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デミング賞大賞 受賞報告講演要旨

Rane Brake Lining Limited

Deming Grand Prize - 2013

Rane Brake Lining Ltd

Description of TQM practices

CONTENTS

Mission & Value

- ✦ Provide superior products and services to our customers and maintain market leadership.
- ✦ Evolve as an institution that serves the best interests of all stakeholders.
- ✦ Pursue excellence through total quality management.
- ✦ Ensure the highest standards of ethics and integrity in all our actions.

Rane Brake Lining Limited

Vision

To be a global supplier of choice in friction material industry through technological innovation and total quality.

1. Company Profile

1.1 Rane Group profile

The Rane group was established in 1929, comprising of seven companies with twenty five plants dedicated to automobile component manufacturing. It symbolizes the successful integration of global quality with indigenous expertise. It employs over 5200 highly trained personnel and has an annual sales turnover (2012-13) of about INR 29230 Million (~ US $ 538 million).

Rane group manufactures a comprehensive range of automobile components like hydraulic power steering systems, manual steering & suspension systems, valve train components, friction material products, steering columns & electric power steering, seat belt systems and die casting products. The product-wise sales contribution by group companies in the year 2012-13 is shown in Figure-1 below.

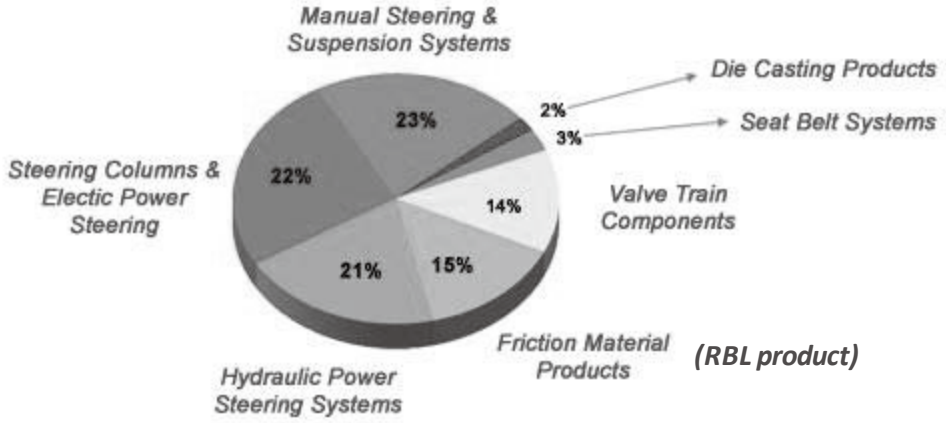


Figure 1 – Sales contribution by product line

It is the leading OE supplier of various auto components. The group exports to 31 countries around the world. RBL won the coveted Deming Application Prize in 2003 – first among the Rane group companies, followed by three more group companies. Three of the group companies have won the Deming Grand Prize.

1.2 Rane Brake Lining Limited (RBL) business

RBL was established in 1964 and has achieved the distinction of being domestic leader among friction material manufacturers. RBL manufactures friction material products like brake linings, disc pads, clutch facings, clutch buttons for automotive applications and composite brake blocks for Railways.

It supplies friction products for all surface transport applications from motorcycles to trains. RBL had an annual sales turnover of INR 3750 Million in 2012 - 2013. Figure-2 shows the sales turnover of RBL over the years.

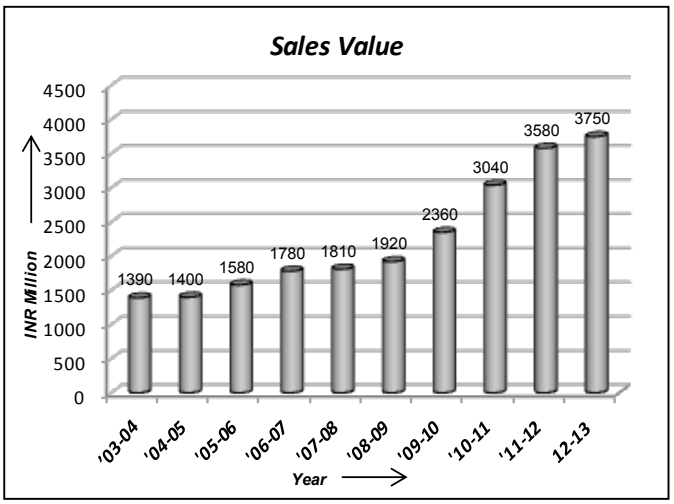


Figure 2 – RBL Sales turnover

1.3 Infrastructure

RBL has four plants located in the major Indian cities of Chennai, Hyderabad, Puducherry and Trichy. These were established in 1964, 1991, 1997 and 2008 respectively. RBL is equipped with state-of-the-art facilities and has employee strength of 896 trained personnel.

RBL is having collaboration with Nisshinbo Industries Inc., Japan and this helps RBL in bringing out truly world-class products for our customers. R&D is given high priority and it is equipped with latest testing facilities. R&D centre is approved by Department of Science & Technology, Government of India.

All four plants are equipped with production facilities to manufacture different types of products.

9 depots are situated across the country with concentration on south, north and west in India to cater to aftermarket requirements. RBL locations on the India map are shown in Figure-3.

Figure 3 – RBL depot location

1.4 Product and Vehicle Segment coverage

RBL manufactures Brake Linings, Disc Pads, Clutch Facings, Composite Brake Blocks and Clutch Buttons. Following Figure-4 illustrates RBL products.

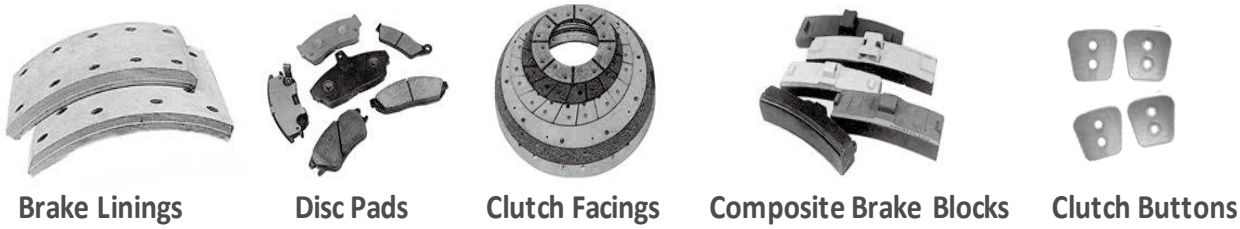


Figure 4 – RBL products

RBL products are used in brake system between wheel and brake shoe to decelerate & stop the vehicle and in clutch system between flywheel and clutch plate to transmit rotary motion.

The products are supplied in Asbestos (A) and Asbestos Free (AF) grades to OEMs through brake assembly manufacturers (Tier-1), aftermarkets and export markets. The location of brake system in an automobile is as shown in Figure-5.

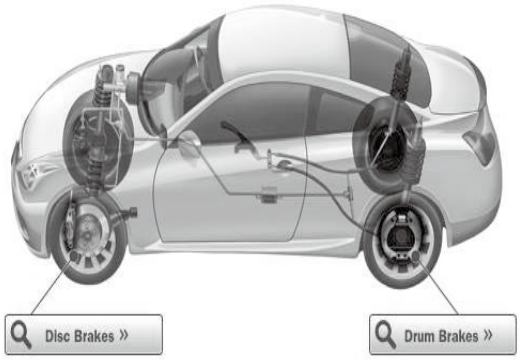


Figure 5 – Location of Brake System

The following Figure-6 further illustrates where RBL products are fitted in the Brake system.

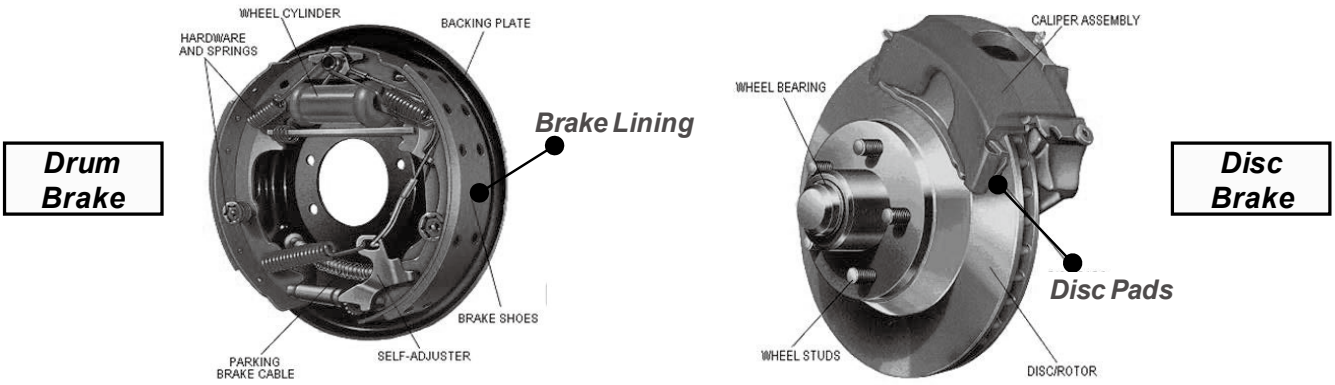


Figure 6 – RBL products fitted in Brake system

1.5 Customers and Competitors

Customers

RBL supplies friction material to all leading OEMs in India through brake / clutch assembly manufacturers, aftermarket, export market for Heavy Commercial Vehicle (HCV), Light Commercial Vehicle (LCV), Utility Vehicle (UV), Passenger Car (PC), Two Wheelers (2W), Tractor segments and Indian Railways and the major customers of RBL are shown in Table-1.

