody>
</table>

H Profit % of Sales (G / A)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29%</td>
<td>34%</td>
<td>22%</td>
<td>15%</td>
</tr>
</tbody>
</table>

Workings

Table 1: Customer Sales Analysis - Revenue Analysis

<table>
<thead>
<tr>
<th>Particulars</th>
<th>P</th>
<th>M</th>
<th>W</th>
<th>Total Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (Sale Units × Sale Price (gross))</td>
<td>2,50,000</td>
<td>2,37,500</td>
<td>3,12,500</td>
<td>8,00,000</td>
</tr>
<tr>
<td>Less: Sale Return (Step 1 × Return%)</td>
<td>1,250</td>
<td></td>
<td></td>
<td>31,250</td>
</tr>
<tr>
<td>Net Sales</td>
<td>2,48,750</td>
<td>2,37,500</td>
<td>2,81,250</td>
<td>7,67,500</td>
</tr>
<tr>
<td>Less: Cash Discount</td>
<td>7,462</td>
<td></td>
<td></td>
<td>8,438</td>
</tr>
<tr>
<td>Net Proceeds</td>
<td>2,41,288</td>
<td>2,37,500</td>
<td>2,72,812</td>
<td>7,51,600</td>
</tr>
<tr>
<td>Final Collections vs Original Sale</td>
<td>97%</td>
<td>100%</td>
<td>87%</td>
<td>94%</td>
</tr>
</tbody>
</table>

Table 2: Assignable Marketing, Administrative and Distribution Costs

<table>
<thead>
<tr>
<th>Particulars</th>
<th>P</th>
<th>M</th>
<th>W</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order Taking and Processing (# of orders × cost per order)</td>
<td>1,200</td>
<td>600</td>
<td>4,500</td>
<td>6,300</td>
</tr>
<tr>
<td>Expedited / Rush Orders (# of orders × cost per order)</td>
<td>250</td>
<td></td>
<td>1,250</td>
<td>1,500</td>
</tr>
<tr>
<td>Delivery Costs (Distance in km. × cost per km)</td>
<td>8,000</td>
<td>4,000</td>
<td></td>
<td>12,000</td>
</tr>
<tr>
<td>Sale Return Processing (# of returns × cost per return)</td>
<td>150</td>
<td></td>
<td>1,200</td>
<td>1,350</td>
</tr>
<tr>
<td>Billing Cost (# of invoices × cost per invoice)</td>
<td>200</td>
<td>100</td>
<td>750</td>
<td>1,050</td>
</tr>
<tr>
<td>Customer Visit (# of customer visits × cost per visit)</td>
<td>800</td>
<td></td>
<td>4,000</td>
<td>4,800</td>
</tr>
<tr>
<td>Inventory Carrying Cost (# of units × inventory carrying cost p.u.)</td>
<td>10,000</td>
<td>9,500</td>
<td>12,500</td>
<td>32,000</td>
</tr>
</tbody>
</table>
Customer strategy: It can be seen that Pamphlet LLP has an overall profit of Rs.112,600 or 15% of sales. While the performance is good, the firm’s management has to analyze customer wise profitability.

(a) W is the largest customer in terms of units sold. However, Table 1 above shows that sale returns at 10%, which is unusually large compared to other customers. Pamphlet LLP has to investigate why the returns are of such large quantity. Possibly, there could be communication gap between the firm and W. Possible non-conformity in goods delivered has resulted in returns. Only 87% of the original sale value is being collected. The root cause of the problem has to be identified and rectified. This will also reduce the sale return processing costs.

(b) W has placed many rush orders, which requires Pamphlet LLP to ship these orders immediately, using costlier means of transportation. Currently, there is no charge for shipping rush orders. In order to deter W from repeatedly placing rush orders, Pamphlet LLP can charge the customer for shipping such orders beyond a threshold number of orders. Say rush orders beyond 2 orders will be charged to the customer.

