

2015年度

デミング賞大賞
受賞報告講演要旨

National Engineering Industries Limited

CHAPTER 1: OUTLINE OF THE ORGANIZATION

1.1 History

NATIONAL ENGINEERING INDUSTRIES LTD., JAIPUR was founded in the year 1946 as a pioneer industry in the field of bearing manufacture by the renowned industrialist, late Shri B.M. Birla, under the name of "National Bearing Company Limited and is the part of one of the big industrial group namely C.K. Birla group. Spanning four continents, the group has a global revenue of over USD \$ 1.6 billion with interest in major industries, which include Automobiles, Earthmoving and Power Transmission equipment, Heavy machinery, Information technology, Paper, Cement, Building Products, Electrical Fans, Consumer durables, Vegetable Oils, Soap & Detergents, Engineering & contracting for Industrial & Infrastructure projects and emerging areas like Oil & gas, Geomatics and Environment.

The company is now manufacturing nearly 100 million bearings per year in over 1000 different sizes ranging from 6 mm bore to 1300 mm outer diameter. NEI gross turnover (inclusive of excise duty) & percentage of export sales are shown in Fig. 1.1 & 1.2 respectively and various mile stones are shown in table 1.1

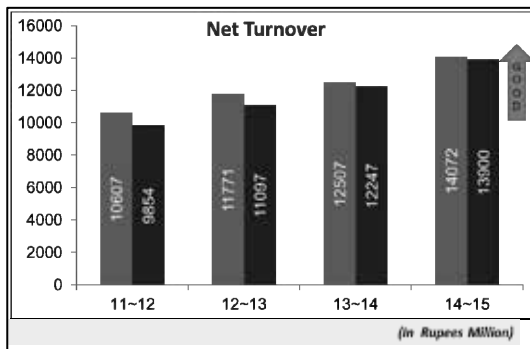


Fig1.1 Trend of NEI Turnover

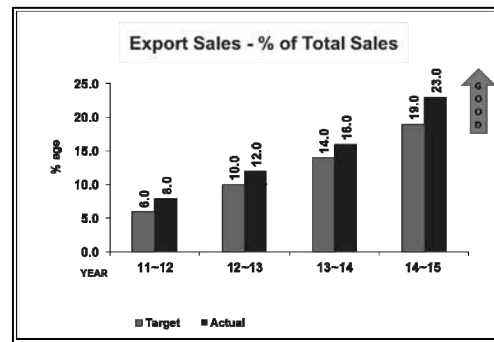


Fig 1.2 Trend of Export Sales as % of total sales

NEI manufactures wide range of Ball Bearings, Spherical & Cylindrical Roller Bearings, Axle Boxes for Railway Rolling Stock, Steel Balls, Tapered Roller Bearings, Large Diameter Bearings, Spindle Inserts etc. and the name of the company was changed in 1958 to "National Engineering Industries Ltd." retaining its original trade mark NBC for bearings.

Table: 1.1 Table showing landmarks in history of NEI

Year	Milestone	Year	Milestone
1946	Company established under the name of NBC	2003	TS-16949 & TPM Kick-off
1950	Ball Bearing Division started	2005	AARM-1003 Quality System Certification
1951	Railway Bearing Division started	2007	TPM Excellence award for Newai Plant
1967	Tapered Roller Bearing Division started	2008	TPM Excellence award for Jaipur Plant
1981	Newai Plant Started	2010	Deming Application Prize
1982	Technical collaboration with Brenco , USA for Cartridge Tapered Roller Bearings	2012	ACMA Award for Manufacturing Excellence
1985	Technical collaboration with NTN, Japan for Ball Bearing	2012	ACMA Award for Excellence in Technology
1995	ISO-9001 Certification	2013	TQM Diagnosis
1997	Technical Collaboration with NTN, Japan for Cylindrical and Tapered Roller Bearing	2014	OHSAS-18001 Certification
1999	Implemented SAP Solutions for ERP	2015	IRIS-Certification, ACMA Award For Excellence in technology (Large Category), CII(ER) certificate for Model TQM Company
2000	ISO-14001 & QS-9001 Certification	2015	Deming Grand Prize

1.2 Plants and Products

National Engineering Industries has its Marketing, Research & Development, HR & Finance, Logistics are located at Jaipur. Manufacturing centre are located at Jaipur, Newai, Manesar and Vadodara .Jaipur plant is equipped to manufacture wide range of products whereas Newai & Manesar manufactures only Ball Bearings. More details are shown in Table 1.2. This Table Shows that the main functions are located in Jaipur and few products are produced in Newai and Manesar. Fig 1.3 shows the products manufactured at NEI.

