CHAPTER -10

APPLICATIONS OF TOTAL QUALITY MANAGEMENT IN DIFFERENT INDUSTRIES AND SECTORS
10.1 MOTOROLA’S SECRET TO TOTAL QUALITY

The Galvin Manufacturing Corporation, later renamed Motorola, Inc., began operations on September 25, 1928, in a small section of a rented building at 847 Harrison Street in Chicago; the company had five employees. Now in its sixty-second year, Motorola is ranked among America’s 150 largest industrial corporations with close to 98,000 employees worldwide and sales approaching $8 billion.

In 1988, Motorola received one of the first Malcolm Baldrige National Quality Awards. No single article can address all the elements in Motorola’s corporate quality system or explain in detail how to set up a quality system that will win the Baldrige Award. Instead, some of the elements of quality control of manufacturing operations within the semiconductor products sector will be examined. The secret to Motorola’s success in quality control is a focused effort in three major areas: material control, in process control, and containment. Within each major area are several key items that must be addressed to achieve success.

MATERIAL CONTROL

Motorola stresses to all vendors that percent AQL (acceptable quality losses) is unacceptable and that their defective units are measured in parts per million. Moreover, Motorola’s goal is to reduce the number of its vendors by an average of about 50% each year, only those vendors that meet expectations for superior quality will be retained or added to its vendor base, Motorola has substantially improved as its vendors have improved their quality, Each vendor must indicate its $C_{pk}$ performance (process capability index, which accounts for non-centered process averages). Vendors should have an acceptable $C_{pk}$ and a program to achieve a $C_{pk}$ of 2.

The vendor rating system measures vendors on the quality of product delivered and the timeliness of those deliveries. Vendors with higher ratings get more business; poor vendors are dropped. Most vendors now receive a monthly or quarterly rating of their performance.

Special programs are provided to individual vendors as needed, including training for service vendors. For example, a seminar for a travel industry vendor demonstrated how the principles for Six-Sigma Quality could be applied to that business.
Motorola's Six-Sigma Quality Concept

When Motorola was awarded the Malcolm Baldrige National Quality Award in 1988, a summary of its quality achievements was distributed as part of an informational packet. That summary contained the following description of Six Sigma Quality:

"To accomplish its quality and total customer satisfaction goals, Motorola concentrates on several key operational initiatives. At the top of the list is Six Sigma Quality, a statistical measure of variation from a desired result. In concrete terms, Six-Sigma translates into a target of no more than 3.4 defects per million products, customer services included. At the manufacturing end, this requires designs that accommodate reasonable variation in component parts but production processes that yield consistently uniform final products. Motorola employees record the defects found in every function of the business, and statistical technologies are increasingly made part of each and every employee's job".

CERTIFYING VENDORS

1. The best way to address material control is through vendor certification program. Motorola's program consists of five phases:
2. Agree on key parameter measurements, and the work on having supplies correlate with these measurements.
3. Demonstrate consistency on key parameters. Once products correlate with measurements, Motorola will continue to inspect incoming products and review measurements for correlation for an indefinite period of time, depending on volume and how long it takes to have confidence in the quality of incoming products.
4. Institute statistical process control (SPC) on critical processes to achieve preliminary certification. In this phase, agree to certain critical processes on which SPC is to be implemented. When review of SPC shows that the critical processes are under control, preliminary certification can be granted.
5. Develop and approve a never-ending improvement plan, and grant full certification. In this phase, the vendor is expected to develop and share its plan for ongoing process cost and yield improvements. Once this plan is approved, the vendor is granted full certification.
6. Maintain an ongoing partnership. Review common goals on a quarterly basis. Long-term contracts and preferred vendor status are granted in this phase.

Also integral to the ongoing evolution of each vendor is a yearly audit of the following areas:
- Quality Management
- Quality Control
- Procurement
- Material Control
- Record keeping
- Methods documentation
- Calibration
PROCESS CONTROL
Motorola uses two tools to establish in-process controls: SPC and process audits. During the last four years, more than $170 million has been invested in training people and improving their skills. Virtually all U.S. personnel are being trained in quality. For example, from 1986 to 1988, more than 10,000 technical personnel were trained in SPC and design for manufacturing techniques. More than 50,000 people are being trained in the concepts of Six Sigma (such as the use of SPC in all work, including non manufacturing tasks).

Motorola defines three phases of SPC implementation:

PHASE I:
Avoidance-characterize the process and establish control limits.

PHASE II:
Path to Six Sigma-identify and quantify critical circuit/device parameters that need tighter distributions to satisfy Six Sigma requirements.

PHASE III:
Never ending improvement-continue to tighten distributions and establish new control limits.

Once the final phase is reached; ongoing improvement continues. Work is under way to computerize control techniques.

Motorola uses two types of audits for process control: engineering and monitor. The former is conducted by a QA engineer and entails an intense review of all process steps including equipment parameters, handling techniques, and SPC. Box 9-2 shows the audit checklist.

A certified auditor conducts the monitor audit; it reviews a broad range of issues such as whether specifications and revisions are correct, whether logs are filled and maintained properly, etc. The system is set up so that any discrepancy critical, major, or minor is documented, and corrective action is required in writing. Critical defects must be corrected immediately; major and minor problems must be remedied within five working days. The proof of success is that results from customer audits for the past two years have been excellent.

CONTAINMENT
Containment means inspecting out defects until permanent corrective actions can be implemented. Statistical sampling plans are used to inspect each lot as it finishes each operation. The sampling plans are based on two items. The historical process capability in parts per million is determined and used with a sampling plan that has a high confidence level of rejecting lots that do not meet requirements. Each operator then decides either to scrap or to screen the product in question before sending it to the next operation. Screening means that 100% inspection is performed, and all products that does not meet requirements is scrapped. Rework is not allowed.
The result is that each operation receives only product that is known to be good and can therefore concentrate on process control and avoid defects. No sampling plan or even 100% inspection can guarantee that all defects will be eliminated, but the combination of these techniques makes near perfection possible.

The result of the focus on material control, in process control, and containment is a total quality system that aims for never ending improvement in product quality and that eventually will lead to the ultimate goal of Six Sigma products.

10.2 TATA STEEL’S JOURNEY TO TOTAL QUALITY

Tata steel, like many other Indian giant industries, enjoyed a safe and protected market niche until 1990 when steel market was opened to foreign competitors and import which faced unnatural tariff barriers found accessibility to Indian Market. Though Tata had enjoyed confidence of discerning Indian buyers of steel, yet they were not inclined to relax and lose their guards. Jamshed Irani was at that time incharge of Quality and later retired as Managing Director in 2002 after serving the company for a decade in that position. Reflecting the performance of his company, which is oldest steel manufacturer in India, Dr. Irani says that without doubt Tata Steel was producing good quality of steel because total managerial emphasis was on production. Looking back on those days Irani thinks of treacherous waste which was hidden in the system and the cost was transmitted to the buyer of the product.

The first step toward TQM was taken to identify the customer and to reaffirm the resolve of the company to work for the benefit of the customer. Alongside they also identified the product which customers from niche market wanted to buy. The company then embarked upon the programme of sensitizing employees at all levels with relevance of quality and need for keeping customer requirement in mind when discharging their duty. They were also told that every other person with whom they deal within the company was their customer. There began a practice of signing internal customer memoranda of understanding with their immediate upstream supplier and thus the company achieved compliance with predetermined product specification, cost and delivery schedules. This assured quality across the value chain.

Tata Steel established a tiered quality structure as early as 1990. This effort was in stimulating team effort to achieve quality with an apex quality council at the top and several quality councils and sub-councils at middle management and lower levels. The cross functional teams for quality were immensely useful in developing the desire for the continuous quality improvement in areas where people had ceased to look for improvement. The cross-functional teams were trained in methods of improving quality by diagnosing the problem and finding remedy. The company thought it fit to recognize people who succeeded more than others in carrying out the quality improvement programme by honouring managers, engineers and workers in the presence of wives and others in 1991. This was the beginning of institutionalized recognition of efforts aimed at quality improvement. The company also initiated the habit of communicating with the employees at all levels and brought out all the reasons for pursuing the goal of quality. They were also
communicated with the idea of the customer and considering the next process and processor as customer to deliver the products with quality as desired by the next process.

The company kept on reminding itself that momentum of quality which was gained at the initial stage should never be lost and the vigor of pursuit should be maintained. In this effort the company continued documenting its vision, mission, check list, business processes and strategic objectives. They continue to reinforce sustaining efforts of pursuit of quality

**Tata Steel’s Visions**
- Tata Steel enters the new millennium with the confidence of learning, knowledge based upon happy organization.
- We will establish ourselves as supplier of choice by delighting our customers with our services and our product.
- In the coming decade we will become the most cost competitive steel plant and so serve the community and the nation.
- Where Tata Steel ventures . . . others will follow.

**Key Business Processes**
- Market development.
- Order generation and fulfillment.
- Operations (Production and Maintenance).
- Investment Management.
- Planning and Risk Control.
- Supply Chain Management.
- Human Resource Development.
- Social Responsibility.

**Strategic Objectives**
- Create a culture of continuous learning and change.
- Achieve world-class status in services and product.
- Reach the position of most cost competitive steel producer.
- Establish industry leadership.

**Personal Checklist**
- Develop a personal vision – what do I want to accomplish in life.
- Tell the truth about current reality.
- Do the tough things no one else wants to do.
- Restructure the top team if necessary.
- Build a powerful guiding coalition.
- Guide the creation of shared vision.
- Take the responsibility of main change agent.
- Create endless opportunities for two way communication.
• Create opportunities for innovations in the rank and file.
• Maintain focus
• Realign HR systems, overcome obstacles.
• Model the desired managerial behavior – above all maintain credibility.
• Preserve the core values of Tatas and my own.