OE segment:

Brake Assembly Manufacturers (Tier-1)	Vehicle OEMs	Railways
• *Amalgamations Repco Ltd,* • *Automotive Axles Ltd,* • *Brakes India Ltd,* • *Brembo Brake India Private Ltd,* • *Endurance Technologies Private Ltd,* • *Exedy India Ltd,* • *Foundation Brake Manufacturing Ltd (Formerly Robert Bosch Chassis Ltd),* • *Luk India Private Ltd,* • *Mando India Ltd,*	• *Ashok Leyland Ltd,* • *Asia Motor Works Ltd,* • *Bajaj Auto Ltd,* • *Caterpillar India Private Ltd,* • *Force Motors Ltd,* • *Ford India Ltd,* • *General Motors,* • *Honda Siel Cars India Ltd,* • *Hyundai Motor India Ltd,* • *Mahindra & Mahindra Ltd,* • *Mahindra Navi Star Automobiles Ltd,* • *Maruti Suzuki India Ltd,* • *Nissan Motors India Private Ltd,* • *Renault Nissan Automotive Private Ltd,* • *Royal Enfield Motors Ltd,* • *Tata Motors Ltd,* • *Tractors and Farm Equipment Ltd,* • *Toyota Kirloskar Motor Private Ltd,* • *Ve Commercial Vehicles Ltd,* • *Volkswagen* • *Yamaha Motor Private Ltd*	• *Delhi Metro Rail Corporation Ltd,* • *Indian Railways,* • *Malaysian Railways,* • *Sri Lankan Railways*

Table 1 – Major Customers of RBL

Aftermarket segment: There are more than 10,000 dealers serviced by 7 Whole Sale Distributors (WSD) across the country. RBL has 9 depots spread across the country with location choice specific to business density for servicing the market requirements.

Export segment: RBL exports to Australia, Sri Lanka, Bangladesh, United Kingdom and Middle East countries for independent aftermarket products.

Competitors

India is becoming a preferred destination for many global automobile manufacturer to set up their manufacturing facilities. RBL is facing stiff competition in OEM business from both local players and global competitors. Entry of global auto majors is likely to encourage entry of new global competitors for RBL.

In aftermarket, which is highly fragmented, RBL faces stiff competition from large number of organized and un-organized players.

In the Railway segment RBL shares its position with more than ten competitors.

1.6 Manufacturing Process

The manufacturing process followed at RBL is as per the flow chart (Figure-7) shown below.

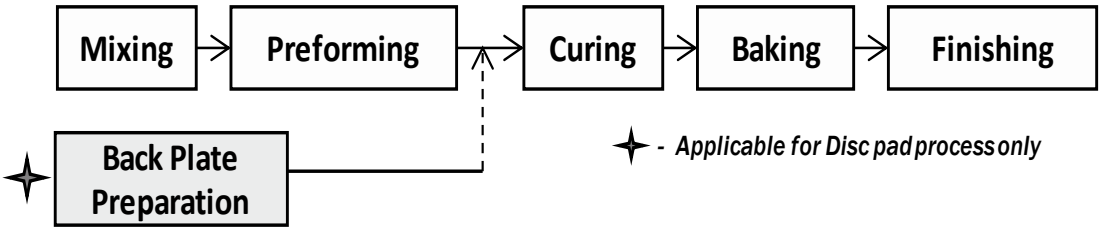


Figure 7 – Manufacturing Process followed at RBL

1.7 Management System Certification

All the manufacturing plants of RBL are certified by TUV Nord, Germany for the following management systems:

- ISO 9001:2008 – Quality Management System,
- ISO/TS 16949:2009 - International Automotive Quality System,
- ISO 14001:2004 : Environmental Management System,
- BS OHSAS 18001:2007 - Occupational Health & Safety Management System.

2. Organization Structure and Management

2.1 Organization of RBL

Rane Brake Lining Limited (RBL) is headed by the President who reports to the Chairman and the Board of Directors. The organization structure comprises of Corporate functions and plants. The corporate functions and plants are shown in the following organization chart (Figure-8).

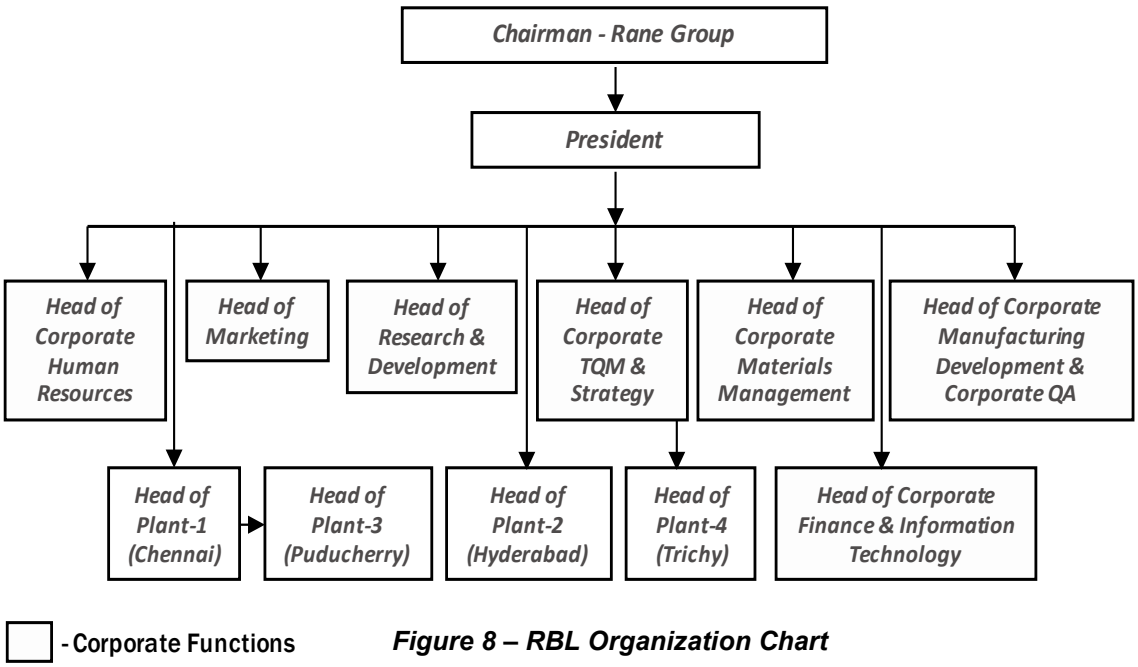


Figure 8 – RBL Organization Chart

Each corporate function is headed by a senior executive called 'Functional Head' and each plant is headed by a senior executive called 'Plant Head'. The plant functions are shown as below are headed by managers called 'Section heads'.

- Manufacturing Modules,
- Plant Quality Assurance,
- Plant Manufacturing Development,
- Plant Engineering,
- Plant Human Resource,
- Plant Commercial (except Plant-1),
- Plant Finance & Information Technology

RBL employs 896 manpower and the break-up of manpower is as shown in Table-2;

Function	Managers & Above	Engineers / Officers	Operators	Total
Corporate Functions	59	45	0	104
Plant-1 (Chennai)	15	30	138	183
Plant-2 (Hyderabad)	21	30	216	267
Plant-3 (Puducherry)	12	24	61	97
Plant-4 (Trichy)	13	25	207	245
Total	120	154	622	896

Table 2 – Break-up of Manpower

2.2 Communication meetings

In the following communication meetings, relevant information is communicated and shared to all the employees (in a fixed frequency) and queries of all nature are clarified.

- **Strategic Business Plan meeting** – President chairs the meeting annually with management staffs to share marketing forecast, competitive environment, future challenges & opportunities, next 3 years plan and promote involvement
- **TQM meeting –** Plant Head addresses all employees on monthly basis to communicate previous month plant's performance covering PQCDSM, current month plan, market condition, major activities, special events and distribute awards of TEI activities like QCC, suggestion, kaizen and 5S.
- **Employees Union Office Bearers meeting -** Plant Head meets the Union office bearers along with HR personnel every month to address employee related concerns / issues / grievances.

2.3 Reviews

Reviews are being carried out at scheduled intervals to measure the effectiveness of business processes and target achievements. The following Table-3 shows in brief the structured reviews at RBL.

	Title / Subject	Purpose	Reviewed by	Frequency
BUSINESS	• Strategic Business Plan Review	• To set long term business targets	Chairman	Annual
	• Strategic Review Forum	• Sharing best practices	Chairman	Annual
	• Annual Operating Plan	• To set annual business plan targets	Chairman	Annual
	• President's Diagnosis	• To review overall annual performance, identify the root cause for the gap and remaining issues	President	Annual
	• Quarterly Business Review	• To review business performance and guidance through experience from other companies	Chairman	Quarterly
	• Monthly Business Review	• To review performance and suggest area for improvements	President	Monthly
	• Design Review	• NPD status review	President	Monthly
	• Section Review	• To review managing points and DRM items of all section heads	Functional / Plant Heads	Monthly
QUALITY	• Quality Review	• To review quality performance	President	Monthly
	• Quality Review	• To review performance and identify the areas for improvements	Plant Heads	Monthly
DELIVERY	• Monthly Sales Review	• To review performance of all market segments	President	Monthly
	• Monthly Schedule Meeting	• To review previous month schedule adherence. • Current month schedule and resource planning	Head Marketing	Monthly
	• Weekly Production Review	• To review performance plan vs actual and suggest area for improvements / countermeasures	Plant Heads	Weekly
COST	• Strategic Sourcing Review	• To review cost reduction plan vs actual and suggest improvements	President	Monthly
SAFETY	• Safety Committee Review	• To address safety issues / improvements and preventive measures	Safety Committee (Including Operators)	Monthly

Table 3 – Reviews

2.4 Audits

Structured audits are being carried out by top management, external/internal auditors and customers to assess the adherence level and to identify the areas for improvement at pre-determined frequencies. The various audits conducted at RBL are given below (Table-4).

Audit	Purpose	Auditor	Auditee	Frequency
INTERNAL				
Apex Council Audit	• Assess effectiveness of TQM practices in every Rane company	Apex Council members	All Functions/ Sections	As per plan
TQM Audit	• Assess the level of implementation of TQM practices in RBL	RBL Corporate TQM	All Functions & All Plants	Monthly
Process Audit	• To ensure process conformance	QA Engineers	All Manufacturing modules	As per plan
Product Audit	• To ensure product conformance	QA Engineers	All Manufacturing modules	As per plan
System audit	• To ensure compliance	Internal Auditors	All Functions/ Sections	As per plan
Supplier audit	• To ensure suppliers' adherence to RBL requirements	CMMD, Plant QA	Suppliers	As per plan and on Issues
EXTERNAL				
QMS, EMS & OHSAS Audit	• To ensure compliance to the Standard requirements	TUV Nord, Internal	All Functions/ Sections	As per plan
Customer Audit	• Adherence to the system to meet their requirements	Customer representative	QA, Plants	As per Customer plan
Financial Audit	• To ensure conformance to Financial accounting system	Internal Auditors / Statutory Auditors	All Functions/ Sections	As per plan

Table 4 – Audits

3. TQM Promotion

3.1 TQM Organization

The TQM organization at Rane has three tiers consisting of the TQM apex council at the Rane group level, RBL TQM steering committee at RBL company level, RBL TQM steering committees at the individual plant level / office level.