Table 1.2 Details of Manufacturing Centers

DETAILS	JAIPUR	NEWAI	MANESAR	Vadodara
Product (ProductRange)	<p>Ball Bearing Radial Ball Bearing (6 mm Bore to 160 mm OD) Angular Contact Bearing, etc.</p> <p>Tapered Roller Bearing (15 mm Bore to 240 mm OD)</p> <p>Railway Bearings -Cartridge Tapered Roller Bearings (CTRB) -Spherical Bearings -Cylindrical Bearings</p> <p>Large Diameter Bearings</p>	<p>Ball Bearing Radial Ball Bearing (12 mm Bore to 62 mm OD)</p>	<p>Ball Bearing RadialBall Bearing (17 mm Bore to 52 mm OD)</p>	<p>Ball & Tapered Roller Bearing Radial Ball Bearing (10 mm Bore to 30 mm OD)</p> <p>Taper Roller Bearing (40 mm bore to 180 mm OD)</p>
Floor area (sq. mt.)	99100	7195	4050	20000
No. of Employees as on 31.1.15 (Staff+Workmen)	2165	267	62	215
Gross Turnover in Rs. Million (14~15 Upto Feb'15)	11131	970	575	57



Ball Bearings



Tapered Roller Bearing



Cartridge Tapered Roller Bearing (CTRB)



Spherical Bearing



Cylindrical Bearing



Large Diameter Bearing

Fig 1.3 Products manufactured at NEI

1.3 Customers and Market

1.3.1 Customers

NEI's Key Customers comprising of segments like Automobile, Auto components, electric motors & pumps, and railways as shown in Table 1.3.

Table 1.3 NEI's Key Customers Segment wise

Segment	Major Customers
Automobile	<p>a) Cars & MUV: Maruti Suzuki India Ltd., Hindustan Motors Ltd., Mahindra & Mahindra, Nissan</p> <p>b) Commercial Vehicle: Ashok Leyland, Force Motors, Volvo, Eicher Motors, TATA Motors, Mahindra & Mahindra, Daimler India, Fuso.</p> <p>c) Two/ Three Wheelers: Bajaj Auto Ltd., Hero Motocorp, Honda Motorcycle & Scooters India Ltd., Suzuki Motorcycle India, Royal Enfield Ltd., Yamaha Motors India Pvt. Ltd., TVS, Piaggio .</p> <p>d) Tractors: TAFE, TAFE Motors & Tractors Ltd, Escorts Mahindra & Mahindra Ltd., Punjab Tractors, New Holland, VST Tillers, Same Deutz-Fahr India Ltd., International Tractors Ltd.</p>
Auto Component Manufacturers	American Axle & Manufacturing, Spicer India, Kinetic Engineering, Rane, Avtec Ltd., Axles India Limited, Tech Auto Pvt. Ltd., DANA
Electric Motors & Pumps	AL pump Limited, B.E Pumps Pvt. Ltd, Fieldman Engineers Pvt. Ltd, Indra Marshal Oil Engines, Kalsi Group, Kirloskar Brothers Ltd, La-Gajjar Machineries Ltd., NGEF Ltd., Kirlosker Electric Co., Agni Motors, Bharat Bijlee
Railways	Indian Railways, wagon, coach & Locomotive manufacturers as Original Equipment all across the country
Large Diameter Bearing	Steel Mills, Heavy Engineering Plants and Thermal Power Plants
Exports- OEM	Consolidated Metco Inc., Amsted Railway, NTN Corporation, Daimler, BMW, AgraleS.A, Kazel Hydraulic, NISE, Getrag Innovations Centre, Mitsubishi Fuso
Export – After Market	Australia, Bangladesh, Bhutan, Colombia, Czech Republic, Egypt, Guyana, Kuwait, Myanmar, Nepal, Sri Lanka, Tanzania, UAE

1.3.2 Market

NEI market share amongst the organized domestic manufacturers is shown in Fig 1.4. NEI's market share in ball bearings, taper roller bearings and railway bearings is 28.76%, 43.67% and 43% respectively amongst the domestic bearing manufacturers in India.