There have been changes taking place in Tata Steel’s approaches toward business of steel. However, it remained a traditional company operating in closed environment but the cataclysmic developments characterizing the opening up of Indian economy in early 1990s motivated Tata Steel to change its policies toward quality fast. Today it has emerged as an agile organization capable of facing competition with effectiveness. Tata Steel has become world’s leading integrated steel plant and this achievement is still more significant because it is one of the earliest steel plants of India.

JURAN’S INFLUENCE ON TATA STEEL’S QUALITY SEARCH
Juran suggests that poor quality cost can be classified into four broad categories:

**Internal Failure Costs**
Scrap, re-work, failure analysis, re-inspection, re-testing, avoidable process losses, downgrading.

**External Failure Costs**
Warranty, complaint adjustment, returned material, concessions.

**Appraisal Costs**
Incoming inspection and testing, in-process inspection and testing, final inspection and testing, product quality audits, maintaining accuracy of testing equipment, evaluation of stocks.

**Prevention Costs**
Quality planning, new product review, process control, quality audits, supplier Quality evaluation, training.
Prevention costs keep failure and appraisal costs to minimum.

It was in late 1980s that Tata Steel resolved to make better products. Indian economy had not been liberalized until then. The Chairman Russi Modi and Managing Director J. J. Irani in search for top international consultant zeroed on Juran Institute and through them invited Indian affiliate of Juran Institute, Qimpro Consultant. Tata Steel wanted to take the advantage of Juran’s experience with Bethlehem Steel. Qimpro was given opportunity to speak before top management of Tata Steel in their executive training center at Dimna, 50 km from Jamshedpur.

In those days, Tata Steel had no competition and it could sell any grade of steel. The marketing system was nothing but rationing. Quality was no issue. The management at top level in the company had anticipated a change in business environment. They thought if environment changed, they might not be able to bring improvement in quality of steel and
65000 employees may not help reduce the rejection rate of 3 per cent. Juran’s approach requires to estimate the cost of quality as the first step. During Qimpro’s session with top management their finance director Ishrat Husain gave first estimate of cost of poor quality as 3% of sales. This estimate was revised to 9% by the end of the day one. The other day saw the estimate revised to whooping 25%. This stirred the top management and the chairman ordered to reduce the cost of poor quality to half over a period of 5 years.

It was immediately targeted that sources of poor quality be plugged. Five projects were chosen. Savings of Rs. 2.3 crores per annum was achieved in LD shop and Tube division recorded the savings of Rs. 1.7 crore per annum. The managing director personally reviewed the progress in all target areas. It took Tata Steel 10 years to achieve excellence through well structured quality programme which began from identifying all areas of poor quality. They then formed apex council for quality on plant level and several at division levels. During this period, Tata Steel sought ISO 9000 certification and also conducted self-assessment on the lines of Baldrige Award. The apex council assessed the company at a level under 200 on a maximum of 1000 in 1991. On the way the apex council proposed JRD Quality Values Award for all Tata Group Companies. In the year 2000, Tata Steel won JRDQV scoring 600 out of 1000 points. JRDQV covers corporate areas such as leadership, strategic planning, customer focus, process management, human resource focus, information and analysis and business results.

In July 2001, Tata Steel was judged first among 12 of the world’s top steel makers. This was achieved despite reduction of workforce by 30,000. There was no industrial unrest on gradual reduction of workforce because the policy was transparent.

10.3 LOSSES CUT 76 PERCENT WITH TQM IMPLEMENTATION

The Ingersoll-Rand (IR) Energair plant at Davidson, North Carolina, is a small plant with a big success story. This plant reports success in dramatically reducing manufacturing losses—a 76% reduction over to 10 months. These results were achieved through the use of statistical process control (SPC). Following table shows the monthly trend of rejections at final test.

<table>
<thead>
<tr>
<th>Month</th>
<th>Rejection Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>10%</td>
</tr>
<tr>
<td>Feb</td>
<td>5%</td>
</tr>
<tr>
<td>Mar</td>
<td>3%</td>
</tr>
<tr>
<td>Apr</td>
<td>2%</td>
</tr>
<tr>
<td>May</td>
<td>1%</td>
</tr>
<tr>
<td>Jun</td>
<td>0.5%</td>
</tr>
<tr>
<td>Jul</td>
<td>0.2%</td>
</tr>
<tr>
<td>Aug</td>
<td>0.1%</td>
</tr>
<tr>
<td>Sep</td>
<td>0.05%</td>
</tr>
<tr>
<td>Oct</td>
<td>0.01%</td>
</tr>
</tbody>
</table>

The IR plant is strictly an assembly and test operation for small air compressors used to operate air tools. The compressors are used in the highly competitive do-it-yourself consumer market, with sales in the construction and trade markets as well. All manufactured parts for the compressors are shipped to the plant. A close relationship is therefore maintained between the plant and its suppliers. Packaging and distribution of the compressors are also handled from this faculty.

ASME-1, coded air receivers are grit-blasted, painted, baked, and sent to the assembly process. There are two basic assembly lines: the "tilt-piston" line and the "portable/vertical" package line. The tilt piston line assembles a 3/4 horsepower thankless compressor and motor subassemblies. Other typical subassemblies at Energies are manifolds and pressure switches. The portable/vertical line assembles tank mounted compressors, which range from 3/4 to 5 horsepower.

After assembly, every compressor from both lines is tested on a computerized test stand to
verify performance and ensure quality conformance. Specific criteria are used for testing performance. These include motor electrical standards; pump requirements, and the mechanical integrity of the compressor assembly.


**DEMOS CONTROL CHART SYSTEM**

The success achieved in reducing manufacturing losses at final test resulted from the company's commitment to continually improve product quality. To meet this objective, management decided to implement a continuous SPC program. This program was designed to catch defects at the point they occurred in the process and identify immediate corrective action. IR chose the Demos control chart system.

This system organizes all attribute and variable quality data into an integrated, plant-wide SPC system. The system identifies and concentrates on the few major continuing problems and eliminates the wide proliferation of charts on minor or trivial problems. It summarizes all information into management control charts so that the program can be specifically directed by the management team.

Using a pyramid technique, inspection, scrap, and rework data are integrated and organized into a series of control charts. The entire system can include over 1000 items—defect types, operators, machine operations, and part types.

With pinpoint accuracy, the system identifies each out-of-control item as well as each item that has improved in performance. Also, the system routinely and automatically directs major effort and corrective action by the entire organization toward those areas that have the poorest quality.

Using this system, plant managers set as their objective a rejection rate that is lower every month than the previous month until 0.1% is reached. If at any time the rejection percent is higher than the previous month, it indicates that the program has lost momentum and that a strong effort is needed to reestablish it, until the current month's percent again is the lowest point. For example, Figure 10.2 shows that upwards trends occurred in December and April.

The trend in December resulted from changes in assembly workers during holiday vacations, and pled with increased production requirements at the time. This trend reversed after cross-training the assembly workers and maintaining continuity in assembly methods.

The upward trend in April resulted from a problem with small motor wiring fixtures. IR took up the problem with the motor manufacturer, resulting in improved methods and fixture controls at the vendor's site. Figure 10.3 shows that after correction action the downward trend was reestablished the allowing month.
IMPLEMENTING THE SYSTEM

At the introduction of the Demos control chart system at the plant, managers gathered data at final test stations on each assembly line. Control charts were constructed to identify out-of-control conditions and to evaluate corrective action taken on their causes. Table 7.21 shows the data for six days in the plant's daily overall production lines at final test.

The process averages appear in the left-hand column of Table 10.1. Overall plant performance is 6.5%. The portable and tilt piston lines have process averages of 8 and 4.8%, respectively. Daily performance for each line is shown progressively in the columns. For each day, the values in Table 10.1 show the number of rejections, the number of items produced, and the percentage of rejections, respectively. On January 6, plant performance is 9.1% - the portable and tilt piston lines are 11.9% and 4.0%, respectively. The chart indicates that specific data and results since January have continued to show dramatic improvement.

<table>
<thead>
<tr>
<th>Process Average (p in %)</th>
<th>Production Line</th>
<th>January</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Portable/vertical</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Number of rejections</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Number of Produced</td>
<td>247</td>
</tr>
<tr>
<td></td>
<td>Percent rejection</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>Tilt Piston</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>Number of rejections</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Number of Produced</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td>Percent rejection</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>Total rejects</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total Production</td>
<td>398</td>
</tr>
<tr>
<td></td>
<td>Percent defects</td>
<td>6.5</td>
</tr>
</tbody>
</table>

When an entry exceeds the upper control limit for its process average, it is boxed; if it is below the lower limit, it is circled. The overall performance of the plant is out of control on the high side on January 6 and is worse on January 7. Performance is brought back into control on January 11, and on January 12, performance is better than the lower control limit. The boxes and circles show that the portable line is responsible. Therefore, the investigation is now focused on the portable line. Details on the different types of rejections that occur on the portable line are investigated.
Table 10.2 shows the data on the portable line for the same time period. The daily totals on the different types of defects are shown along with the total production for the day. The average percentage of defects in each category is also shown. The portable line total percentage is out of control on the high side on January 6 and 7. It is in control on January 11 and is exceptionally good on January 12. The boxes show that leaks and pressure switches caused the high out-of-control condition on January 6. The pressure switch problem had been solved the next day but not the leak problem had been solved the next day but not the leak problems. On January 11, both the leak and pressure problems had been solved. Even though the pressure switch problem reoccurred on January 12, the performance for leaks is so superior that the overall performance for the portable line is exceptional and plots below its lower statistical limit. Attention was now focused on the leaks on the portable line. Table 10.2 shows the number of defects of each type within this category for the same time period.