(c) W has placed 15 orders for 1,250 units. Comparatively, P and M placed 4 and 2 orders for approximately 1,000 units each. W can be requested to place fewer orders with larger quantity per order, in order to optimize ordering cost.

(d) Being the largest customer, W has 5 sale visits from Pamphlet LLP, which is more than the other 2 customers. Priced at Rs.800 per visit, this very costly. At the same time, W is yielding the least profit. Therefore, Pamphlet LLP should reassess if resources can be reallocated to the other two more profitable customers. That may encourage more sales from higher yielding customers.

(e) Since W seems to need more hand-holding in terms of more sales visits as well as higher rush orders, Pamphlet LLP may assess if it wants to discontinue or reduce business. Alternatively, it may reassign these resources towards existing or newer customers to get better profitability. However, if W can be migrated to a higher profitability, Pamphlet LLP need not lose out its market share.

(f) Customer M is the most profitable yielding 34% return over sales, although in terms of ‘Advanced Learner’s Dictionary’ ordered, it is the smallest of the three. Pamphlet LLP can assess if it can extend some discount, in order to encourage more sales. Currently, Customer M does not get any discount.

(g) Pamphlet LLP can assign more sales visits to Customer P and M to encourage them purchase more as well as provide high quality customer service.

4. (a) Environmental Management Accounting (EMA) is the process of collection and analysis of the information relating to environmental cost for internal decision making. EMA identifies and estimates the cost of environment related activities and seek to control theses cost. In Gulf Oil, during refinery operations, waste water, fugitive emissions, flue gases and solid wastes are generated. Due to this excess waste and gas emission, environmental cost rises. Scarcce natural resources should be used in such a way so that their consumption is sustainably optimized. In order to cutback environmental cost, EMA can be applied as follows:

Waste

Gulf Oil should measure, manage and monitor waste from operations in order to minimise impact on people and the environment. ‘Mass balance’ approach can be used to determine how much material is wasted in production, whereby the weight of materials bought is compared to the product yield. From this process, potential cost savings may be identified.
In Gulf Oil, wastes are oily / chemical / biological sludge, scrape batteries, e–waste, chemical containers, effluent etc. Waste generated in operations is either treated within the premise or disposed through approved waste treatment, storage, and disposal facility. To avoid the usage of chemical drums/ containers in large quantity, separate storage tanks can be created for bulk storage of additives to reduce the drum procurement and disposal.

Further, refineries in operation should be upgraded from time to time to minimize waste.

Water Management

Businesses pay for water twice – first, to buy it and second, to dispose of it. If savings are to be made in terms of reduced water bills, it is important for Gulf Oil to identify where water is used and how consumption can be decreased.

For water conservation, sustainable water management techniques should be adopted. In refining operation, water is mainly used in boilers and cooling units. Collective efforts should be made to optimize water consumption and maximum reuse of used water. Advanced treatment system like rain water harvesting, ultra-filtration, reverse osmosis etc. may be used for water purification for further use. This would lead to substantial reduction in intake of fresh water.

In addition, Gulf Oil staff should be alerted for water conservation through seminars, presentations, conference, awareness campaigns.

Energy

Often, energy costs can be reduced significantly at very little cost. Environmental Management Accounts may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings. Some of energy conservation initiatives may be taken by Gulf Oil like:

- Conducting periodic energy audits for identifying energy saving opportunities.
- Phasing out conventional lights and replacement with LED lights/induction lights.
- Power factor improvement by installation of capacitor banks.
- Installation of 5 star rated energy equipment.
- Prevention of idle running of equipment.
- Installation of solar lights.
- Use of Nano molecular thermal additives in ACs.
- Installation of efficient energy monitoring system for energy intensive equipment.
- Capacity improvement for batteries.

Consumables and Raw Material

Refineries ‘refine’ crude oil in massive quantities, to produce the fuels need. There should be continuously monitoring on optimum utilization of crude oil to improve gross refining margin. The gross refining margin is the difference between the total value of petroleum products coming out of an oil refinery (output) and the price of the raw material, (input) which is crude oil. Even not only crude oil there should also be optimum and sustainable utilization of resources like additives, chemicals etc. from procurement to production stages.