TQM Apex Council: The TQM apex council is the governing body formed at the Rane group level. The Apex council comprises of Chairman (Rane group), Chairman (Rane Holdings Limited), Managing Director (Rane TRW Steering Systems Limited), Presidents and TQ Coordinators of group companies and group TQM coordinator. The responsibilities of the TQM apex council are - To evolve overall policies and guidelines for group companies on TQM and assess TQM implementation status at various locations

This body meets every month to review the progress of TQM initiatives in one of the plants of the different group companies. This ensures top management commitment in promoting and guiding the companies in implementing the TQM initiatives.

RBL TQM Steering Committee: This company level committee comprises of President, Corporate TQM Head, all Functional Heads and Plant Heads. The responsibility of company level TQM steering committee is to promote TQM knowledge and motivate the people for implementation of TQM activities. It meets monthly to review the progress. The structure is elaborated in following TQM organization structure chart (Figure-9).

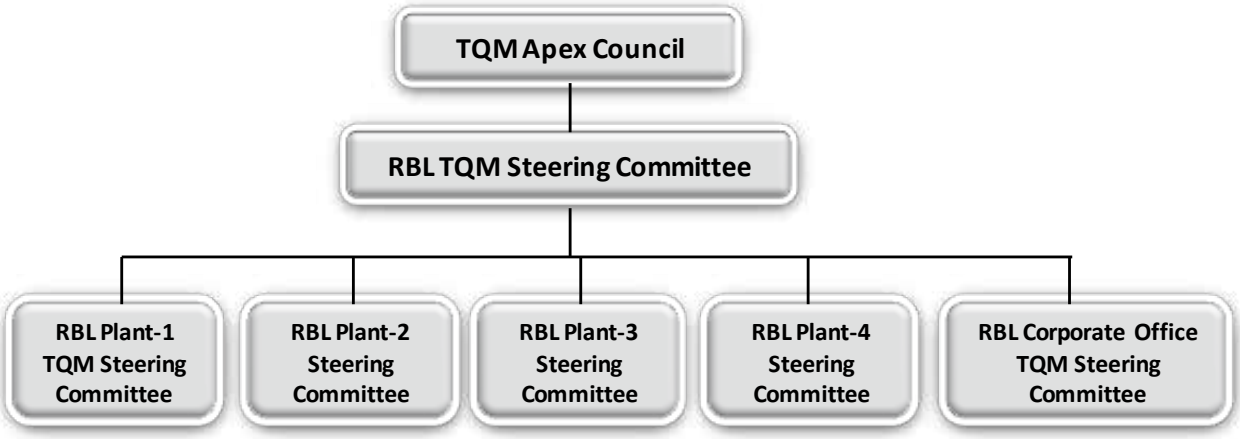


Figure 9 – TQM Organization Structure

RBL Plant / Functions TQM Steering Committee: This committee comprises of respective Plant Head / Functional Head and all their Section Heads. The TQM steering committee focuses on implementation of TQM activities and completes the improvement points suggested by APEX council & Corporate TQM. It meets monthly to review the progress of TQM implementation and extends necessary support as required.

Every plant has a Plant TQM Co-ordinator. Besides, there are representatives in each department who facilitate TQM implementation in that department. They are trained in TQM principles and practices. They play a key role in educating their team members to enable practice of TQM.

RBL TQM Promotion office: This is a corporate function in RBL headed by Head of Corporate TQM & Strategy and includes coordinators who work in the respective plants and functions. The promotion office provide support, guidance and ensure TQM practices in all functional areas.

RBL TQM Model: To continuously promote TQM practices and the TQM way of working. RBL developed a TQM model in the post Deming period as shown in the Figure-10. This model illustrates the various elements and objectives of TQM. This model will help in proper understanding and alignment of TQM practices across the organisation.

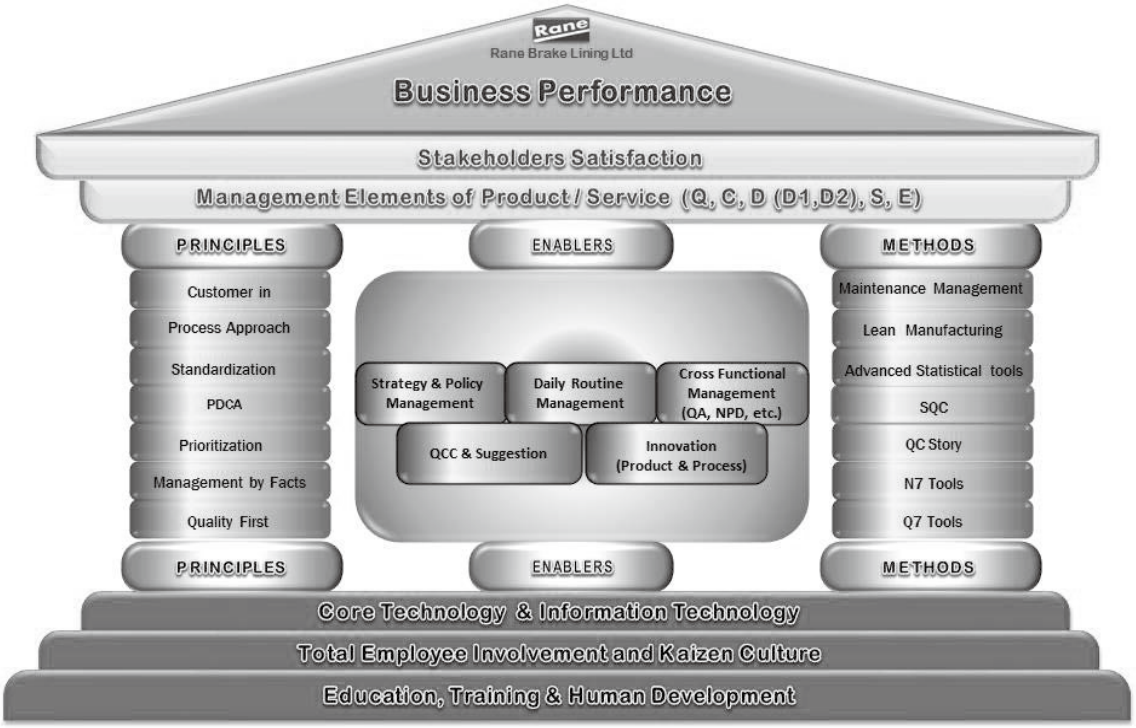


Figure 10 – RBL TQM Model

3.2 TQM Activities

RBL identified Strategy & Policy Management, Daily Routine Management, Cross Functional Management (QA, NPD, etc.,), Quality Control Circles (QCC) and Suggestions and Innovation (Product, Process) as enablers (refer Figure-10) and critical for TQM promotion and achieve its objectives / goals.

3.3 TQM promotional forums

TQM communication meetings: The TQM meeting at fixed intervals headed by Plant head serves to communicate to all employees about the previous month performance, current month plan, market condition, major activities, special events and to distribute awards of TEI activities like QCC, suggestion, kaizen and 5S.

TQM reviews: The monthly business review (MBR) as indicated in Table-3 headed by President, ensures all plants & functions adopt TQM practices and sustain improvements.

Post Deming, CFTs were formed across the plants for improvement in Quality, Engineering and HR functions. The corporate functions meet every month along with the plant persons to take actions, wherever improvements are required in their appropriate areas. In addition to the above CFT reviews, monthly interplant reviews are also being conducted for Yield Improvement and Energy Saving Projects. Energy saving projects are carried out by benchmarking from Rane group, other company visits, seminars etc., The activities are horizontally deployed across the plants to improve the yield and energy efficiency. The year-end diagnosis by President reveals the overall annual performance, root cause for the gap and remaining issues.

TQM audits: Post Deming, TQM audit (Table-4) is planned and audited by Corporate TQM promotion office on monthly basis. This audit ensures to assess the level of implementation of TQM practices across RBL and to identify the gaps and initiate actions. The scores of all plants and functions are shared in MBR which helps the senior management team to improve the areas based on audit finding. This process helped in better practice of TQM, which was evidenced during the Apex council audit, where RBL score is top amongst the Rane group.

4. Strategic planning and Policy management

4.1 Background

Prior to Deming, RBL enjoyed good relationship with Tier-1 customers and aftermarket customers with its customer oriented strategies and product supremacy in asbestos.

Entry of global OEMs in India like Toyota, Honda, Nissan, General Motors, Ford, Hyundai, Volvo etc., and their localization for friction material products, brought huge growth opportunities, at the same time paved the way for entry of more global players in friction material industry.

Post Deming, RBL had faced many crisis which includes loss of business to competition in Heavy Commercial Vehicle (HCV) lining and industrial relation issues in Chennai plant, which necessitated strengthening of strategic planning and policy management which includes Vision, Strategic Business Planning process, DRM etc.,. RBL policy management system flow chart is as given below (Figure-11).