**TABLE 10.2 Data for the Number of Rejections on the Portable Line**

<table>
<thead>
<tr>
<th>Process Average (p in %)</th>
<th>Defects</th>
<th>January</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3.0</td>
<td>Leaks</td>
<td>4</td>
</tr>
<tr>
<td>2.6</td>
<td>Motors</td>
<td>4</td>
</tr>
<tr>
<td>0.4</td>
<td>Pumps</td>
<td>1</td>
</tr>
<tr>
<td>0.1</td>
<td>Sheaves</td>
<td></td>
</tr>
<tr>
<td>0.3</td>
<td>Pressure Switch</td>
<td>2</td>
</tr>
<tr>
<td>0.2</td>
<td>Cosmetic</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>Miscellaneous</td>
<td>2</td>
</tr>
<tr>
<td>0.4</td>
<td>Bad Check Value</td>
<td>1</td>
</tr>
<tr>
<td>8.0</td>
<td>Total defects</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Total Productions</td>
<td>367</td>
</tr>
<tr>
<td></td>
<td>Percent defects</td>
<td>4.9</td>
</tr>
<tr>
<td>Process Average (p in %)</td>
<td>Defects</td>
<td>January</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------</td>
<td>---------</td>
</tr>
<tr>
<td>0.5</td>
<td>Tank weld</td>
<td>1 1 5 1 1</td>
</tr>
<tr>
<td>0.1</td>
<td>Inspection plugs</td>
<td></td>
</tr>
<tr>
<td>0.7</td>
<td>Manifold</td>
<td>1 3 12</td>
</tr>
<tr>
<td></td>
<td>Pressure switch</td>
<td>1 10</td>
</tr>
<tr>
<td>0.5</td>
<td>Check Valve</td>
<td>1</td>
</tr>
<tr>
<td>0.1</td>
<td>Discharge elbow</td>
<td>1</td>
</tr>
<tr>
<td>0.1</td>
<td>Nylon tube</td>
<td></td>
</tr>
<tr>
<td>0.7</td>
<td>Discharge tube</td>
<td>1 2 11</td>
</tr>
<tr>
<td>0.1</td>
<td>Drain Valve</td>
<td>1</td>
</tr>
<tr>
<td>0.3</td>
<td>Others</td>
<td>2 2</td>
</tr>
<tr>
<td>3.0</td>
<td>Total defects</td>
<td>4 6 30 8 17 3</td>
</tr>
<tr>
<td></td>
<td>Total Productions</td>
<td>247 367 578 120 453 531</td>
</tr>
<tr>
<td></td>
<td>Percent defects</td>
<td>1.6 1.6 5.1 6.7 3.7 0.6</td>
</tr>
</tbody>
</table>

Table shows that the out-of-control condition was caused by leaks from the manifold and the discharge tube. Although pressure switch leaks caused a problem one day, all leak problems were solved by January 12. Exceptional leak performance results are shown on January 12, and this performance is the main reason for the superior overall performance on this date.

**CORRECTIVE ACTION**

Once the problems were identified on the charts, corrective actions could be immediately taken. The main forum for corrective action at the plant is the daily action meeting. Each morning at 8:00 A.M., the operations manager meets with manufacturing and quality
assurance supervisors and appropriate specialists. They review daily control charts, define current problems, review progress, and agree on corrective actions.

The greatest overall improvement was in reducing air leaks in the portable line. An 83% reduction was achieved by reducing the initial percentage of leaks from 6.5 to the latest value of 1.1%, as shown in Table 10.1

<table>
<thead>
<tr>
<th>Tilt Piston Line</th>
<th>Initial Percentage</th>
<th>Final Percentage</th>
<th>Percent Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>High amps</td>
<td>2.5</td>
<td>0.2</td>
<td>92</td>
</tr>
<tr>
<td>Pressure</td>
<td>1.9</td>
<td>0.1</td>
<td>95</td>
</tr>
<tr>
<td>Knock</td>
<td>1.5</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0.8</td>
<td>0.2</td>
<td>75</td>
</tr>
<tr>
<td>No start</td>
<td>0.6</td>
<td>0.3</td>
<td>50</td>
</tr>
<tr>
<td>Hi pot</td>
<td>0.5</td>
<td>0.8</td>
<td>-60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7.8</strong></td>
<td><strong>1.5</strong></td>
<td><strong>81</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Portable Line</th>
<th>Initial Percentage</th>
<th>Final Percentage</th>
<th>Percent Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaks</td>
<td>6.5</td>
<td>1.1</td>
<td>83</td>
</tr>
<tr>
<td>Motors</td>
<td>2.4</td>
<td>1</td>
<td>58</td>
</tr>
<tr>
<td>Pumps</td>
<td>0.7</td>
<td>0.2</td>
<td>71</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0.5</td>
<td>0.1</td>
<td>80</td>
</tr>
<tr>
<td>Pressure switch</td>
<td>0.2</td>
<td>0.1</td>
<td>50</td>
</tr>
<tr>
<td>Cosmetic</td>
<td>0.2</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Sheaves</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Check valve</td>
<td>0</td>
<td>0.3</td>
<td>-∞</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10.6</strong></td>
<td><strong>2.9</strong></td>
<td><strong>72</strong></td>
</tr>
</tbody>
</table>

IR identified several corrective actions needed to reduce leaks in the portable line. Training began immediately to achieve better discipline in the process. Upgrading of the tooling improved efficiency. Experiments were designed and monitored to quality the methods, tools, and process. Also, rearranging the assembly lines produced better control of material flow and balanced assembly operations.

Another significant result came out of a vendor-oriented quality problem with motors. IR requested a resident quality engineer from the motor vendor. He and the IR plant workers monitored all defect characteristics and identified the root causes. After mutual agreement as to what the problems were, they took corrective actions. Some were taken in Energair's plant, others in the vendor's plant.
Engineers monitored these corrective actions on the portable line and data-Faxed control charts on the vendor's motor assembly facility. These charts clearly pointed out the problems requiring correction at the vendor's plant and traced them as they were addressed. Root cause identification and corrective action on the product lines initiated minor design changes and overall product improvement.

On the tilt piton line, the system identified specific failure modes and, as with the portable line, called for extensive involvement with the motor manufacturer for corrective steps.

They agreed on design changes and addressed assembly criteria at both the small compressor plant and the manufacturer's facility. The SPC charts monitored these changes at the small compressor plant, and feedback was data-Faxed daily to the vendor. Batch lots were identified to maintain control as each batch was monitored.

IR management believes that the benefits achieved by the continuous quality improvement program are many. The actions that reduced rejections at final test automatically and simultaneously improved product quality. Also, the benefits of reducing rejections significantly reduced quality costs. For example, a reduction in the rejection rate:

- Generated savings in scrap and rework costs
- Reduced failure costs
- Reduced in-process inventories
- Improved delivery performance
- Increased productivity

Therefore, rather than costing the company money, this quality improvement program made money by reducing the rejection rate, quality improvement was free.

Another benefit was the increased visibility of problems. Through the visibility achieved with the Demos system, problems are defined—whether within the process or at the vendor's site. This information becomes a valuable tool when dealing with a vendor oriented quality problem and permits an unemotional and objective discussion of the problem. Thus, the continuous quality program used at the Davidson plant has become an external program for constant quality improvement by some of its major vendors.

CONCLUSION
An analysis of the above cited successful TQM implementation experiences reveals that the organization's ultimate objective of adopting TQM for bringing revolutionary change in organizational philosophy and culture would bear fruit only if the concepts and philosophy of TQM are learned and understood properly. Treating TQM as a bandwagon, a buzz word and looking for some new management philosophy would not solve the organization's problems. Also, the gains from TQM cannot be expected in a short time. It takes arduous and sincere efforts from top to bottom in the organisation to realize the sweet of TQM.
10.4 NEED FOR TOTAL QUALITY MOVEMENT - TELCO JAMSHEDPUR

ABSTRACT
The study presents the situational analysis stressing the need for Total Quality at TELCO. It provides a systematic approach to Total Quality Movement at Jamshedpur Works. The movement consists of statement of Organizational Quality Policy, formulation of quality councils, perceiving the new role of a manager, measurement of quality in terms of cost. Organization wide, training for awareness and skill at various levels and, lastly reward and recognition for quality attainment.

INTRODUCTION
There was a time when the entire quality programme of an Organization was limited to, merely separating defective from good ones by a handful of unsung individuals. Since then we have come a long way. With time, quality has assumed a new dimension, its scope has widened, its boundary has broadened and, even the very concept has changed. To-day we have come to a stage when quality is stretching its arms to embrace everyone in the Organization, at all levels and every functional activities.

Quality is no longer remaining confined to mere operation and product, Emphasis is shifting from "Product Quality" to "Quality of Work", "Quality of Thought" and "Quality of Everything We Do".

Situational Analysis
TELCO's quality policy is centered around "Customer Affection", which is measured by quality of product performance. The quality of performance is monitored by Export and Domestic Quality which are subsequently monitored by:

- Field Failure 'and opinion survey by customer contact. Quality of Product Performance depends on:
- Quality of Design. Manufacturing and Service.

Jamshedpur Works being primarily engaged in the manufacturing activities recognizes that along with manufacturing capability, motivation for quality of human performance is a significant criteria for assuring quality of conformance.

Quality of Human Performance depends on:
- Communication (Open)
- Respect for all
- Attention to Details
- Leadership by Leading
- Cleanliness of work environment
- Optimum work force
- Team Work

Quality is measured in terms of cost of Field Failure, Internal Rejection and Inspection. The cost in all these three accounts can be reduced by generating quality and shifting its emphasis from product to process, detection to prevention, from external customers to both external and internal customers and lastly, from experience base to data base decisions.