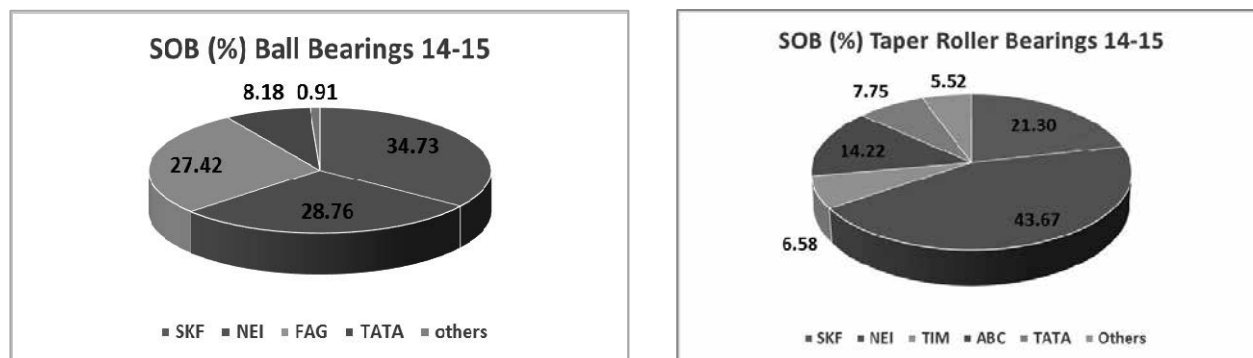


Fig 1.4 NEI market share Product wise among Domestic manufacturers

1.3.3 Global Presence

NEI is exporting its Products to the countries across the Globe like Italy, Germany, USA, Japan, Brazil, Sri-Lanka, Bangladesh, Nepal and Indonesia.

1.4 Organization Structure

Organization Structure consists of Functional Heads who are the heads of a function and reports directly to the President & CEO. Divisional / Departmental Heads are reporting to the Functional Heads. Departmental Heads are taking care of individual departments. The organization structure of NEI is shown below in Fig 1.5.