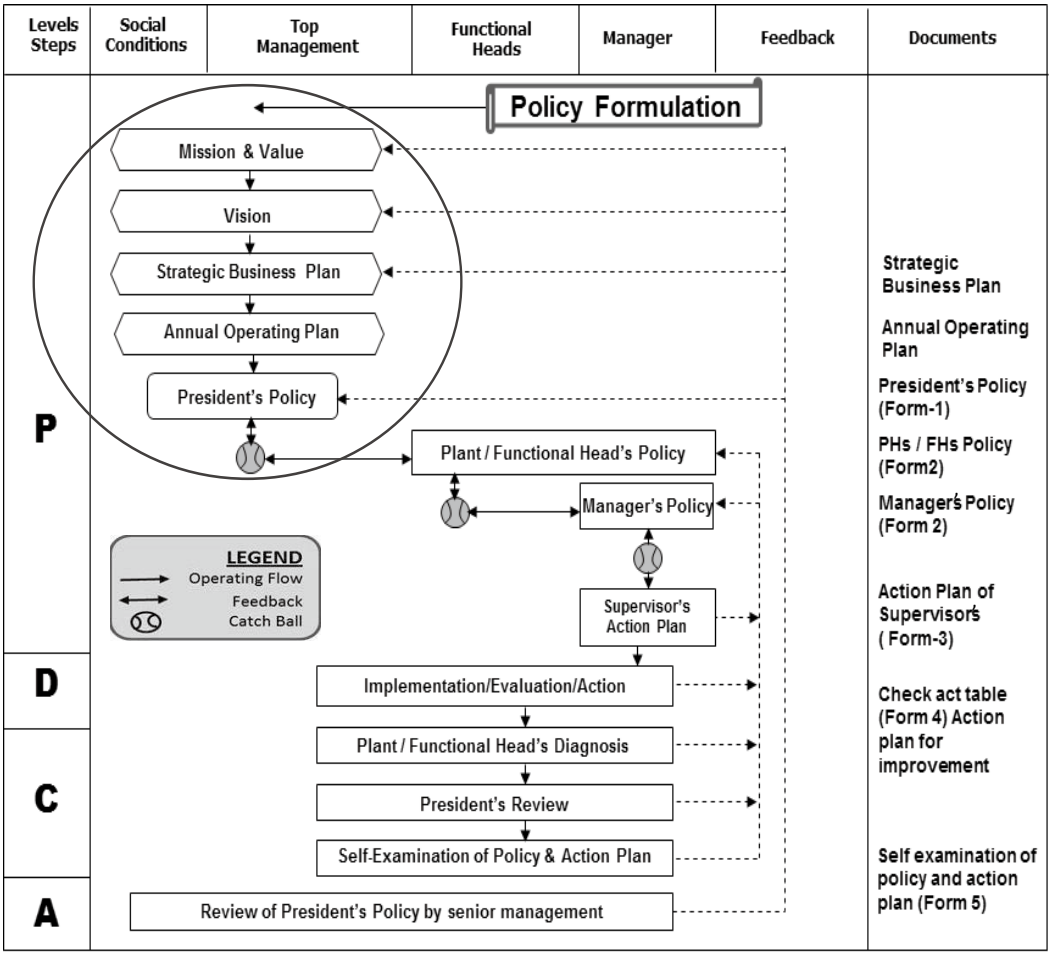


Figure 11 – RBL Policy Management system flow chart

4.2 Vision revision

Company Vision is set for long term such as ten years. The goals were set in line with the Vision. However, if senior management feels a review of vision is required in view of any major environmental changes, this will be discussed in the SBP workshop of that particular year. After the review, if required, vision will be revised.

Since domestic leadership is firmly established and there was a need felt for bigger initiatives to energize the company. Hence, the organization Vision was reviewed in 2012 and revised as below,

Vision - from 2012

To be a global supplier of choice in friction material industry through technological innovation and total quality.

Through SBP process, goals were set to achieve the revised Vision.

4.3 Strategic business planning (SBP) and Policy formulation

The SBP process was facilitated by senior management team headed by President. All senior and middle management team members participate and finalize the SBP plan for the next three years. This SBP workshop is being conducted once in a year for one full day. SBP Plan is carried out as per the flow chart given in Figure–12.

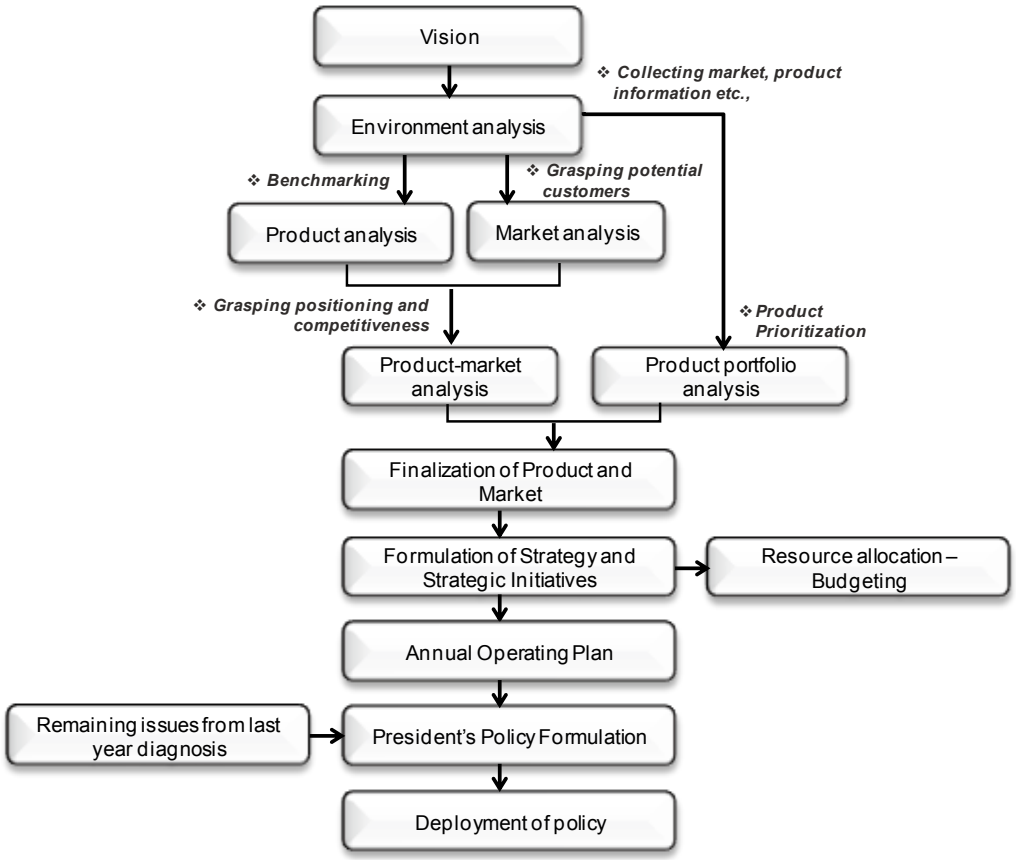


Figure 12 – Strategic Business Plan flow chart

The environment analysis is done through collecting market and product information through various sources like customers, other associations etc., and forecast market growth potential for the next three years.

The product analysis is made to understand our product strengths and weaknesses in comparison with our products/competitor's products. The needs of customers are captured in market analysis and the market competitiveness is assessed through product-market analysis. The priority to develop products is decided through product portfolio analysis. With the above environment analysis the products and markets are determined. The strategy and strategic initiatives are formulated for the finalized products and markets. Overall linkage matrix for vision, goals, strategy, priority areas and strategic initiatives was prepared and communicated to all.

Following five chapters explains how the strategic initiatives like Proactive Marketing, Proactive New product development, Lean Manufacturing including TPM practices, Human resource management - skill and competency enhancement, enhance kaizen culture are practiced to realize the vision & goals.

5. Major Activities

5.1 Proactive Marketing

(1) Background

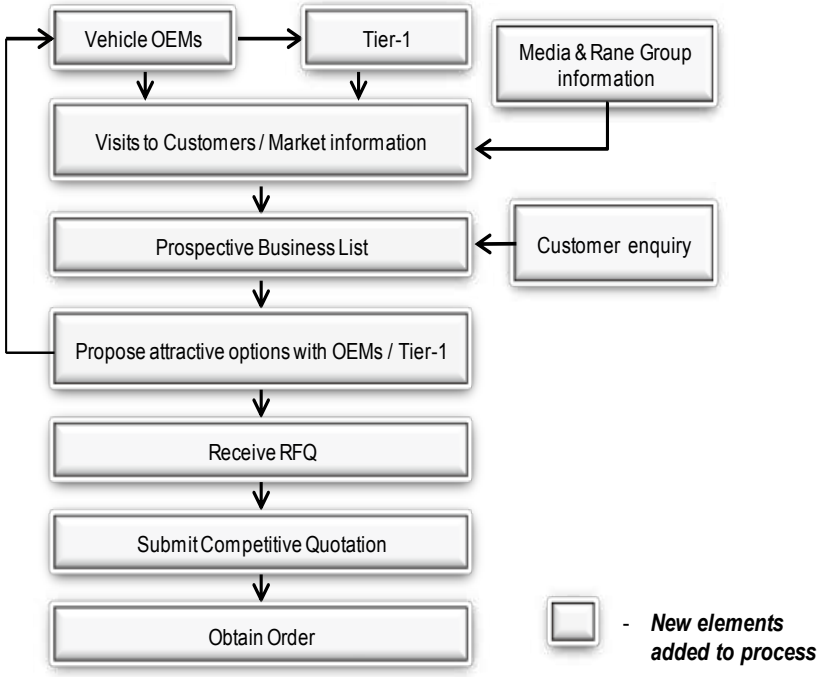
RBL marketing encompasses three functions such as 1. Sales, 2, New product introduction and 3. Service. The Company's business portfolio is broadly classified into two, namely Tier1 and Aftermarket. Indian automotive market is on a high growth mode and the attractiveness of the market ensured many international vehicle OEM's to set up their manufacturing facility in India. This has increased the opportunities as well as challenges to Indian auto component manufacturers.

The challenges faced by RBL: a) Tier-1 & Vehicle OEM: To remain a market leader in key market segments like Passenger Car (PC), Multi Utility Vehicles (MUV) and Medium & Heavy Commercial Vehicles (M&HCV), b) Aftermarket: To retain leadership position in M&HCV segment and expand customer base and reach and c) Exports: Global Quality Norms, Foreign exchange fluctuations and Product Mix.

(2) Major Activities

① Changed Marketing and Sales process:

In the earlier process, RBL interacted with Tier-1 and collected information about the future business opportunities. The enquiries generated were then reviewed internally for appropriate discussion with Tier-1 and Request For Quotations (RFQ's) were followed up. In the marketing & sales process, information about the future business opportunities were identified through interaction with vehicle OEMs, Rane group companies and information from media were also considered. In the changed process, the key focus is to make visit to vehicle OEMs once in three months and to Tier-1 once in two months to collect information about new vehicle launches.



Note: Attractive options are formulation options closely matching customer's major product criteria.

Figure 13 – Changed process

The process includes mapping of all business opportunities to arrive at a prospective business list. Technical interactions with vehicle OEMs is another facet of the changed process.