Hence, there is a need for Total Quality Movement where quality will be everyone's responsibility and quality has to be emphasized in everything we do.
Total Quality Movement — A System Approach
Some of the guidelines of Total Quality are:

- Philosophy: Prevention Not Detection
- Approach: Management Driven Technique
- Responsibility: Every One
- Measure: Cost of Quality
- Standard: DO IT RIGHT THE FIRST TIME, EVERY TIME
- Scope: Continuous Improvement
- Range: Company Wide

The strategies and their inter-relationships in the framework of Total Quality Planning are highlighted as follows:

Organizational Quality Policy (States Organizational objectives and priority on Total Quality). The salient features of the Quality Policy are:

- Customer Satisfaction through consistently high quality products backed by effective after-sale-service.
- Continuous upgradation of Product, Process and Raw Material.
- Commit ourselves to Do it Right, the First Time, Every Time.
- Improve Work life and environment around us.
- Maintain highest standard and create a culture of excellence in all we do.

Quality Councils (Provides a structure for implementation of strategies)
The Quality Council is a 3-tier structure, i.e. Top Management Quality Council (TMQC), Divisional Management Quality Council (DMQC) and Divisional Task Group (DTG). The TMQC, consisting of three members from the Top Management Group (TMG), is responsible for monitoring the implementation strategies, quality improvement project and Organization Training Plan. The DMQC, consisting of Divisional Manager and his team, monitors the same as TMQC but at the divisional level. The DTG, consisting of the Manager and his group is responsible for the quality improvement projects. The TMQC will brief the TMG quarterly and DMQC will brief the TMQC monthly about the actions taken and results achieved.

Managers' New Role (Organizational Perception of Changing Roles)
- Supplier/Processor/Customer Status
- Visible Commitment to Quality
- Data base decision making
- Customer (Internal/External) Satisfaction as a measure of performance

Employees' New Role
- Treat next man in the process as customer
- Measure performance on customer feedback
- Monitor and Control Inputs not the Outputs
- Do the job right, the first time, Every time
- Use statistical techniques for problem solving
Communication (Provides & common understanding of Total Quality)
- Quality Policy down the level
- Strategies of Total Quality in Quality Magazine
- Quality Performance from internal and external customers in daily quality meeting

Change Agents (Emphasizes Total Quality as a Mgt. driven technique for continuous improvement)
- Top Mgt. / Div. Mgt. Quality Councils
- Trained Facilitator
- Outside Quality Experts

Standards and Measurements (Measure Quality of Performance both internal and external)
- Customer satisfaction and Employee Attitude Survey
- Cost of Quality Measurement

Organization Wide Training (Training for awareness and skill)
The training package can be broadly classified as: Quality Management (Level I, II,III), Statistical Tools (Seven Tools, Elementary and Advanced Statistics), Measurement Reliability, Economics of Quality and lastly, Statistical Applications.

Training Methodology consists training the Supervisors to train their subordinates through class room cum workshop training. Outside experts are also invited for top management training. The training duration for Operators (24 Hrs.), Chargeman (32 Hrs.), till Asst, Managers (45 Hrs.). Managers (24 Hrs.), and Divisional Managers and above (16 Hrs).

Recognition (Motivation for Quality of Human Performance)
- Quality attainment, a dimension in the appraisal system
- TELCO quality award
- Quality Improvement Project Presentation to Top Management

CONCLUSION
Total Quality in TELCO is not only confined to product or process. We have extended the scope to service functions like Finance, Medical Care, Construction and so on, Jamshedpur Works is committed to Total Quality and, we recognize that the first round or training for all our people will create the awareness and enable us to get over the cultural back lash. With a comprehensive system approach the Total Quality Movement has started. But it is just the beginning - and a long way to go before we rest.
10.5 QUALITY ASSURANCE IN SERVICE SECTORS

The Defense Services need a variety of sophisticated and complex stores which are required to perform satisfactorily under, adverse operational and environments continuously. This calls for a high degree of Quality and Reliability in these systems. Therefore, a sound quality assurance programme for Defense Stores is necessary. Another important strategic need is building up self-reliance on foundation of development to deliver stores of required Quality and Reliability incorporating Slate of Art of Technologies.

The Ordnance Factory in particular, in the past, had an assured market, protected not only international but internal competition. The user has had little choice of the product for various reasons.

This position has since changed considerably. The resource crunch as well as demands from the other section 'Within our boundaries, we have to cater to the rising users’ expectations who are exposed to newer generation of arms and ammunitions available abroad. Hence, the existing concept and method of ensuring Quality and Reliability in Defense Stores, needs to be reviewed with modem methods and concepts as the demand on modem weapon systems and equipments have stretched technologies to their limits resulting in most exacting specification of design, quality, reliability and safety. Rapid technological developments should be taken as a National drive for quality management as done in Japan and other developing countries.

WHAT QUALITY MEANS
Quality is the degree of satisfaction derived by the User from a product. In respect of defense hardware, quality means, performance and conformance to the Standards set for it over a period of time. In other words, it is not only mere satisfaction of performance, at a one time test, but continued guarantee of performance, even after a lapse of time which is known as Reliability. Other elements of quality depend upon specifications such as Interchangeability and Maintainability. Summing up, we can say that quality expectation is stringent in Reliability Interchangeability and Maintainability.

THE PRESENT AND PROPOSED SYSTEM FOR QUALITY ASSURANCE
The present system of inspection of segregating bad from good may bring down the rejection say, from 10% to 3% and there may be improvement in quality but the quality of the product still remain within the specification window and customer satisfaction is limited. This may be termed as static quality improvement.

Therefore, quality culture should be developed by workers participation and there should be continuous suggestions from every employee to improve quality using Quality Circle as principle tool to develop such culture. Further, it should be the endeavour of every organization to motivate their employee to bring out their inner skills for innovative ideas to improve quality and implement such ideas without delays to give the user absolute satisfaction of the product. Such process may be termed as Dynamic Quality Improvement.
To meet the Quality challenges and ensure Quality Assurance areas requiring attention are discussed in the subsequent papers

**HUMAN RESOURCE DEVELOPMENT**

People are the most valuable resource within any organization and to recognize that a highly flexible, quality conscious work force, functioning as a team is the goal we have to aim in order to create the correct working environment for continuous improvement. Employee involvement is the tool to promote this change of attitude within the organization and this together with harmonization of conditions will play a key role in this objective.

Man power with adequate skill is another important aspect. A ratio between the direct production labour and Quality Assurance Personnel should be clearly worked as otherwise imbalance may occur which will ultimately reflect on the product quality. The ratio is generally fixed depending upon quantum and the quality of product involved.

When once the right ratio of Quality Assurance personnel is arrived at, training of personnel is essential for quality improvement to provide the right people with right quality control methods at the right time so that they can create the necessary process changes into bring about quality improvement.

**DOCUMENTATION**

Documentation is a very important part of Quality Assurance activities. Without proper documentation, Quality Control and quality assurance have a tendency to degenerate on the shop floor, with consequences down the line to the finished product. All documents associated with production and quality control should be identified and pre-determined as regards the responsibilities for their maintenance, upkeep and flow where applicable. This is particularly true in our country where there is tendency to switch over from formal to informal control system which ultimately leads to deterioration or loss of control. Documents for Quality Control should constitute the basic datum upon which quality assurance system will be built. Lack of order or sequence of documents improper thereof must be viewed seriously and persons concerned for maintaining them should be held responsible. The documents should be maintained at various inspection control points for easy references. The regular check for product quality, process control, surveillance and quality audit should also be properly recorded and supported by documents.

**Vendor assessment/rating**

Proper vendor rating for assessing the performance of a Supplier in comparison with other supplier with a view of drawing up a comparative scale should be made for taking decision regarding placement of new contracts with the existing vendors.

The first step of quality assurance is selection of a suitable vendor, sufficient care must be taken to assess the vendor and for this purpose, judicious recording of findings in the vendor capacity report must be done. Before selection of Vendor for particular product, a fair assessment of the capability of the manufacturer should be made.
SUPPLIERS QUALITY ASSURANCE
Suppliers Quality Assurance, plays a support role in developing a supplier to meet Ordnance Factory Quality needs.
Supplier Development and supplier Quality Assurance closely work with supplier to upgrade the supplier capabilities by:
- Providing all drawings, Specification for material and process standards.
- Visit to suppliers’ premises to guide in manufacture and explaining inspection requirement.
- Providing material testing facilities.
- Providing all types of Technical guidance.
- Making Supplier responsible for the Quality of his Supplies

INDIGEMSATION
In the recent years, die pace of indigenization has picked up considerably. This has reduced the import bill and increased our procurement from indigenous suppliers. Some of the aspects of the vendor development for healthy indigenization process and for the Quality Assurance are listed below:

i. Due weightage to Quality Control System of the Vendors should be made at the time of placement of order. The aspect of lowest price should not be the criteria, for placement of orders. The aim should be, to develop a small number of reliable, quality conscious, vendors on a long time contract basis,

ii. Need to improve the system of exchange of information such as Drawings, Samples, Process details, testing procedures, total requirement etc. should be freely and readily available to the vendor.

iii. Our testing procedure, contract details, quality requirements, fitments trials should be made clear to the Vendor. Our stringent testing and evaluation comes as a great surprise, to many vendors.

METROLOGY AND QUALITY CONTROL FACILITIES
This is an important area where product quality can be improved to a great extent. Hence, to provide analytical support to the task of quality assurance facilities at Standards Room and Laboratory are modernized appropriate lo hi-tech production technology and new product requirement.
Some of the significant facilities added are
- Computerised three dimensional measuring Machine.
- Computerised Roundness Testing Machine.
- Computerised Hilix and involutes Checking Machine.
- Profile Surface Finish Checking Machine.
- Shadow Graph Testing Machine
- Magnetic Crack Detector
- Metal Spectro Scope
- Carbon Sulphur Determinator
- Digital Accurate Weighing Machine -.00001 Gram.
- Digital Hardness Tester.
- Computerised Portable surface finish Tester.
**PROCESS CONTROL**

The control of quality during the process of manufacture is one of the most important functions of a quality control system. All processes are subjected to various influences such as mechanical, electrical and environmental changes which tend to deviate the process from initial setting. The process control aim to regulate the process to counteract these changes so that the process quality remains within acceptable limits. A process going out of control may result in the production number of defectives before it is detected. It is, therefore, essential that effective control systems be devised which are able to detect deviation in the process at the possible moment so that corrective measures are initiated before an appreciable quantity of defectives are produced. In-process control is an effective method which would provide an early and accurate reflection of the status and condition of all parts being processed.