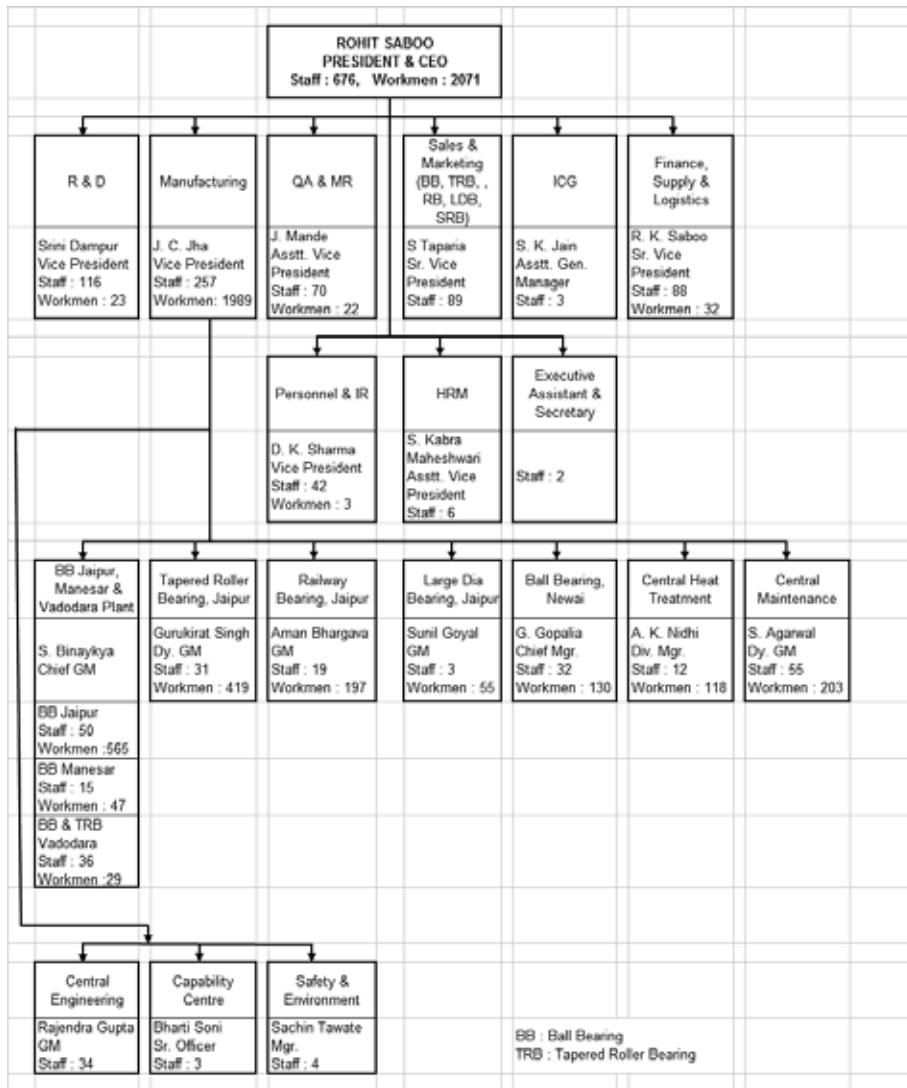


Fig 1.5 Organization Structure of NEI

1.5 Collaboration

BRENCO Inc. (Amsted Rail) of U.S.A. - Since 1982 for Cartridge Tapered Roller Bearings for Rail Road applications.

NTN Corporation of JAPAN – NEI has collaboration from 1985 onwards for the following products - Ball Bearings, Cylindrical, Spherical Roller, Clutch Release, Belt Tensioners, Generation-1, Generation-2 wheel Bearings. From 1997 onwards for the following products Tapered Roller Bearings (single row, double row & four row tapered roller bearings).

Izumi Kinzoku of JAPAN – Since 1996 for re-manufacturing, retrofitting and overhauling of grinding and Super-finishing machines for bearing races.

CHAPTER 2: BUSINESS GOALS AND MANAGEMENT STRATEGIES

2.1 Business Environment

2.1.1 Economic

India's economic scenario is showing positive signs of improvement. A gradual recovery is underway for the Indian economy. The country's real GDP growth increased to 5.6 percent in the March 2013 quarter and is expected to clock a growth of 6.6 per cent in FY16.

Index of Industrial Production (IIP) rose by 1.1 percent in FY 15 (till Jan'15) compared to dip of 0.1 percent in the previous fiscal. The output of the manufacturing sector, which accounts for over 75 percent of total production, grew by 1.5 in FY 15 (till Jan'15).

In view of the upswing in both GDP and IIP in current year and next fiscal, NEI is also expecting to continue its robust growth trend with key contributions coming from Auto, Industrial and Railways sector.

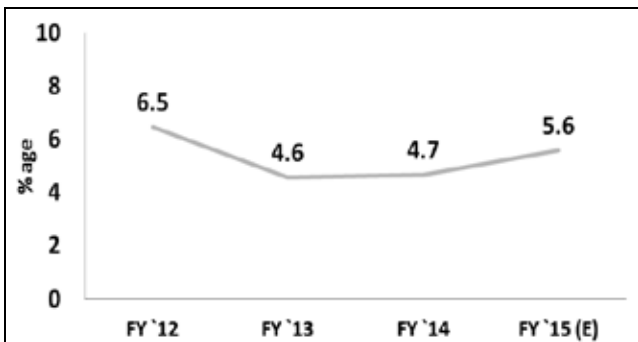


Fig 2.1 GDP Trend

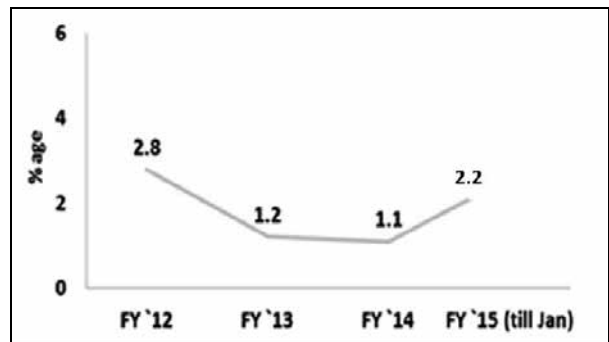


Fig 2.2 IIP Trend

2.1.2 Consuming Industry

The user segments to Indian Bearing industry mainly comprises of sectors like Automobiles, Railways, Industrial & others. The share of each segment is shown in Fig 2.3.