RBL Marketing and R&D propose attractive options to vehicle OEMs and Tier-1 to obtain RFQ. RBL then submit competitive quote to obtain order. To enable the changed marketing and sales process, the department organization structure was changed. The changed marketing & sales process is shown in Figure-13.

② Introduction of Coverage Ratio (CR) and Hit Ratio (HR)

In order to make changed market & sales process effective and to evaluate the changed process, RBL introduced indices of coverage ratio and hit ratio. Coverage ratio (CR) is the index which is used to measure the conversion rate of prospective business and Hit Ratio (HR) is the index which is used to evaluate the strike rate of new business.

- Coverage Ratio (CR) = (No of RFQ's Received / Total no of RFQ's issued by customers) x 100
- Hit Ratio (HR) = (No of Orders won / Total No of Orders issued by customers) x 100

CR & HR are checked every quarter and corrective actions initiated wherever required.

③ Bid pipe line

RBL through management experts and bench marking with Mahindra & Mahindra Tractor- Division selected Bid Pipe Line system. Effectiveness of RBL marketing & sales process is followed through bid pipe line system. We have added three new elements to this process.

Purpose of Bid pipeline system:

- Review receipt of prospective RFQs
- Based on progress identify actions in specific programs
- Review conversion of RFQs to business

(3) Effects

- Coverage ratio from 50% to 70%.
- Hit ratio consistently maintained between 80% and 90%.
- RBL sales index almost doubled compared to competitor.
- Overall market share grown by 1.7 times.

5.2 New Product Development

(1) Background

The significance of new product development is increasing with customer expectations on Quality, Cost, Delivery and Reliability. So we need to develop products with: (a) high quality (b) low cost (c) meeting various global standards and regulatory requirements and (d) faster development cycle time.

Challenges: With the growing competition and customer expectations, RBL needed to retain market leadership through enhanced capability of developing new products for all market segments.

(2) Major Activities

① New product development through Formulation Library

a) **Need for formation of Formulation Library** : RBL being the market leader, customers expect us to recommend the best friction material grade for a given new application. Due to frequent model changes by customer, shorter development lead time & lower development cost are the needs. Hence a formulation

library was organized with all available product output data combined with various application-related input data for quick selection / development.

b) **Contents of Formulation Library**: The formulation library consist of all developed formulation grades and the grade applications for various brake types and vehicle type applications. Actual Performance test details like frictional factor as coefficient of friction (Mu) / brake factor, % fade, speed / pressure sensitivity and wear/life etc., were captured against each base grade. Each formulation grade and its raw material composition ratio data is also compiled to correlate with quality performance results. The new product development process was integrated with Formulation library application to standardize the process as explained below:

Earlier process (Before 2003)

- Selection of friction material grade was carried out based on past experience only.
- Many iterations were carried out during development & hence resulted in longer lead time - development period of 2 years.
- Data base of library of grade organized with only test data.
- Meeting all specification was difficult and customer accepted with deviations.

New process (Since 2009)

- Library data base updated with all customer / product applications data & field data
- After RFQ receipt, feasibility study is done to meet specifications and selection of grade made based on facts
- Detailed discussions held with customer and suggestions shared to meet specifications.
- Must & attractive quality requirements & cost target identified.
- Short-list of nearest 2~3 grades was done through Formulation Library as standardized process.

Development and Benefits of Formulation Library: Earlier any new friction material grade development took normally a longer time ranging from 1.5 to 2 years. Use of Formulation Library is effectively done to reduce development cycle time. This is achieved by short-listing formulations as required for any application and using nearest grade possible as such. If improvement is still required for any product specification or benchmarked requirement, new grades are developed with minimum iterations by improving the nearest grade.

For new segment product introduction also, Formulation Library data is effectively used for extension of an existing grade. This is done through minor modifications / fine tuning the material composition by considering the extended input conditions or new market / customer expectations like load or brake inertia. By quick selection and application through Formulation Library and reduced iterations, new products are developed and offered for OE and aftermarket needs by shortening lead time, thus improving NPD hit ratio / number of new products introduction.

② Enhancing Product Reliability Testing and Validation

The dynamometer testing lab of RBL is one of the largest in India and a pioneering test facility for friction material testing. We benchmarked with global leader NISB-Japan for the test facility range and test results accuracy levels and taken up continuous improvements. This enabled R&D to do required tests within RBL facility and also to reduce development cost. This capability improvement is taken up by:

a) Alignment of test procedures to international standards: Targets are fixed for achieving accuracy of tests with respect to NISB test method / equipment. Competency of testing and analytical reporting by RBL engineers are improved on a continuous basis by training. Test lab management system is improved by benchmarking with NISB Japan and continuous improvements are made in operations and maintenance.

b) Innovative product reliability testing methods: Apart from customer specified tests or routine performance tests, efforts are continuously made to simulate field failure conditions in dynamometer test methods. Based on field visits by dyno lab engineers and data gathered from field experience, the accelerated tests are done to simulate field performance and field failures to predict product reliability.

Accelerated test results are given as input to formulation development / NPD teams by testing team, to study and improve the quality and reliability of current products as well as proposed new products.

(3) Effects:

- Number of New products developed (for OE and Aftermarket) increased from 10 to 32
- New product sales has improved two times
- Average New product development lead time has reduced from 32 weeks to 16 weeks

5.3 Manufacturing Management

(1) Background

Over a period of time, market demand for friction material products has increased along with high expectation on Quality, Cost and Delivery. Manufacturing management at RBL focus to meet these expectations through,

- Quality improvement
- Productivity improvement
- No muda production
- Flexible production
- Equipment improvement
- Manufacturing cost reduction

Post Deming, the focus was more on improvement activities. In order to facilitate and ensure continuous progress, framework (Figure-14) was established using concepts of Lean manufacturing and TPM. Quality improvement and productivity improvement are covered briefly in this chapter.

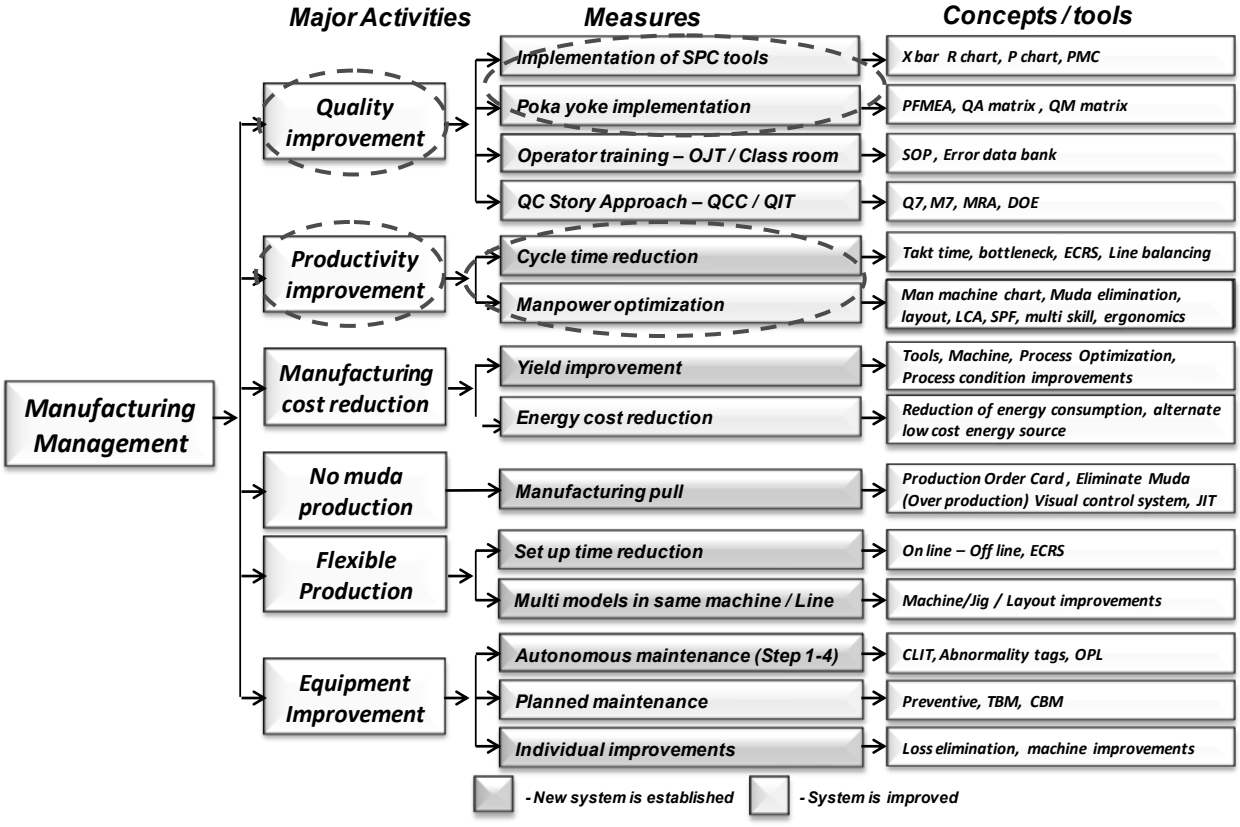


Figure 14– Framework of manufacturing management

(2) Major Activities

① Quality Improvement

a) Implementation of SPC tools

Trained all executives by renowned professor on SPC tools. Professor visits monthly for guiding the teams in implementing SPC. Each plant has established SPC stations to monitor the product critical characteristics like width, thickness, hardness, density, etc. Improvement projects were taken up to enhance the Cpk if it is <1.33.

Plant	Prevention Type Poka-yokes	Detection Type Poka-yokes	Total
P1	131	24	155
P2	29	9	38
P3	35	29	64
P4	19	14	33
Total	214	76	290

Table 5–No of Poka-yokes at all plant

Process parameters like cure pressure and temperature are monitored through process monitoring charts (PMC), which are maintained by operators.

b) Poka-yoke Implementation

In all the plants of RBL, poka-yoke system implementation has been taken as one of the effective mode of preventive actions which has made our processes robust. Prevention type and Detection type poka-yoke established across all the plant of RBL as shown in Table-5.