The details of in-process inspection through steps of first piece inspection, patrol/shop floor inspection and-final inspection are explained below:

i. First piece inspection and approval eliminates the necessity of scrapping a substantial part of production run by locating the cause for rejection and correcting deficiencies before time and material are wasted.

ii. Patrol/Floor inspection is the most crucial of all functions-performed under quality control. The determination of points at which material is to be inspected, the number of checks/inspections in any particular period would depend upon quantity of rejects as revealed by the in-process inspection.

iii. Final inspection and testing of the completed product can be adopted by use of sampling for acceptance/rejection of material or 100% inspection of the finished product.

**QUALITY AUDIT**

Quality audit is an appraisal of the entire system of Quality control used by a company. The objectives of quality audit is to assess through objective evidence the adequacy of and adherence to the documented Quality Control System and procedures to ultimately assure quality of products and its improvements. The quality audit can be performed on systems and procedures, product or process.

**PRODUCT IMPROVEMENT**

Major challenges of the industry in 1990s’ is to build user confidence about product quality. We are now operating in an environment of increasing customer demand for quality, foreign competition, Government regulation and increasing manufacturing cost. The concept of product improvement eventually takes form of specific product performance to meet customer expectation of cost and durability objectives through a long range product planning and engineering review analysis. The methodology adopted for product improvement varies from Industry to industry as it relates to specific technology, nature of manufacturing industry; the design know how, the ancillary industry to provide technology. Product improvement is defined as an activity through which a new product is generated or new functions are added to an existing product to enhance functions already being performed providing more reliability and efficiency at optimum cost to meet customer demand.
MANUFACTURING PROCESS TECHNOLOGY AND CONTROL

i. The production process should be capable of producing to meet the design requirement with smallest variations of parts consistently at economical cost, to achieve product improvements. In order to ensure constant improvements in manufacturing process the following becomes necessary.

ii. The policy of pre-production planning activity should be of never to manufacture defective parts.

iii. The production process should be under statistical control to generate parts within mid zone design tolerance.

iv. The machine tools and facilities required to ensure process control should be maintained in good order with high rate of availability.

v. The state of art machine tools technology, (CNC Machine System) low cost automation facility for material handling, advanced measuring system to ensure that total process is made fool proof with effective plant layout.

vi. Constant modernisation and upgrading of Machine tools and facility.

vii. Continuous training and education system to employees to upgrade their skills to meet the new technologies with operator process control technique would improve the product quality and sustain it well.

PRODUCT TESTING AND EVALUATION

Customer demands for higher quality product with performance and reliability besides ever increasing need to guarantee high availability. To meet customer expectation at competitive cost, the initiative for product design and manufacturing is posing a challenge. This generates need for extensive testing and evaluation to ensure product performance/reliability and customer satisfaction. In order to improve the product the following becomes necessary.

i. Testing of product for performance at the end of production line to check conformance to standard specifications,

ii. To test the product for durability and reliability in laboratory test bench for accelerated life testing,

iii. To test a batch of initial product from production in different condition to assess endurance of product,

iv. To test equipment in different service conditions to understand the need for improvement to meet special condition.

Product improvement is a progressive step towards overall improvement of product performance and services to meet and surpass increasing customer demand for higher durability, reliability, safety of operation and to provide value for money. Product development is a methodology towards new production evaluation with focus on new technology acquisition and adoption.

COMPUTER AIDED QUALITY ASSURANCE IN

Modern production system such as computer aided Machine Tools in the factory, integrated data processor in the office, computers to expedite management decision making, had made great impact in the operation of business today. It is obvious that major technological changes cannot be over laid upon the old manufacturing without bringing in effective improvements. Compared with hand operations, automation require far better procedures.
for determining the quality availability of new design prior to start of production, incoming material quality and in process quality. It will require the development of far more effective inspection, test measuring and feed, back control device. The importance of computer application has recently attained importance and reorganization.

COMPUTER AIDED QUALITY
For the products/pans where computer aided design (CAD) and computer aided manufacturing (CAM) are available the same engineering data base may be utilised by quality information equipment to produce approaches to computer aided quality (CAQ). This integrated engineering data base that designed the product and guided its manufacture with inspection and test of the product.

ADVANCED MACHINING TECHNIQUES
In the earlier system of low volume component production, quality depended on human skill and inspection after production. Today's manufacturing technology and quality control do not depend on post production inspection. Quality is built into the production, process automatically.

Bearing this in mind, we in HVF have introduced Machines with CNC systems with CNC machining centers for Boring, Milling, Drilling, Turning and Grinding to ensure high quality level of components.

MOTIVATION THROUGH QUALITY CIRCLE
It is now being increasingly realized all over the world that in order to face the emerging challenges it is imperative that high standards of quality in all our operations are achieved. This would be possible only through harnessing of the immense potential of our valuable human resource through developing in them self motivation and enriching their Quality of Work life.

The participative concept of Quality Circles, evolved in August 1987 in Heavy Vehicles Factory, provide a unique opportunity to satisfy the esteem requirements of the employees at all levels and motivate them to participate in improving the total performance of the organisation. There are at present 24 quality circles with 200 members participating in them. With adopting this philosophy we are confident that there will be definite Quality improvement in future.

CONCLUSION
The success of Quality standards maintained by any organization lies in adherence to planned inspection systems with modern Quality Control Methods and developing a strong quality culture clearly making "Quality" the responsibility of every employee. We are confident that through the measures that we have already implemented and that on the anvil we can meet the needs and challenges of Quality Assurance in nineties.
10.6 IMPACT OF TOTAL QUALITY MANAGEMENT ON PRACTICING PROFESSIONALS OF GARMENT SECTOR

The improvement in the knowledge level of trainees-of Quality Management Programme is measured through objective type of questionnaire before and after the programme. This paper analyses the effect of various factors such as initial knowledge, educational background, status in the organisation, experience, working department etc. on the knowledge improvement (learning) of the participants.

INTRODUCTION

Corporate Quality Assurance division of D. R. Garments Ltd., is Organising number lot Quality Management training programmes for all levels of its-executives from alt functional department. The type of programmes conducted is shown as under:

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Title</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Quality Management for Qa/Qe Executives</td>
<td>5 days</td>
</tr>
<tr>
<td>2</td>
<td>Quality Management for Other Functions</td>
<td>5 days</td>
</tr>
<tr>
<td>3</td>
<td>Process Control for Operational Executives</td>
<td>5 days</td>
</tr>
<tr>
<td>4</td>
<td>Statistical Process Control</td>
<td>10 days</td>
</tr>
<tr>
<td>5</td>
<td>Industrial Experimentation</td>
<td>8 days</td>
</tr>
<tr>
<td>6</td>
<td>Quality Assurance for Technical Executives</td>
<td>6 days</td>
</tr>
<tr>
<td>7</td>
<td>Quality Audit</td>
<td>3 days</td>
</tr>
</tbody>
</table>

The purpose of training programmes is to bring improvement in knowledge, attitudes and skills of trainees which should subsequently lead to improved situations (Quality/Productivity) back on their Jobs. Recently lot of interest has been evinced by many in evaluating results of the training programmes (ref.1-4) by measuring.

1. Principles, facts, techniques etc. acquired by the participant during the training session
2. Tangible results achieved by the trained participants at their work place in terms of improved quality, productivity etc.

The present paper attempts to measure learning or the knowledge and skill improvement of the participant during the programme and analysing the same, statistically.

EVALUATION OF LEARNING

For the purpose of evaluation, learning is defined as attitudes that were changed and knowledge and skills that were acquired. It does not include on the job use of the attitudes, knowledge and skills (ref. 1).
Each participant is given an objective type of questionnaire before and after the programme. The initial and final scores are evaluated and presented to participants in the form of a Histogram (chart-1) during the concluding session. However, individual scores are not disclosed to the participants.

STATISTICAL ANALYSIS OF SCORES

For the present study, scores of 153 participants from General Quality Management Programme (conducted in 88-89) have been analyzed. These participants were drawn from different disciplines (design, production, quality, material's management etc.), different units of D.R.Garments; having different qualifications (Post graduates, graduates, diploma holders etc.), having different status in the organisation (Lowest level to senior level executive), having varied terms of experience after their qualifying examination (1 year to 35 years). The effect of various personal factors of participants on their learning has been the criteria of analysis. The findings are presented in Tables 2 to 12. Average initial score $\bar{x}_1$, average final score $\bar{x}_0$, standard deviation ($\sigma$), variation from estimate $\bar{x}_0 - \bar{x}_0$, analysis of stay puts (those who have not gained) and, analysis of inter-1 action of various factors is presented in these tables.

The feedback of the participant was also obtained but was not co-related to learning since the anonymity of participants was maintained in the feedback format.

Bivariate distribution of scores is given in table-2. A scatter diagram of initial score $x_1$ and final score $x_0$ is shown in Chart-2. A Regression analysis done gave the following results:

$$x_0 = 28.6 + 0.67x_1 \pm 18.11$$  \hspace{1cm} (1)

$$R^2_{0.1} = 43.1\%$$

$$x_0 = 28.9 + 0.64x_1 + 0.02x_2$$  \hspace{1cm} (2)

$$R^2_{0.12} = 47.83\%$$

The Partial correlation,

$$R_{0.21} = -0.02$$

This shows that the initial knowledge of participant influences to a large extent the score improvement.
Relevant statistical summaries relating the scores with bio-data are presented in tables 3 to 10.