2.1.3 Competition

National Engineering Industries competes with global & domestic manufacturers like SKF, FAG, Timken, TATA, ABC, NRB, Koyo and NTN along with imports of brands like SKF, FAG, NSK, NTN, KOYO, TIMKEN, ZKL, and URB. There is a persistent threat of low cost bearings from China. NEI has 27% share among the domestic bearing suppliers in India (Fig 2.4).

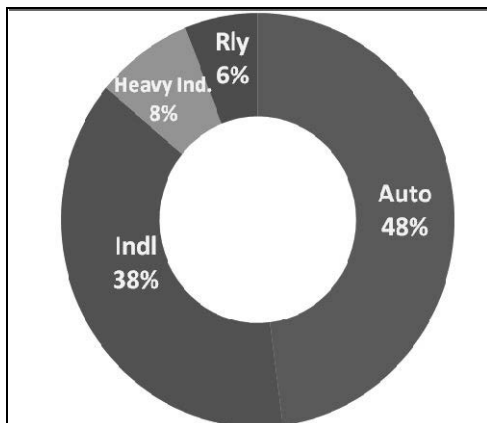


Fig 2.3 User segments in Indian Bearing Industry 2013-14

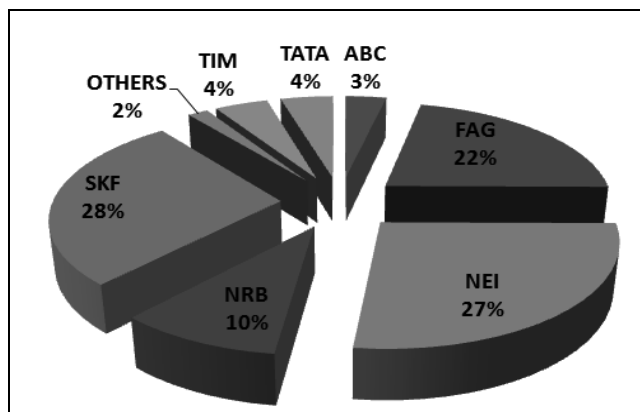


Fig 2.4 Bearing Industry Share Domestic market 2013-14

2.1.4 Market

The domestic market size is Rs 7,537 Cr. The domestic market is broken into Organized Sector, Unorganized Sector and Imports. The organized sector of the bearing producing industry in India has a share of Rs 3,713 Cr. NEI has overall market share of 13.63% considering Imports, Organized Sector & Unorganized Sector of bearing suppliers. The Market dynamics (Fig 2.5) states that 40% of bearings are used by Replacement market and balance 60% is consumed by OEM industries.



Fig 2.5 OEM Vs Replacement

2.1.5 Technology

Complete in house facility is available in R&D centre for Design & development, Industrial engineering & Machine Building. NEI has the state-of-the-art grinding technology for grinding Bearing races. The grinding lines are equipped with in-process & post process gauges. Assembly lines are located in centrally air conditioned area with auto gauging and testing equipments. To meet the rapid increase in demand for quality, NEI has constantly upgraded its facilities such as heat treatment furnaces, machine tools & technology, material testing laboratory, prototype testing machines, testing methods & equipment. Some of the testing & Inspection facilities are shown in Fig 2.6 - 2.8