② Productivity improvement

The productivity improvement is achieved through cycle time reduction and manpower optimization.

a) Cycle time reduction: Productivity improvement is achieved through reduction of cycle time in all the processes. Bottleneck operations are identified and improvement projects are carried out by a CFT to reduce the cycle time.

b) Manpower optimization: In our process some of the processes are manpower intensive by nature, where deployment of manpower is higher because of layout design and muda in the process.

Man power optimization has been done through development and implementation of man machine chart, Elimination of different types of mudas through kaizen and Major improvements carried out in loading, unloading, layout modifications, inspection and walking time reduction.

Case example: Man power optimization at plant 2

At RBL plant-2, batch production was practiced in brake lining (HCV & PCV) modules in all finishing lines. Due to this, manpower deployment was more, resulting in lower productivity. Cycle time of all operations were studied by using man machine chart and Muda's (Waste) were identified and eliminated at each work station by converting layout from conventional to "U" type by bringing the machines closer.

Few "Low Cost Automation (LCA)" concepts implemented for holding the job while actual machining is in progress, which also resulted in multi machine handling. This improvement resulted in man power reduction from 8 to 4 in one finishing line. We have modified all 4 finishing lines in CVBL modules.

(3) Effects

- Customer Line Rejection reduced from 137 ppm to 12 ppm
- Productivity has improved by 70%

5.4 Human Resource Management

(1) Background

The ever growing market and entry of global Multi-National Companies (MNC) like Toyota, Nissan, Hyundai, etc., had created a high demand for talented workforce. To meet the enhanced customer requirements and to face stiff global and domestic competition, HR processes like

- Recruitment, Training & Development,
- Skill & Competency enhancement,
- Morale enhancement,
- Kaizen culture and
- Safety & Health were focused and strengthened.

This chapter briefly explains Skill and Competency enhancement, Morale Enhancement and Kaizen Culture

(2) Major Activities

① **Enhancement of Skill and Competency:** To meet the growing needs of the customer, the skill and competency process was enhanced and index have undergone changes over the years.

a) Skill and Competency Evaluation: The skill evaluation is done for operators. There are totally 7 generic skill (like Quality systems, Lean manufacturing) and 49 functional skill (like Mixing, Preforming) across the organization. To make the skill assessment more objective we've introduced sub skill. Each functional skill consists of around 2 to 5 sub skill - Example: Raw material weighing, Bulk density checking etc., are sub skill of Mixing.

Competency evaluation is done for executives. There are totally 20 generic competency (like learnability, team working) and 48 functional competency (like knowledge of product, knowledge of process) across the organization.

The skill and competency evaluation is done once in a year by the immediate superior using the evaluation form. The evaluation is done through one on one discussion. During the process, the superior will also refer to previous year evaluation details and the past training details. The evaluation for successive years will be done in the same format to understand the progress over the years.

b) Skill and Competency upgradation

After the evaluation process, the skill and competency requiring improvements are identified and prioritized. An annual training calendar consisting of on the job and off the job training is prepared. The functional skills are upgraded through on the job training by the immediate superior and the generic skills are upgraded through off the job training by HR.

Once the employee reaches Level 3 skill in his current job, as part of multi skill development he will be trained in skills related to other departments where he has not reached level 3. Likewise multiskilling requirements are identified and training is being planned and completed. Similarly generic competency gaps are addressed through off the job training.

② **Morale enhancement**

The employees' morale is improved through following initiatives:

a) Communication: To create enabling atmosphere and to keep our employees abreast with the changes, communication programmes are organized periodically. Every day before the commencement of the work, DRM meetings are conducted in all departments. In the DRM meetings discussions are held on the previous day's plan vs actual and plan for the day is also shared with all executives and operators. Monthly communication meetings are conducted at all plant locations. In the said communication meetings the plant head shares the information pertaining to the performance of the plant for the previous month.

b) Engaging Employees' Family: Creating a psychological bond with people is highly valued in Indian culture as the same has a positive impact in influencing morale of our employees, considering this we organize family visit and factory visit programmes. Besides the above, the employees' family members are

also encouraged and given opportunity to participate in Corporate Social Responsibility (CSR) activities along with the employees. This creates a sense of belongingness amongst the family members.

c) Celebrations: Sociocultural events are playing important role in distressing and relationship building, which in turn boosts employee morale. Therefore, all our plants celebrate festivals like “Ayudha Pooja”, “Deepavali”, etc., Birthdays of employees are also celebrated every month at all locations. During celebrations fun activities are being organized.

d) Other initiatives: Yoga: Executives attend yoga programme conducted by a certified instructor. Wherein posture and breathing exercises are taught to bring in relaxation and improve health.

Recreation: Recreation centers are created in all plants and the same is equipped with carom board, chess, table tennis etc.,

③ Establishing Kaizen Culture

To bring orientation towards continuous improvement and to enhance employee involvement, we constantly focus on kaizen culture. Kaizen Culture is established through Kaizen Scheme, enhancing and supporting Kaizen culture.

Kaizen scheme

a) Suggestion: Operators are encouraged to give & implement their suggestions relating to improvements on Productivity, Quality, Cost, Delivery, Safety, Morale and Environment. The list of employees who are not actively participating in suggestion scheme are identified and counselled to give suggestions. The suggestions received from employees are periodically evaluated for reward. The photographs of the best suggestors are also displayed in the shop floor.

b) Quality Control Circle (QCC): Operators are encouraged to take part in QCC and motivated to take up projects which will have impact on Productivity, Quality, Cost, Delivery, Safety, Morale and Environment. Those who are not participating in QCC are counselled and attached with active QCC team to create interest in active participation. Non active QCC are provided with training and additional support to improve their knowledge and confidence level. These measures have helped us to increase the interest and participation level among operators.

c) Quality Improvement Team (QIT): QITs are need based cross functional teams formed among executives. These teams take up specific improvement projects and complete the project using QC story approach. The best performing QIT is rewarded. Also the best teams are allowed to participate in RBL’s QIT convention and external conventions organized by ACMA (Automotive Component Manufacturers Association), QCFI (Quality Circle Forum of India) and others.

Enhancing Kaizen culture

Kaizen culture is improved through the following initiatives:

a) QCC / QIT Convention: The company conducts an annual convention every year wherein the QCC / QIT teams from all plants and functions present their projects. RBL has won the Chairman’s trophy twice and runner up position thrice in the past five years.

b) Rewards and Recognition: Employees who have participated in suggestion schemes and quality circles are recognised and rewarded during monthly communication meetings.

Supporting Kaizen culture:

a) Education and Training in QC story: Employees are trained in QC story methodology to take up projects relating to their work area for improvements.

b) Book of Learning: Book of Learning (BOL) is a knowledge management initiative. It is an online knowledge data bank used to capture the technical and equipment learning's from all plants and corporate office. The knowledge gained after completion of QCC and QIT projects are captured by the BOL-champions of each location and is uploaded in the data bank maintained in the system. It is a user friendly system as

any employee can access the available data by typing in the key words to search the information he/she is looking for.

(3) Effects

- Suggestion/ operator / annum improved by more than 3 times
- QCC projects / team / annum improved by 4 times
- QIT projects has improved by 3 times

5.5 Utilization of IT

(1) Background

IT team is continuously focusing on the following to achieve policy objectives:

- Qualitative reports for team members for effective decision making process
- Integration of different programs to reduce lead time and improve efficiency
- Supporting manufacturing processes for systemization of process flow as applicable
- Improved data processing speed through networking and hardware maintenance
- Automation of business processes

IT team's approach towards development of new projects are two fold

- In-house development
  - ❖ Simple programs
  - ❖ Complex programs which are developed through institutionalization of software development process
- External support

(2) Major Activities

① **Institutionalization of software development process**

RBL has revisited the software development process and strengthened the software development process. Above process resulted in effective software development and internal customer satisfaction.

The important activities in this flow chart (Figure-15) are as follows:

1. Done through CFT.
2. Design review.
   - ❖ Reviews are done by experts (other than CFT members).
3. Trial run for a period of 1 to 2 weeks.
4. Users feedback resulting into Final Design release.
5. Collect the customer voice for system evaluation after 3 months.

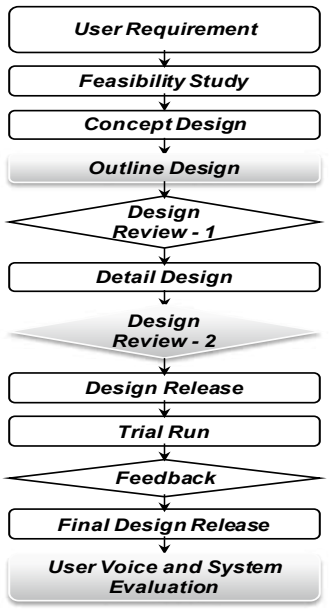


Figure 15 –Software development process – Complex program

② **Total picture of IT:** IT encompassing all functions

Area	IT system
Quality	Book of Learning
	Incoming inspection log report
	Rejection report - Cause wise
Marketing	Coupon Payment Software
	Customer wise Sales gap analysis
	Sales analysis
	Unified billing process
Manufacturing	Schedule Adherence Report
	Production - Asking rate report
	Semi Finished Goods ageing report
HR	Statutory Compliance Kit (STACK)
	Competency mapping

Area	IT system
Materials	Material Planning
	Material Price Variance
	Aumation of rejection accounting
Engineering	Computer Aided Design - CAD
	Product dimensions to Design report
Research & Development	Formulation Library
	R&D stock ageing report
Finance	Sales Commission report
	Vendor payment process automation
	Receivables - Monthly & Daily report
	Royalty report
ERP Pacakge	SAP (Integrated with all modules)

③ Major IT Systems

In order to improve Quality, Cost, Delivery and Morale (QCDM), IT function has developed the following systems.

a) Quality System

(i) Rejection Report – Module-wise and Cause-wise report : System support provided to quality team in the form of a dash board report. This is to have rejection analysis on shift wise and day wise. Input data on rejections taken from SAP system. Developed rejection report compiles all inputs and helps to study module-wise and cause-wise rejections. Further drill down of report facilitates to study top ten rejections with cause wise details. Trend charts generated with the above inputs. It has helped Quality and Manufacturing teams to further analyze root cause and identify the counter measures quickly. Report helped team members to spend time on analysis of rejections and derive corrective measures than data compilation and report generation.

b) Marketing – Commission : RBL caters need of various segments like OE, Aftermarket, Exports and Railways. In the process of expanding market base and reliable dealer network, RBL offering commission to customers amounting to INR 129 Million per annum. It covers various schemes like Product Incentive (PI), Overriding commission (ORC), Turnover discount (TOD) etc. Since volume of products and values are high, IT function took the project to systemize total process.