Gulf Oil may use recyclable technology for raw material and consumable wastages which provides sustainability in terms of environmental protection and reduction in carbon footprint. Periodic testing should be performed to assess the health of equipment and pipelines as to have better process of raw materials and consumables.

Transport

Again, EMA may be used to identify saving in terms of transport of goods and materials. At Gulf
Oil, in order to cutback emission and fuel consumption due to transportation, route optimization activity may be used like allocation of customer on the basis of nearest depots and locations as to reduce distance, real time fleet tracking using GPS (to make sure that vehicles do not deviate from assigned shortest route) etc.

(b) The budgetary control system appears to have several very important shortcomings which reduce its effectiveness and may in fact cause it to interfere with good performance. Some of the shortcomings are explained below.

Lack of Coordinated Goals: Mr. Singh had been led to believe high quality output is the goal; it now appears low cost is the goal. He does not know what the goals are and thus cannot make decisions which lead toward reaching the goals.

Influences of Uncontrollable Factors: The actual performance relative to budget is greatly influenced by uncontrollable factors i.e. rush orders. Thus, the variance reports serve little purpose for evaluation of performance.

The Short-Run Perspectives: The monthly evaluation and the budget tightening on a monthly basis result in a very short-run perspective. This will result in inappropriate decisions.

The improvements in the budgetary control system must correct the deficiencies described above. Accordingly:

− Budgetary control system must more clearly define the company’s objectives.
− Budgetary control system must develop an accounting reporting system which better matches controllable factors with supervisor responsibility and authority.
− Establish budget values for appropriate time periods which do not change monthly simply as a result of a change in the prior month’s performance.

The entire company from top management down must be educated in sound budgetary procedures so that all parties will understand the total process and recognize the benefit to be gained.

5. (a) The incremental cost associated with the IMAX show appears to be Rs.10,000 i.e. cost of running the show. The allocated fixed cost per show is not relevant because the total amount of fixed costs for the year will not change as a result of the special show. Further, the stated ticket prices are not relevant because the show will take place at 08:30 AM when the IMAX is not usually open – thus, the students will not be displacing any regular visitors. Based on the financial data provided, the minimum price quote appears to be Rs.10,000.

‘X’ should consider the following factors:

▪ Does the station have a souvenir shop and/or cafeteria?
If so, many students are likely to buy food and/or souvenir items, thereby increasing the station’s contribution. In turn, this would reduce the minimum price quote.

▪ What is the impact on future revenue?
After seeing the show, many students may return with their parents, thereby increasing future revenue.

▪ Are there costs linked with the special showing that are not included in the Rs.10,000 variable cost number?
For example, will the station have to pay an overtime premium.

‘X’ should also consider the educational mission of the Planetarium Station. Such shows directly contribute to this mission, the station, and, hopefully, the betterment of the students. The special shows may be an excellent way to expose some students to earth science – these students may have never gone through the Planetarium Station if it were not for the school excursion.
Overall, the “best” price to charge is unclear and requires some judgment as ‘X’ needs to balance an array of financial and non-financial factors.

(b) Aspects that need to be reported in the TBL report:

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Aspect</th>
<th>Category on the TBL Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Caregiver, with the help of traffic police, has implemented a “green corridor” for ambulances that carry donor organs for transplantation. Organs harvested from the donor at one hospital can reach another hospital with the recipient patient at the earliest.</td>
<td>Social bottom line, since green corridor would enable the ambulance to transport harvested organs between the hospitals at the earliest this would be beneficial for patients in need of critical care.</td>
</tr>
<tr>
<td>(ii)</td>
<td>Medical waste is discarded at a landfill in a nearby dumpsite. Some of the waste are not bio-degradable.</td>
<td>Environmental bottom line, as it affects the ecological surroundings of the town.</td>
</tr>
<tr>
<td>(iii)</td>
<td>Lab reports are being made available online within the hospital computer system. This would reduce printing costs and storage space needed to maintain older records.</td>
<td>Environmental bottom line, since paper, cartridge and storage requirement would be lower. This preserves environmental resources.</td>
</tr>
<tr>
<td>(iv)</td>
<td>The hospital is planning to market ‘medical check-up packages’ so that facilities in its outpatient department can be utilized better.</td>
<td>Not relevant to TBL report. This is a marketing strategy to improve profitability.</td>
</tr>
<tr>
<td>(v)</td>
<td>The number of inpatient hospital deaths decreased 8%, from 776 in 2016 to 715 in 2017.</td>
<td>Social bottom line, since hospital mortality rate measures the clinical quality.</td>
</tr>
</tbody>
</table>

6. (a) Analysis of Cost plus Pricing Approach

The company has a plan to produce 2,00,000 units and it proposed to adopt Cost plus Pricing approach with a markup of 25% on full budgeted cost. To achieve this pricing policy, the company has to sell its product at the price calculated below:

<table>
<thead>
<tr>
<th>Qty.</th>
<th>2,00,000 units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable Cost (2,00,000 units × Rs. 32)</td>
<td>64,00,000</td>
</tr>
<tr>
<td>Add: Fixed Cost</td>
<td>16,00,000</td>
</tr>
<tr>
<td>Add: Profit (25% of Rs. 80,00,000)</td>
<td>20,00,000</td>
</tr>
<tr>
<td>Revenue (need to earn)</td>
<td>1,00,00,000</td>
</tr>
<tr>
<td>Selling Price per unit (Rs. 1,00,00,000 / 2,00,000 units)</td>
<td>50 p.u.</td>
</tr>
</tbody>
</table>

However, at selling price Rs. 50 per unit, the company can sell 1,40,000 units only, which is 60,000 units less than the budgeted production units. After analyzing the price-demand pattern in the market (which is price sensitive), to sell all the budgeted units market price needs to be further lowered, which might be lower than the total cost of production.
Statement Showing “Profit at Different Demand & Price Levels”

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Budgeted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qty. (units)</td>
<td>1,68,000</td>
<td>1,52,000</td>
<td>1,40,000</td>
<td>1,28,000</td>
<td>1,08,000</td>
</tr>
<tr>
<td>Rs.</td>
<td>73,92,000</td>
<td>72,96,000</td>
<td>70,00,000</td>
<td>71,68,000</td>
<td>64,80,000</td>
</tr>
<tr>
<td>Less: Variable Cost</td>
<td>53,76,000</td>
<td>48,64,000</td>
<td>44,80,000</td>
<td>40,96,000</td>
<td>34,56,000</td>
</tr>
<tr>
<td>Total Contribution</td>
<td>20,16,000</td>
<td>24,32,000</td>
<td>25,20,000</td>
<td>30,72,000</td>
<td>30,24,000</td>
</tr>
<tr>
<td>Less: Fixed Cost</td>
<td>16,00,000</td>
<td>16,00,000</td>
<td>16,00,000</td>
<td>16,00,000</td>
<td>16,00,000</td>
</tr>
<tr>
<td>Profit (Rs.)</td>
<td>4,16,000</td>
<td>8,32,000</td>
<td>9,20,000</td>
<td>14,72,000</td>
<td>14,24,000</td>
</tr>
<tr>
<td>Profit (% on total cost)</td>
<td>5.96</td>
<td>12.87</td>
<td>15.13</td>
<td>25.84%</td>
<td>28.16%</td>
</tr>
</tbody>
</table>

Determination of the Best Course of Action

(i) Taking the above calculation and analysis into account, the company should produce and sell 1,28,000 units at Rs. 56. At this price company will not only be able to achieve its desired mark up of 25% on the total cost but can earn maximum contribution as compared to other even higher selling price.

(ii) If the company wants to uphold its proposed pricing approach with the budgeted quantity, it should try to reduce its variable cost per unit for example by asking its supplier to provide a quantity discount on the materials purchased.