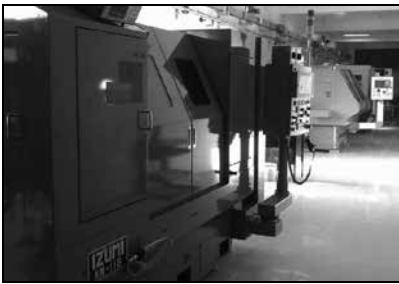


Fig 2.6 Prototype Shop



2.7 SEM – Scan Electron Microscope



Fig 2.8 Benchmarking center by Zeiss

Wienstroth Furnace Installation

To Cater sales requirement of large size bearings (>5.5"OD) NEI opted for Salt Bath quenching type continuous Roller Hearth furnace from Wienstroth Germany in year 2014. The capacity of this furnace is 1500 kg / hr against the existing furnace of 450 kg / hr. The furnace has salt bath with in-line salt recovery system as quenching media and the product micro structure after quenching is fine needle line Martensite. This energy efficient gas fired high temperature furnace produces products with hardness variations within 1 HRc after Tempering.



Fig 2.9 View of Wienstroth Furnace

NEI's technological capabilities are also supported by collaboration with NTN Corporation, JAPAN for Ball, Tapered Roller and Spherical Roller Bearings; BRENCO Incorporated, U.S.A. for Cartidge Tapered Roller Bearings & Izumi Kinzokukogyo Co. Ltd., JAPAN for manufacturing, retrofitting and overhauling of grinding and super-finishing machines.

Based on the above analysis of Business Environment both internal and external, organization has concluded that NEI will be only in antifriction bearings and allied engineering products. In order to achieve the same, organization has decided to pursue the TQM process.

2.2 Mission & Vision

MISSION

- Grow in the business of anti friction bearings and other allied engineering products and services.
- To deliver superior value to our customers, suppliers, share holders, employees and society at large.
- Pursue excellence through Total Quality Management.

VISION

- To become a preferred antifriction bearings supplier in domestic market and focus on select export markets.

- To enhance our presence in allied engineering products & services.
- To attain Gross turnover of INR 50 billion by Yr. 2020-21

2.3 Business Planning Methodology

To understand the market landscape, NEI’s position, past growth patterns and derive the strategic shifts, a robust framework i.e. “where to play and how to win” (refer Fig 2.10) has been used. Based on this framework, long term projections are made and initiatives are created.

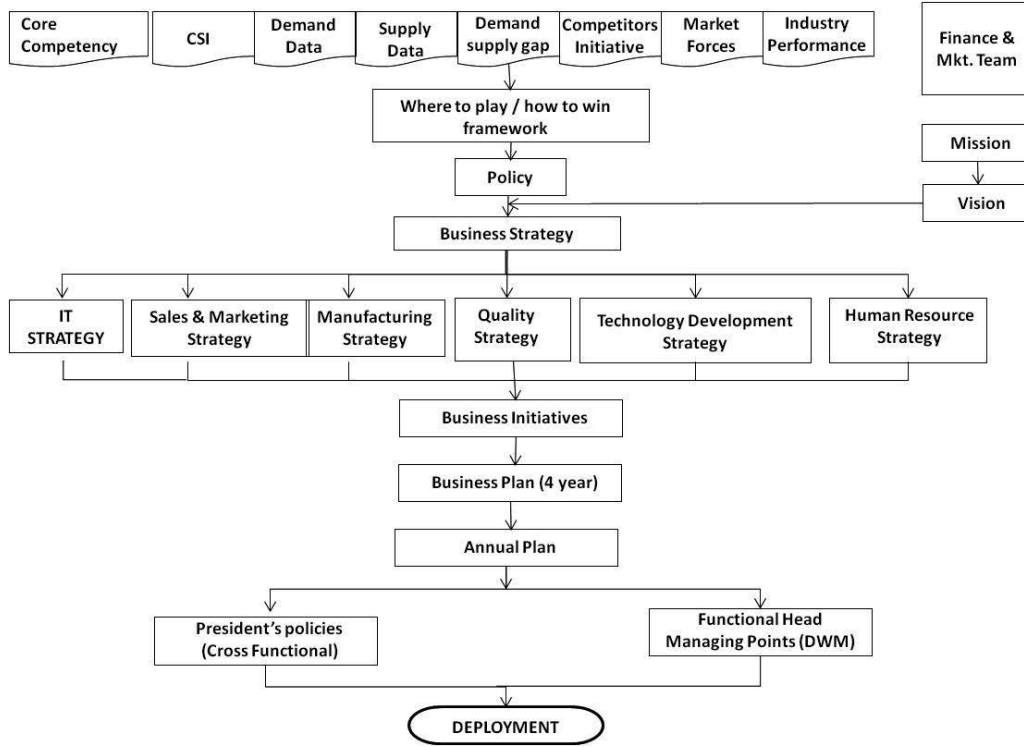


Fig 2.10 Policy Development Model

2.4 Management Strategies and TQM Objectives

Using the mechanism stated in article 2.3, NEI has formulated its policies, strategies and goals as under. The details of the process are explained in Chapter- 4.