Total process integrated with actual sales output with the help of .Net program. Masters created considering Plant, Part number, Customer, and applicable rate of commission. Existing ERP SAP integrated with .Net program, which facilitates to generate product number wise commission immediately. This program not only helped in avoiding manual errors, but also saved one man day for marketing and finance team in preparation of said report. Also data retrieval becomes easier, manual dependency avoided to retrieve past data.

c) Delivery – Schedule Adherence Index Report (SAI) : SAI is on one of the plant performance metrics. It is being measured based on the production commitment quantity given by the team and final delivery made to Finished Goods (FG) stores. IT team developed a report capturing monthly production commitment quantity with daily and weekly targets. Report generates daily production against commitment quantity. SAI report has specific feature that any quantity produced less than 70% of committed quantity will be considered as nil. Specific report will provide module wise and part number wise actual production against target. It is helping the shop floor managers as an effective tool, to evaluate daily performance and take counter measures on an on-going basis which results in improvement in overall performance. It is being used as an effective tool for planning and improving the performance.

d) Book of Learning: Book of Learning (BOL) is a knowledge management initiative. It is an online knowledge data bank used to capture the technical and equipment learning's from all plants and corporate office. The knowledge gained after completion of QCC and QIT projects are captured by the BOL-champions of each location and is uploaded in the data bank maintained in the system. It is a user friendly system as

any employee can access the available data by typing in the key words to search the information he/she is looking for. The search can be specified to failure modes, themes, departments and plants.

(3) Effects

- Customized reports developed has improved from 150 to 540
- Man hours spent on report preparation has reduced from 131 to 38 hours

6. Unique Activities

6.1 Development of Breakthrough Eco-friendly New Products in Short Lead-time

(1) Aim: The friction material is a composite and has to satisfy many attributes in brake application concurrently like brake performance, fade and wear and more often compromise is made or broad optimization only achieved due to complex nature of materials involved. RBL needed to improve the ability to meet most specifications as per customer needs i.e., Specification hit ratio with appropriate formulation.

There was a constant pressure and need for reduction of lead time for new product development in the context of increasing competition and frequent model changes by car manufacturers. More indigenous development of formulations with cost-effectiveness was also required, since adopted formulations from our collaborator - NISB Japan are generally costlier.

RBL had the bigger challenge of migrating to Asbestos-free formulations in all markets and our initial asbestos free developments took longer time and affected the sales revenue. Hence there was a need to develop the formulation library data to be used for new business requirements with shorter lead time and to improve the success ratio in meeting specifications / business growth needs.

(2) Activity : Formulation Library: Based on the past available assorted data on various formulation grades, vehicle and brake application data, dyno test results and physical properties and raw materials, a structured data base was created. The logic table of cause versus final product effect was also created based on practical experiences / theories and used for right selection of raw materials for a new formulation. The library data was made available and updated on-line for easy reference and application. Details of benchmark grades were also made available. The past field or development issues were also captured as fault-tree analysis and evaluation points are captured as lessons for future development efforts and process capability improvements in new products.

This formulation library was used both for reactive (Enquiry based on explicit requirements) and proactive type NPD initiatives (proposals with implicit needs or unseen requirements) for business development and growth in all segments.

Reactive : For new business enquiry the customer requirements are studied and 2 or 3 grades closer to the requirements would be short-listed on merit of each on various attributes quantified using the library data for given application. If an ‘attractive quality’ is required, minor iterations are done on the best option and offered to customer within the development target time. If first choice grade is accepted directly, the development time or time to market is greatly reduced.

Proactive - Proposal or Product Upgradation type: Based on the business needs and growth plans, periodically the library is studied and new grade development is initiated with assumed or expected application extensions (brake system / vehicle loading / brake inertia) by present / future customers. Through Quality Function deployment (QFD), targets are set and by selecting a benchmark & nearest library grade, iterations done to make new formulations successfully.

Thus the formulation library makes lead time shorter in developing new products and helps in meeting or exceeding customer requirements**.**

(3) Effects:

- By the application of Formulation library approach for NPD, RBL has improved market share in existing segments or entered into new segment in OEM. NPD hit ratio has improved from 70 to 90%
- The use of formulation library has enhanced our ‘time to market rate’ from 1.5 years / new formulation in 2005-2008 to 0.75 year / new formulation in 2008-2011.

6.2 SMART manufacturing system – Trichy plant (Plant-4)

(1) Aim:

RBL – Trichy plant was established with the following aims

- To satisfy the customers with high quality disc pads
- To align to our vision of retaining market leadership
- To introduce new technology in friction material manufacturing
- To become a model plant for the Rane group

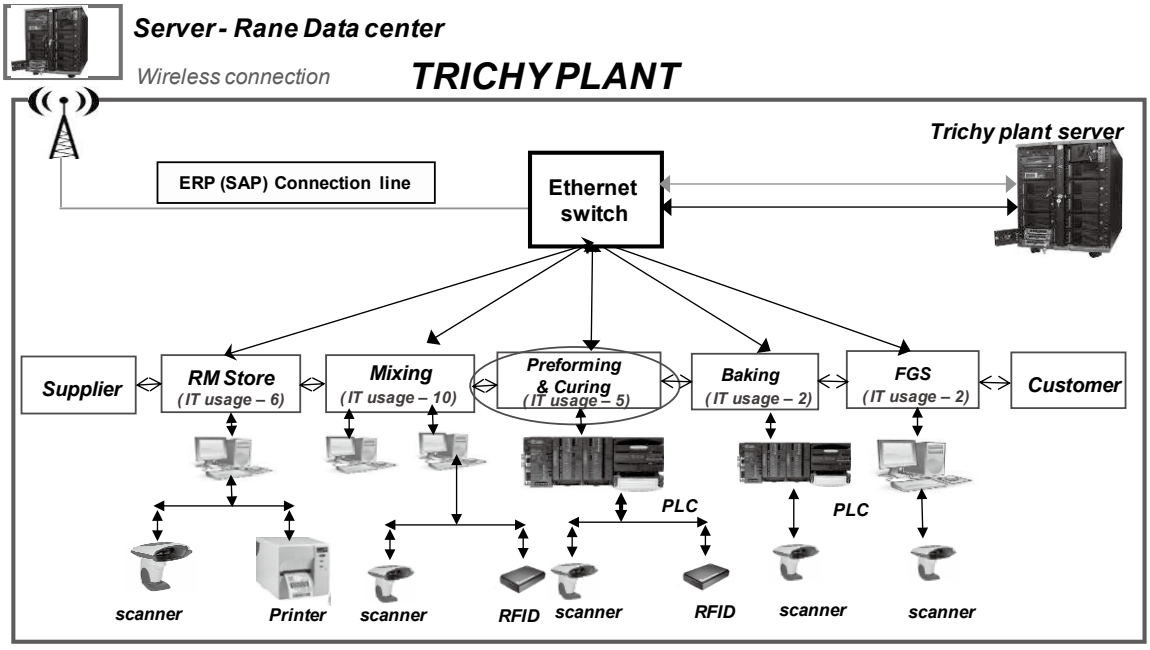
(2) Activities:

①SMART eco-friendly manufacturing system:

RBL - Trichy plant was established with a cross functional project team with involvement of RBL, Nisshinbo and suppliers. Supplier identification, evaluation and stage wise evaluation of machines was done with detailed check lists to equip the production line with high technology machines.

a. Manufacturing Process armed by IT

To enhance the manufacturing facility efficiency and to ensure defect free supplies to customer, production line with new indigenously built software was integrated with the existing ERP (SAP) system. This ensures better control of the process from the raw material receipt till service to customer.



- ***Unique custom built software where all processes are integrated with existing software***
- ***Better control of the process from raw material receipt till service to customer***

RFID-Radio frequency identification device

PLC –Programmable Logic Control

Case Example – Preforming and curing process:

Process parameters control at preform and curing

- Each preform machine having RFID receiver
- Each mix bin having RFID tag
- Preform machine starts if RFID tag details related to mix and machine process parameters are matched
- Curing machine and Preform machine are interconnected through PLC
- Curing machine starts if preform and curing process parameters are validated against mix

Similarly all processes are armed with IT and smart manufacturing system is established and ensures defect free right product to customers

b. **Eco friendly environment: The** plant is equipped with robust dust collector systems to ensure an eco-friendly environment for friction material manufacturing. Towards building a green environment, 1000 trees have been planted inside the premises.

②High Skill and highly motivated operators:

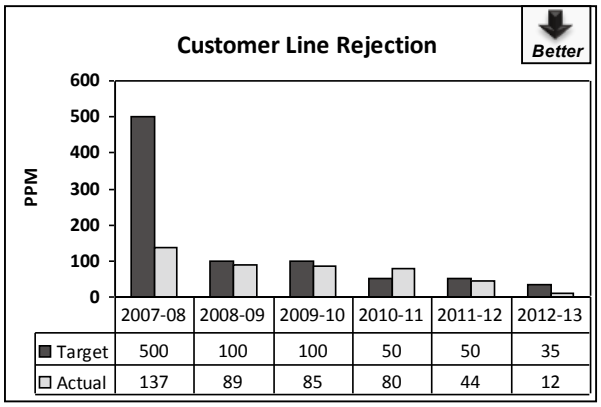
We recruited candidates after detailed evaluation with check list including medical fitness followed by three stages of interviews. Trichy plant has an unique training and development system. 15 days residential training ("Gurukul" training) is given, to align the operators with organization's requirements.

(3) Effects:

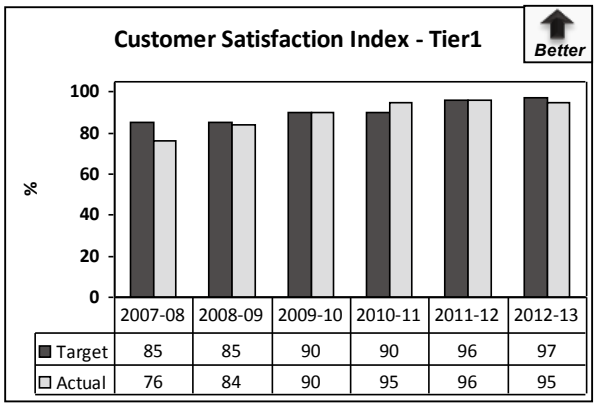
- Customer line rejections in Disc pad division maintained at 1 PPM.
- In-process rejections in disc pad division at 3200 ppm in line with global standards.
- Implemented suggestions at 20 numbers per operator per annum and 100% participation in Total Employee Involvement (TEI) activities.