**INFERENCES**

**Position effect**

The effect of positions are summarised in tables 3 & 8. The average difference of 3.59 is found to be significant at 5% level (t value = 1.88). This means E3 or higher level persons, are faring better in, final tests as compared to E2 or less.

**Qualification effect**

The effect of qualifications are summarised in tables 4 & 9. The observed difference in final score is found to be significant at 5% level (t value is 10.29).

**Training effect**

The effect of having attended a training course earlier is presented in table-10. The observed difference (between the cases of no training earlier and attending a training course on Quality Management or rotated subject) is not found to be significant (t =1.57).

**Interaction effect**

Interaction or combination effects are shown in table 11. The best groups can be classified as:

1. Upto grade E2, 15 years or less experience, graduates in Engineering or above and trained earlier $x_0 = 70.0$
2. Grade E3 or above, 15 years or less experience, and graduates in engineering or above and trained earlier $x_0 = 70.0$
3. Grade E3 or above, less than or equal to 15 years of experience and graduate in engineering or above and no earlier training $x_0 = 70.0$.

The common factors in groups with highest final scores are graduates in engineering or above with less than or equal to 15 years of experience.

**Stayput effect**

As mentioned earlier stayputs are those' who have not shown improvement in the score. The stayputs are classified as of two types:

- A type: $x_0 < x_1$ and $x_0 < \bar{x}_0$
- A type: $x_0 < x_1$ and $x_0 > \bar{x}_0$

The summary of stayputs derived from table 3-7 is shown in table-12. The department-wise difference of stayputs were analyzed and found to be significant.
SUMMARY AND RECOMMENDATIONS

1. It is observed that about 50% of the learning depends on the initial score of the participant.
2. The percentage of stayputs are, A type 14.4% and B type 3.9%.
3. An interesting observation from the study is that service experience is uncorrelated with final score ($x_0$) after removing the linear effect of initial score ($x_1$).
4. A suitable strategy has to be formulated for future programmes so as to reduce the percentage of stayputs and minimize the effect of initial score ($x_1$).
5. A suitable scheme should be devised to evaluate the tangible effect of the programmes in terms of improved quality at participants work place.

Table 2
Bivariate Distribution of scores (Frequency)

<table>
<thead>
<tr>
<th>$x_1$</th>
<th>$x_0$</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70-79</th>
<th>80-89</th>
<th>Total</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>20-29</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>30-39</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>40-49</td>
<td>12</td>
<td>10</td>
<td>9</td>
<td>6</td>
<td></td>
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<td>37</td>
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<td>50-59</td>
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<td>70-79</td>
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<td>1</td>
<td>6</td>
<td></td>
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<td>29</td>
<td>51</td>
<td>34</td>
<td>14</td>
<td></td>
<td>153</td>
</tr>
</tbody>
</table>

$x_1$ - Initial Score  $x_0$ - Final Score
### Table 3

**Position Effect**

<table>
<thead>
<tr>
<th>Position n</th>
<th>Initial Score</th>
<th>Final Score</th>
<th>Average</th>
<th>$x_0 \leq \bar{x}_0$</th>
<th>$x_0 &gt; \bar{x}_0$</th>
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<tbody>
<tr>
<td>Less than E1</td>
<td>11</td>
<td>49 20</td>
<td>11 04</td>
<td>59 54</td>
<td>12 72</td>
</tr>
<tr>
<td>E1</td>
<td>60</td>
<td>50 90</td>
<td>12 64</td>
<td>62 15</td>
<td>11 22</td>
</tr>
<tr>
<td>E2</td>
<td>30</td>
<td>50 50</td>
<td>-</td>
<td>61 56</td>
<td>12 98</td>
</tr>
<tr>
<td>E3</td>
<td>23</td>
<td>59 43</td>
<td>11 99</td>
<td>65 30</td>
<td>11 25</td>
</tr>
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<td>E4</td>
<td>27</td>
<td>53 74</td>
<td>-</td>
<td>66 51</td>
<td>3 90</td>
</tr>
<tr>
<td>E5</td>
<td>1</td>
<td>55 00</td>
<td>-</td>
<td>48 00</td>
<td>-1 71</td>
</tr>
<tr>
<td>E6</td>
<td>1</td>
<td>58 00</td>
<td>-</td>
<td>68 00</td>
<td>-0.88</td>
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### Table 4

**Qualification Effect**

<table>
<thead>
<tr>
<th>Qualification n</th>
<th>Initial Score</th>
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<th>Average</th>
<th>$x_0 \leq \bar{x}_0$</th>
<th>$x_0 &gt; \bar{x}_0$</th>
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<tr>
<td>Post Graduates in Engg.</td>
<td>10</td>
<td>56.80</td>
<td>8.70</td>
<td>66 00</td>
<td>12.53</td>
</tr>
<tr>
<td>M.sc</td>
<td>60</td>
<td>55.50</td>
<td>15.46</td>
<td>65 10</td>
<td>12.62</td>
</tr>
<tr>
<td>Diploma</td>
<td>17</td>
<td>53.11</td>
<td>9.20</td>
<td>64 76</td>
<td>8 56</td>
</tr>
<tr>
<td>+AMIE</td>
<td>62</td>
<td>48 10</td>
<td>12.46</td>
<td>59 48</td>
<td>9.32</td>
</tr>
<tr>
<td>Diploma/ B Sc.</td>
<td>4</td>
<td>43 75</td>
<td>7 50</td>
<td>50 00</td>
<td>13 75</td>
</tr>
<tr>
<td>ITI /Equivalent</td>
<td>4</td>
<td>53.10</td>
<td>12.73</td>
<td>63.00</td>
<td>12 60</td>
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</table>

### Table 5

**Working Department Effect**

<table>
<thead>
<tr>
<th>Department n</th>
<th>Initial Score</th>
<th>Final Score</th>
<th>Average</th>
<th>$x_0 \leq \bar{x}_0$</th>
<th>$x_0 &gt; \bar{x}_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>15</td>
<td>56.47</td>
<td>9.68</td>
<td>67.60</td>
<td>10 37</td>
</tr>
<tr>
<td>Production</td>
<td>27</td>
<td>51 77</td>
<td>13 67</td>
<td>60 77</td>
<td>13 27</td>
</tr>
<tr>
<td>Quality</td>
<td>41</td>
<td>50 63</td>
<td>11 23</td>
<td>62 24</td>
<td>8.71</td>
</tr>
<tr>
<td>Materials</td>
<td>22</td>
<td>51 36</td>
<td>12 03</td>
<td>62 36</td>
<td>13 78</td>
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<tr>
<td>Mgmt.</td>
<td>7</td>
<td>45 43</td>
<td>10.69</td>
<td>52 14</td>
<td>7.7</td>
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<td>Commercial</td>
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318
## Table 6
Unit wise Effect

<table>
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<th>Unit</th>
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<th>Initial Score</th>
<th>Final Score</th>
<th>Average</th>
<th>( x_0 \leq \bar{x}_0 )</th>
<th>( x_0 &gt; \bar{x}_0 )</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( \bar{x}_0 )</td>
<td>( \bar{x}_0 )</td>
<td>(( \bar{x}_0 - x_0 ))</td>
<td>r</td>
<td>%</td>
</tr>
<tr>
<td>I</td>
<td>9</td>
<td>49.89</td>
<td>67.78</td>
<td>6.36</td>
<td>6.08</td>
<td>-</td>
</tr>
<tr>
<td>II</td>
<td>11</td>
<td>52.55</td>
<td>67.00</td>
<td>11.25</td>
<td>3.53</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>35</td>
<td>52.03</td>
<td>64.09</td>
<td>11.26</td>
<td>0.96</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>36</td>
<td>50.14</td>
<td>58.61</td>
<td>9.17</td>
<td>-3.25</td>
<td>6</td>
</tr>
<tr>
<td>V</td>
<td>23</td>
<td>52.87</td>
<td>63.78</td>
<td>11.96</td>
<td>-0.09</td>
<td>3</td>
</tr>
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<td>VI</td>
<td>11</td>
<td>55.27</td>
<td>63.82</td>
<td>15.26</td>
<td>-1.47</td>
<td>2</td>
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<tr>
<td>VII</td>
<td>4</td>
<td>54.00</td>
<td>67.00</td>
<td>3.56</td>
<td>2.56</td>
<td>1</td>
</tr>
<tr>
<td>VIII</td>
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<td>50.00</td>
<td>60.00</td>
<td>-</td>
<td>-1.77</td>
<td>-</td>
</tr>
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<td>IX</td>
<td>4</td>
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<td>58.75</td>
<td>20.71</td>
<td>-4.36</td>
<td>1</td>
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<td>X</td>
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<td>57.26</td>
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Unit stands for manufacturing/service divisions of D. R. Garment. Spread-over all over India.