(b) COMPUTATION OF VARIANCES

Traditional Variance (Actual Vs Original Budget)

Usage Variance = (Standard Quantity – Actual Quantity) × Standard Price
= (2,500 Kg – 2,700 Kg) × Rs. 1.50
= Rs. 300 (A)

Price Variance = (Standard Price – Actual Price) × Actual Quantity
= (Rs. 1.50 – Rs. 2.40) × 2,700 Kg
= Rs. 2,430 (A)

Total Variance = Rs. 300 (A) + Rs. 2,430 (A) = Rs. 2,730 (A)

Operational Variance (Actual Vs Revised)

Usage Variance = (2,500 Kg – 2,700 Kg) × Rs. 2.25
= Rs. 450 (A)

Price Variance = (Rs. 2.25 – Rs. 2.40) × 2,700 Kg
= Rs. 405 (A)

Total Variance = Rs. 450 (A) + Rs. 405 (A) = Rs. 855 (A)

Planning Variance (Revised Vs Original Budget)

Controllable Variance = (Rs. 2.00 – Rs. 2.25) × 2,500 Kg
= 625 (A)
Uncontrollable Variance
= (Rs. 1.50 – Rs. 2.00) × 2,500 Kg
= 1,250 (A)

Total Variance = Rs. 625 (A) + Rs. 1,250 (A) = Rs. 1,875 (A)

Traditional Variance = Operational Variance + Planning Variance
= 855 (A) + 1,875 (A) = 2,730 (A)

Or

INTERPRETATION

Direct Labour Rate Variance:
Adverse Labour Rate Variance indicates that the labour rate per hour paid is more than the set standard. The reason may include among other things such as:

1. While setting standard, the current/future market conditions like pending labour negotiation/cases, has not been considered (or predicted) correctly.

2. The labour may have been told that their wage rate will be raised or bonus will be paid if they work efficiently.

Direct Labour Efficiency Variance:
It indicates that the workers has produced actual production quantity in less time than the time allowed. The reason for favourable labour efficiency variance may include among the other things as follows:

1. While setting standard, workers efficiency could not be estimated properly, this may happen due to non-observance of time and motion study.

2. The workers may be new in the factory, hence, efficiency could not be predicted properly.

3. The foreman or personnel manager responsible for labour efficiency, while providing his/her input at the time of budget/standard, has adopted conservative approach.

4. The increase in the labour rate might have encouraged the labours to do work more efficiently.

In this particular case it may have happened that since labour payment has been increased labour efficiency has also been increased. In a nutshell because of additional labour rate (Adverse), labour efficiency has gone up (Favourable)

Workings

Labour Rate Variance = Standard Cost of Actual Time – Actual Cost
= (SR × AH) – (AR × AH)
Or
= (SR – AR) × AH
= (Rs.8.00 – Rs.8.14) × 3,00,000 hrs.
= Rs.42,000 (A)

Working

Actual Labour Rate per hour = \[\text{ActualPaid} \div \text{ActualHours}\]
Labour Efficiency Variance

\[ \text{Labour Efficiency Variance} = \frac{\text{Rs. 24,42,000}}{3,00,000 \text{hrs.}} = \text{Rs. 8.14} \]

\[ \text{Labor Efficiency Variance} = \text{Standard Cost of Standard Time for Actual Production} - \text{Standard Cost of Actual Time} \]

\[ = (SH \times SR) - (AH \times SR) \]

Or

\[ = (SH - AH) \times SR \]

\[ = (3,12,000 \text{ hrs.} - 3,00,000 \text{ hrs.}) \times \text{Rs. 8.00} \]

\[ = \text{Rs. 96,000 (F)} \]

**Working**

Standard Hours = Actual Production × Std. hrs. per unit

\[ = 52,000 \text{ units} \times 6 \text{ hrs.} \]

\[ = 3,12,000 \text{ hrs.} \]