7. Effects

7.1 Quality:

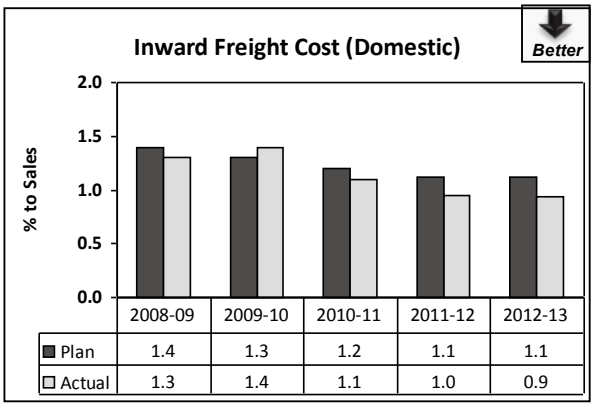


	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Target	500	100	100	50	50	35
Actual	137	89	85	80	44	12



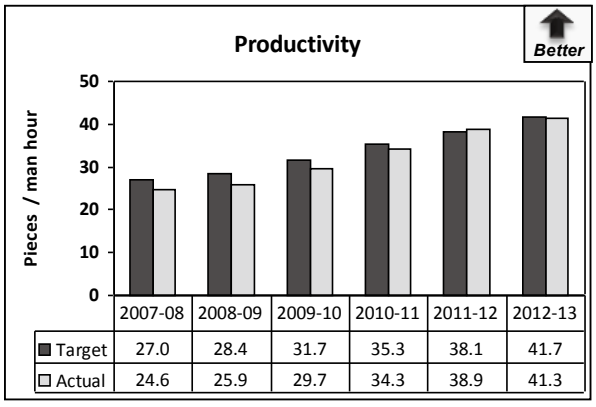
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Target	85	85	90	90	96	97
Actual	76	84	90	95	96	95

7.2 Cost

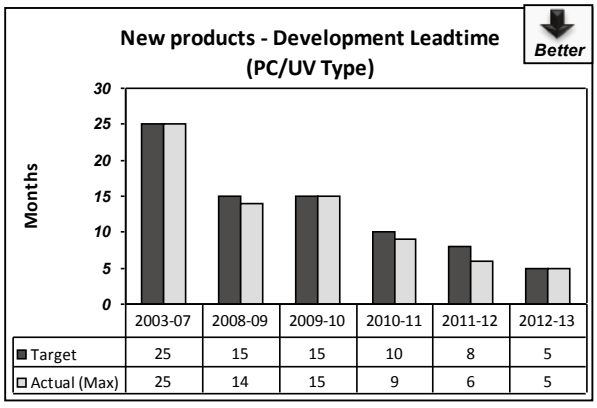


	2008-09	2009-10	2010-11	2011-12	2012-13
Plan	1.4	1.3	1.2	1.1	1.1
Actual	1.3	1.4	1.1	1.0	0.9

7.3 Delivery

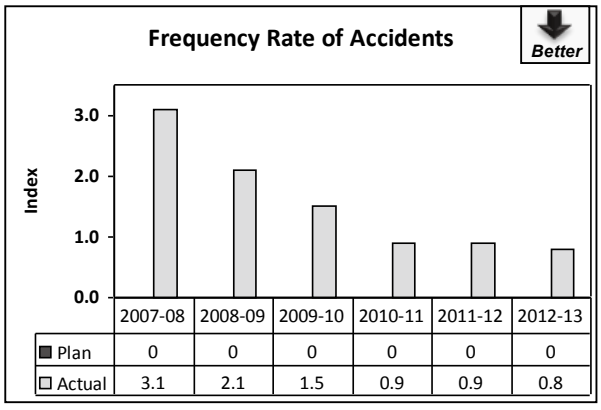


	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Target	27.0	28.4	31.7	35.3	38.1	41.7
Actual	24.6	25.9	29.7	34.3	38.9	41.3

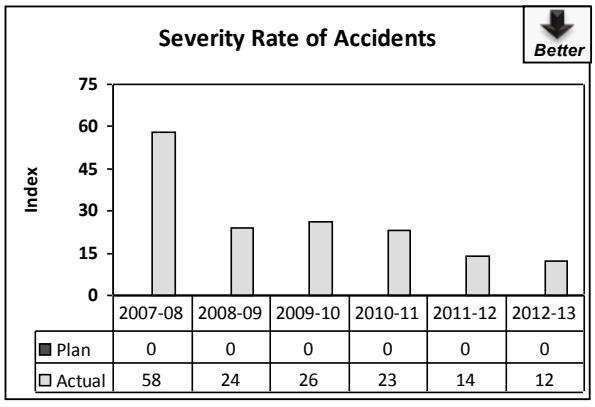


	2003-07	2008-09	2009-10	2010-11	2011-12	2012-13
Target	25	15	15	10	8	5
Actual (Max)	25	14	15	9	6	5

7.4 Safety

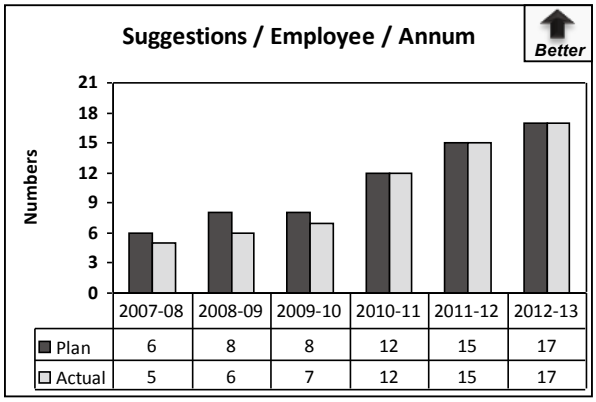


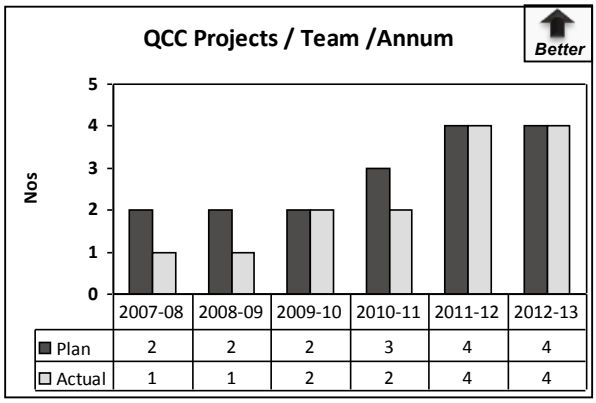
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Plan	0	0	0	0	0	0
Actual	3.1	2.1	1.5	0.9	0.9	0.8



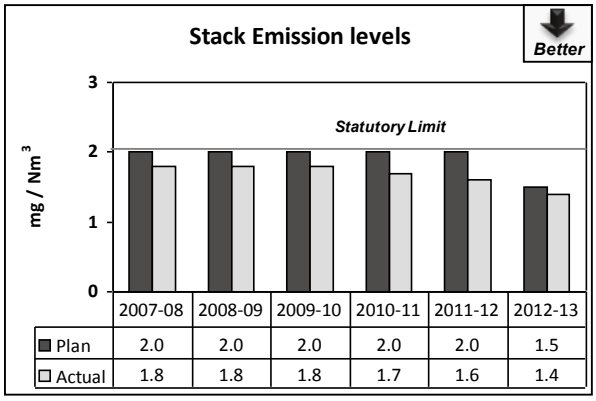
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Plan	0	0	0	0	0	0
Actual	58	24	26	23	14	12

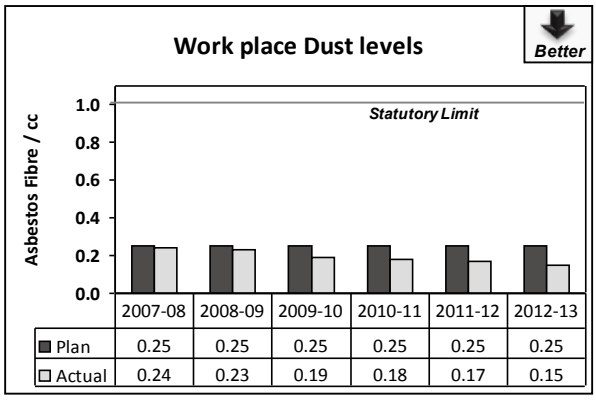
7.5 Morale



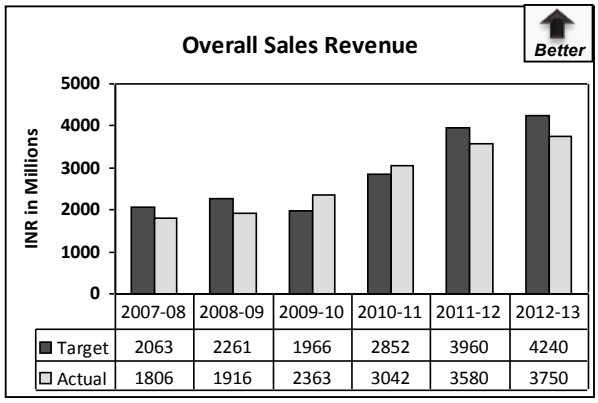


7.6 Environmental





7.7 Business



8. Future Plans

- Ensure dominant market leadership in OEM through customer focus
- Expand business in Aftermarket and Exports through CFT approach
- Cost effective formulation development through Innovation
- Continuous focus on HR excellence

9. Conclusion

- TQM way of working helped us
  - To overcome the stiff challenges
  - Retain domestic leadership position
  - Establish world class plants at Trichy and Hyderabad
- Deming Grand Prize further strengthened our confidence on TQM journey.
- Goals in our continuing TQM journey -
  - **Innovative use of TQM to realize Vision 2020**

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