## Table 7
Earlier Training Attendance Experience

<table>
<thead>
<tr>
<th>Department</th>
<th>n</th>
<th>Initial Score</th>
<th>Final Score</th>
<th>Average</th>
<th>( x_0 \leq \bar{x}_0 )</th>
<th>( x_0 &gt; \bar{x}_0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( \bar{x}_0 )</td>
<td>( \bar{x}_0 )</td>
<td>(( \bar{x}_0 - x_0 ))</td>
<td>r</td>
<td>%</td>
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<td>Attended</td>
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<td>65.93</td>
<td>12.4</td>
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<td>5</td>
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<tr>
<td>QM courses</td>
<td>8</td>
<td>52.37</td>
<td>65.75</td>
<td>4.92</td>
<td>-2.39</td>
<td>-</td>
</tr>
<tr>
<td>Attd. Others</td>
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<td>50.96</td>
<td>61.11</td>
<td>11.17</td>
<td>-1.30</td>
<td>17</td>
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## Table 8
Position Effect

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<thead>
<tr>
<th>Position</th>
<th>( \bar{x}_1 )</th>
<th>( \bar{x}_0 )</th>
<th>( \bar{x}_1 )</th>
<th>( \bar{x}_0 )</th>
<th>( \bar{x}_1 - \bar{x}_0 )</th>
<th>( \bar{x}_0 - \bar{x}_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to E2</td>
<td>61.20</td>
<td>101</td>
<td>50.15</td>
<td>-0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>64.79</td>
<td>52</td>
<td>55.46</td>
<td>-0.63</td>
<td></td>
<td></td>
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<tr>
<td>Difference</td>
<td>3.59</td>
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## Table 9
Qualification Effect

<table>
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<tr>
<th>Position</th>
<th>( \bar{x}_1 )</th>
<th>( \bar{x}_0 )</th>
<th>( \bar{x}_1 )</th>
<th>( \bar{x}_0 )</th>
<th>( \bar{x}_1 - \bar{x}_0 )</th>
<th>( \bar{x}_0 - \bar{x}_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to Diploma or Bsc/B.com</td>
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<td>47.92</td>
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<td></td>
<td></td>
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<td>87</td>
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<td></td>
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Table 10

Training Effect

<table>
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Table 11

Interaction Effects

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<th>Exp. (Years)</th>
<th>Qualification</th>
<th>Earlier training</th>
<th>n</th>
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<th>( x_1 )</th>
<th>( (x_0 - \bar{x}_0) )</th>
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<tr>
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<td>≤15</td>
<td>Diploma or less</td>
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</tr>
<tr>
<td>2</td>
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<td>≤15</td>
<td>-do-</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>≤E2</td>
<td>≤15</td>
<td>B.sc &amp; Above</td>
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<td>63.5</td>
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<td>-1.44</td>
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<tr>
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<td>≤15</td>
<td>-do-</td>
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<td>70.7</td>
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<td>≥16</td>
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<td>57.1</td>
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<td>≥16</td>
<td>-do-</td>
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<td>≥16</td>
<td>B.sc &amp; Above</td>
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<td>-do-</td>
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<td>-2.53</td>
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<td>9</td>
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<td>≤15</td>
<td>Diploma or less</td>
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<td>60.5</td>
<td>59.0</td>
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<td>≤15</td>
<td>-do-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>11</td>
<td>≥E3</td>
<td>≤15</td>
<td>B.sc &amp; Above</td>
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<td>70.0</td>
<td>61.5</td>
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<td>≤15</td>
<td>-do-</td>
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<td>70.1</td>
<td>61.5</td>
<td>0.53</td>
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<tr>
<td>13</td>
<td>≥E3</td>
<td>≥16</td>
<td>Diploma or less</td>
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<td>12</td>
<td>63.2</td>
<td>52.1</td>
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<td>≥16</td>
<td>-do-</td>
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<td>70.0</td>
<td>65.0</td>
<td>1.91</td>
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<td>≥E3</td>
<td>≥16</td>
<td>B.sc &amp; Above</td>
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<td>61.5</td>
<td>50.6</td>
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<td>≥16</td>
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Table 12

Stayput Analysis

<table>
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<td>B type</td>
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<tr>
<td></td>
<td></td>
<td>No %</td>
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<tr>
<td>Design, Produ.</td>
<td>83</td>
<td>2</td>
</tr>
<tr>
<td>Quality,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Matls., Mgmt. &amp; Others</td>
<td>63</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
<td>6</td>
</tr>
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</table>
10.7 IMPORTANT ISSUES FOR ASSURING QUALITY OF SERVICES BY BANKING SECTORS

Unlike the present day a fraud in a bank was a guarded secret until banks came to be seen as public institutions of socio-economic development. The compulsion of secrecy was borne out of the urge to be discreet in matters of customers’ confidence in the institution. As guardians of customers’ money and precious materials deposits, banks had to retain an image of invincibility. At the same time they were obliged to be cautious and correct in their transactions and maintenance of accounts. The banks belonged mainly to the private sector and catered to customers of their choice.

The orientation of Indian banks as organic engines of socio-economic transformation in the length and breadth of the country opened the gates of banks to the populous mass of the discriminated and the poor. To ensure that the gates remained open to the common man, various business targets were imposed. Thus, the conservative banking industry became endowed with public functions and it came under critical scrutiny of the people and institutions of India.

In the service sector performance parameters are immeasurable by nature. Added to this is the difficulty of selecting the right performance parameter. Thus, there is the problem of choosing a viewpoint in the first place and then to determine or develop a measure which becomes the parameter for judgment of performance.

The Indian banking industry can stand proudly to acclaim its achievement in reaching the masses with security vaults for deposits, inter-regions transfer of funds facilities and provision of loans and related facilities to the needy and the enterprising. Come to the question of quality of services and the industry finds itself in a weaker spot. It is this aspect—quality of banking services—that is the focus of this paper. To sharpen the focus the services held in view are those that relate to deposits accounts, though the arguments would be relevant to loan accounts as well.

Very soon after the first nationalization of banks in 1969 deterioration in the quality of services started to be felt. As time progressed it became a veritable concern. Nationalization drove banks into an era of colossal change. Banks which had operated in towns and cities lost their choice of domain. At the same time they were saddled with the responsibility of discharging many new functions. Functioning within bounds of controlled variety and located in prosperous areas, banks found themselves in the throes of pressures to expand under the governing concept of social and economic betterment of the Indian masses. The industry has been surviving in turbulent climate generated by the unceasing thrust of multi-dimensional expansion. While in the midst of this turbulence the industry met with public criticism of its services and has been making efforts to improve its quality of services to customers. And, even though there is dissatisfaction among customers every bank is well aware that to keep its position in comparison with other banks it has customer service as its only trump.
The efforts that have been made have not been confined to individual banks. The banks have made, and are making, joint efforts as well. There are two clearly discernible strands along which the bulk of efforts have revolved. One, analytical studies using Organization & Methods (O&M) techniques later O&M merged into the wider concept of management science. Two, the use of modern technology.

O&M studies have made an impact on workflow in banks, staffing pattern, and innovative practices. In totality they have made a difference in upgrading quality of service. The main approach in this thrust area has been to identify delicacy of work, delay causing practices and inappropriate allocation of work amongst the staff. Lately, for the benefit of customers boards have been put up in banks. On one of the boards norms of time for each transaction are displayed. On another board the procedure for making complaints is exhibited. Customer service committees have been formed in most of the bank offices. And the formation of quality circles for improved functioning is being encouraged.

On technology front a customer finds little that convinces, and justifiably. In comparison with banks of technologically advanced countries an Indian bank presents a lack luster show. But technology has been very successfully used in what is known as the clearing system. Although it is the Reserve Bank of India that deserves kudos for designing and implementing the system it is the customer of a commercial bank who derives the benefit through his bank.

For a decade the Indian banking industry, under the guidance and leadership of Reserve Bank of India, has made efforts to use information technology to solve many of its problems and to serve the customer well. There is no meaningful impact felt as yet. However the use of information technology is seen as the answer to good customer service and it is the main thrust area today around which efforts are being made. In the recent few years banks were advised to use personal computers for deposits accounts in which account holders are too many or in which the number of transactions is very large. Now, there is a shift towards the use of mini-computers in local area networks and computerization of all operations. This exercises in the beginning stages of a pilot project. Presently two important issues arise.

Firstly, what is our concept of service, or rather our view of what it should be. Generally complaints of service pivot around the factors of time and accuracy. But these two factors are far too few in an amplified view. Should we not see service as 'total help' clothed in a garb of politeness. If we consider time and accuracy only then our quality assurance is easily attainable given the help of computers. But the 'total help' concept raises the issue to the metaphysical, taking us into the fields of human psychology, transactional analysis, management sciences and others. For the present we may choose a small number of important factors, namely timeliness, accuracy, sufficiency of information, adequacy of facility, and courtesy.

Secondly, we have to ask why efforts to adopt information technology met with only marginal success in the past. The Reserve Bank of India has provided targets to banks. Personal computers were provided to select offices. Training of staff was arranged. Software writers were engaged. But the manual ledgers still remained denying entry to the computer.
The aim of computerizing at least the most active accounts in a select number of banks did not materialize.

It is from the history given above that the author derives arguments to understand the currents of movement that took the industry away from the goal of excellence in customer service and having seen the movements to set the approach for courses of correction.

Upon nationalization banks were made to tread on unknown grounds under compulsion of meeting social banking targets. Facing targets and competition banks expanded their network of branches (called banks in this paper) continuously. Personnel strength increased by hundreds each year. Come calamities and banks had to rush loans to the effected. In the midst of all this banks were engrossed in devising systems and procedures to cope with the pressures. Little by little they were losing their commercial character and acumen and it the customer who got neglected. Customer today is a cause and not the man banks do business with. Paradoxically it is the cause today that pales before the unceasing complaints of poor service by the very beneficiaries of social banking. Poor customer service is not only a customer’s difficulty it is also a disturbing reflection of the state of affairs within the bank. It is time that commercial banks functions were clearly defined and their commerciality restored to a larger part.

Timeliness, accuracy, sufficiency of information, adequacy of facility and courtesy. For a customer a timely transaction without a mistake is important. For his satisfaction it is also important that he be told about his account’s position periodically, clearly specifying the interest paid to him Of charges levied if any, In the absence of sufficient information a customer has to take the trouble of gathering the information himself, which may make him go from one counter or section to another. To a customer a bank is a place for safe money-keeping and different kinds of monetary facilities. He may choose a particular denomination for payment or he may fuss about the adequacy of the receipt given to him for deposits made by him, It is in the interest of banks to provide for these. Not attending to a customer, or showing indifference, or being rude is merely driving a customer away - an act harmful to commercial practice.

The declared purpose of nationalized Indian Banks is commerce, tempered with humanitarian considerations But unlike a commercial house the system of management is predominantly bureaucratic leading to a mechanistic way of functioning - a mode of functioning discredited by modernized business houses. The nationalized Indian bank is an open system and for it to interact effectively with its environment it needs a structure that promotes organism forms of functioning. For a commercial bank the testing ground is its counters for service to customers. It is from the counters that impulses must travel within the banking organization And in a bureaucracy the flow of advice is from a position of higher authority to a position of lower authority.

Banks have pitched faith in Information Technology to help them in realizing the ideals of assured quality in its services to customers. But their experiences with computers have fallen short of expectations. What was essentially being done was to pole vault a conservative industry to a stage of high technology of the modern day The change was of such an enormity that it aroused deep fears and anxieties in employees Communication is essential to allay fears and anxieties. The form of organizational structure established in
banks is such that it inhabited communication. Thus the resistance by employees of banks to change was stronger than the glitter or promise of technology.

Efforts until now have been largely bereft of the techniques of managing change. It ought to have been realized by banks that they were not changing only a technology system. They were trying to replace a fully-operational, tried, tested and trusted socio-technical system. The unknown is a cause of fear and anxiety and so the unknown socio-technical system was resisted.

To succeed with the import and use of information technology open communication is essential. And the problem of employee resistance needs to tackled by banks at least at three levels. At the level of the individual; at the level of social groups and at the corporate level. Mere training of employees on computers is not enough.

10.8 TQM IN DESIGN INSTITUTES

Abstract:
Recent developments in design education and advancement in several technologies demands excellence and wonders! There is change in Design & Technical education, due to globalization and communication era. A great deal of strategic planning, laying down of appropriate bench marks and goals are essential. Implementation of TQM techniques with transparencies in administration, admission process ensuring proper matrices, continuous and close monitoring at all levels, will definitely lead to the expected results. To discuss implementation of TQM in design institutes elaborately injecting it, to all levels, with assurance of desired results, bridging the gap between expectations and outcome. TQM in design/fashion education can be achieved by:

- Benchmarking in curriculum aspects, staff performance.
- Healthy practices and academic environment
- Other than curriculum assignments as social commitment
- Introducing self discipline in all elements
- Participation of Industry personnel for sharing hands on experience
- Periodic restructuring of syllabi for needs of industries
- Providing the best infrastructure facilities
- Transparency in administration, coordination and teamwork
- Monitoring of students through faculty Guardian scheme
- Incentive provisions for best performers
- Injecting awareness and accountability at all levels
- Interdisciplinary active R & D/ consultancy cell
- Participative management of all concerned

INTRODUCTION
Total quality management in Design Education, is ensuring quality in imparting education to students, through the highly experienced and trained faculty, with great concern to satisfaction of state holders, producing engineers to accept millennium challenges. The quality of students passed out also needs to be accepted globally by industries. A user based support, can be evolved, which can suite the growing needs of the line community and quickly deploy advanced information technologies. The quality infrastructure availability
with unlimited free/open access must be provided to students without any blockage/reservations. The process must penetrate deeper to students, alumni, parents, faculties, society. This can achieve goals like public image elevation attracting meritorious students and faculty, Effective teaching learning process Increasing levels of funding from industry and R & D agencies, involvement of industry personnel in imparting design education; emphasis on practical skills. The recent developments like video conferencing will replace thousands of lectures, traveling laths of kilometers by students/ faculties; there by save fuels in tones, Global wealth; reduce pollution and lot of man hours. It provides knowledge based education.

MEASURES FOR STUDENTS:
As the title suggest Total quality needs to be inculcated in design institutes right from admission to results; at every stage and by all involved. The mind set up to that effect to be changed of students. Staff both teaching and non teaching, even attendants/peons by proper brain storming. If there is no voluntary participation in this process by all elements at all levels, its effect will not be complete During admission process, all the seats, in centralized process, Institutional level and in vacancy rounds should be strictly filled by meritorious students. Resident institutes/colleges, are proved it to be the best option for students overall growth of student. Strict implementation of academics schedules, need to be followed by faculties and ensured by HOD/Principals; with 100% attendance of students in all lectures and practicals. The lectures must be made more and more interesting by using latest teaching aids/tools such as Power Point presentation/video conferencing/Question answer sessions. Proper dialogue needs to be established with students. The senior and experienced faculty may be assigned for difficult subjects like History of Design/Element of Design/Fashion Management/Apparel Technology etc. in which concepts and the fundamentals needs to be cleared. A proper feedback system, may be devised, to ensure effective and quality Teaching Learning process. The center coordinator, should monitor proper progress of syllabus of all the subjects, so that the balance study is feasible for the students. Also the multidimensional development of students be ensured encouraging them to participate in sports; co-curriculum and extracurricular activities by extending the proper guidance from skilled faculties available. Specific programs based on local needs be arranged by the students to meet with other than syllabus/curricula requirements such as Cluster visits/Computer Awareness programmes etc. The center coordinators should develop proper exchange of guidance, from clever students to below average students, as a moral responsibility. The guidance must be extended to the students for exchange of their soft skills, communication skills, and interrelationship among the group, group discussion capabilities, and administrative skills to get better placements in good companies carving their career A Post Gradate cell must be formed with all information of higher studies in India and abroad with ranking of Universities available in this cell, preferably in the third year of programme. An alumni must be formed, which will establish a good bond between the Institute and students and also dialogue between present and past students with better knowledge of Dos and Don'ts this will appeal every year to maintain rapport with past students, facilitate placement of our students, in the companies with proved performance of our past students, who are present manager/Recruiters. It is a proved fact that alumni had contributed a lot in development of the renowned institutes like IITS NITS & IIMS. Proper placement records be maintained, indicating no of students placed with percentage, list of companies, packages offered, track record of passed out etc. The students should be
encouraged to participate in paper presentation competition, Quiz Contents etc. in other institutes/colleges.

**MEASURES FOR FACULTY/STAFF:**
A best faculty is one, who creates interest of one's subject in students mind initiating proper thinking process sequentially. The involvement of students must fully be ensured, during conduct of practicals by individual attention and random data generation so that calculations are done individually by all the students, which enables them, perform well during Central/University examination in practicals and orals. The faculty must be capable by giving them all facilities as per university/State Directorate norms such as scales, allowances. All types of leave vacations, proper deputation to seminars/Conferences at all levels be ensured, keeping abreast of latest developments. Even some additional facilities, such as medical assistance; Holiday/Travel assistance, Remote place allowance etc, may be given to ensure retention of best faculty. A routine practice of developing a small presentation before all faculty by the deputed faculty member be uncalculated, so as to make others also aware about the recent developments. For maintaining academic healthy environment, in institute, the staff seminar scheme be implemented, so as to evaluate the positives and negatives of individual, to get the feedback in time for the corrective action by the individual based on this assessment; Students feedback, self appraisal and review by the Principal/Director, Expert team etc. The best performer must be awarded in the form of cash prize/Member of professional body and appreciate certificate. The weightage be given to publication of books, presentation of papers in International/National Conferences/Journals. Conducting Seminars/Conference in the Department/Institute. Delivery of keynote address/Invited lectures in other colleges/Chairing sessions, in seminars and conferences etc. An inter disciplinary R & D cell be formed so as to take up the collaborative, research from industries and R & D agencies to suit their needs and cater social projects and requirements. This will enhance the confidence among the junior faculty members and students under expertise of Senior and experienced faculty. Revision of syllabi should be periodically done by involvement industrial personnel to cater their needs, without any personnel interests, egos, blocks by removing obsolete portion and adding recent developments. Updating of write ups be ensured periodically/yearly for all subjects. The research/consultancy projects undertaken by the faculty. Grant obtained for this purpose, utilization of grants; completion of the projects in schedule time be taken into consideration. Extra efforts taken by the faculty for below average and above average students. Efforts taken by the individual for establishing interaction with industries; singing of M O.U's/agreements programs per year. Periodic test/prelims conducted with results declared in time mock examinations be ensured. Autonomy in deciding and implementing better practices be given to the departments Co-operation, co-ordination, involvement and team efforts of every one concerned be ensured. Willingness of superiors, in specific well defined objectives, indication for effective implementation by follower group will assure Total Quality in the Teaching Learning process; which is back bone of TQM.

**MEASURES FOR OFFICE STAFF/ADMINISTRATION:**
A proper procedure, job specifications with clear cut duties defined, standardization of procedures with least movements and lead times is need to be set in the office. Positive attitude and proper motivation and involvement of all elements in the system are of most important
Starving for excellence to achieve the quality at Individual/Departmental/Institutes level must be ensured. Appropriate Goals/Bench marks should be set, which must be revised periodically. It should be ensured that the goals are attained with zero defects/deviations.

Periodic progress reports; be taken to ensure corrective actions in time. Each element in the system like teaching staff, non teaching and office, labs, Department, Institutes be given Score/points on the basis of their performance, communicated them yearly, transparently, so as to ensure scope of improvement. Injecting self discipline/Self quality and its maintenance be ensured, in place of imposed discipline /quality standards. Proper Appreciation, motivation, recognition of higher performance /scores be ensured with Clear-cut instructions to lower performers/scorers. The accountability with ranked performance will definitely fetch the expected results.

CONCLUSION:
Application of TQM will results in:

1) Meeting the expectations of stake holders. Students/Parents/Industries and authorities-University etc/Society/nation/world.
2) Continuous improvisation in imparting quality education, with timely corrective measures.
3) Efficient and effective Teaching Learning process
4) Consistency in improved performance with inbuilt higher Reliability
5) Refined and tuned monitoring at all stages ensuring expected levels of quality results; bridging the gap between expectations and outcome.
6) Achieving the targets through strategic, stepped periodic approach and synchronization
7) Best team efforts, without reservations of all concerned and proper motivation/ co-ordination
8) Reward sharing and optimum use of Global Recourses.
9) Education available at reduced cost for tailor made courses in large numbers.
10) Integrated quality to attain higher levels of performance.
11) Establishing a bond between Alumni, College and present students.