*Linkages between the Policies, Business Strategy , Functional Strategy , Initiatives and Goals are shown by Specific colors.

Table 2.1: NEI Policies & Business Strategies

S.No	Long Term Policy	Business Strategy Long Term
1	Achieving excellence in sales and marketing : Increase Market share In organized domestic Bearing Market to 27%	1. Strengthening KAM process. 2. Increase Product range penetration. 3. Increase delivery of New Products. 4.Enlarge Aftermarket distribution channel to reach untapped area.
2	Achieving excellence in sales and marketing : Increase International business to 29% of total sales	1.Increase business in Auto QEMs & Tier 1 suppliers in Europe and USA 2.Strengthen In house quality system practices.
3	Become a bearing application solution provider to Customers.	1. Increase partnership projects of bearing application with OEM Customers. 2.Strengthen capability in application engineering , design & testing.
4	Achieving operational excellence	1. Improve OEE 2. Improve input supplier quality. 3. Strengthen installed best practices in manufacturing & quality. 4. Enhance problem solving capabilities. 5. Lean Procurement &Design
5	Enhance Turn Over by Merger and Acquisition By INR 1500 Mn.	Acquire company having : 1.Wide product range that can help in expanding NEI’s existing product range 2.Access to new customers in markets like NA and Europe; in both direct sales to OEMs and to distributors 3.Technology / R&D capabilities e.g. Gen 3, unitized bearings or any new technology

Table 2.2 Portion of Function wise Strategies , Initiatives & annual Goals

Function	Functional Strategy Long Term	Functional Initiative Long Term	Annual Goal 2015-16	Target	UOM
Research & Development	1.Deliver First Time Right New Products to Marketing on TIME	Align and expand the new product development pipeline from 72 to 100 projects by FY 19. Reduce NPD cycle time by - Strengthen APQP Process. Strengthen DFMEA documentation. Implement usage of DRBFMEA.	Align and expand the new product development pipeline	ND	ND
			.New product development cycle time in Days (Revised) to category wise New products.	ND	ND
	1.Maximize RFQ's from these Countries 2.Strengthen & establish Technical Support capability in focused export area. 3.Adhere to quality system practices.	Scale up R&D capability in application engineering, program management, design & testing functions by – Stationing Application Engineering with key clients, certification programs in Application Engineering and PM and implementing design automation in Product & Tool Design	To Place application engineer In Europe	ND	ND
	Develop partnerships with customers Focus on development of advance technology products Stationing Application Engineers with key clients,	Develop partnerships with customers from 14 to 20 by organizing tech days, joint VA/ VE projects and increasing Engineer Interactions with Key accounts	Number of joint product developments undertaken with R&D teams of OEs	ND	ND
	a.Technology up gradation to facilitate manufacturing excellence. b. Best In Class Capex	Development of integrated and value added products and Technologies by - Development of Gen 3 and Unitized bearings, One way clutch, Pre-set Hubs, Integrated pinion bearing solution Embed 'Best in Class' capex practices to improve Sales to Investment ratio by 10% in the next capex initiative Explore backward integration - To collaborate with part supplier to set up new forging plant for bigger size TRB rings (Cup & Cone)	Embed 'Best in Class' capex practices	ND	ND
Marketing	1. To strengthen KAM capability in getting new business, by increased technical interaction with customers. 2.Appoint New Sockists & Dealers covering Both Industrial and Auto segment After Market	1.Increase market share in auto OEM from 21.7% to 24.7% by FY19 by increasing market share in 2/3 W, CV and in UV 2.Gain M Share in Electric Motors and pumps segment from 4.9% to 9.9% and 5.9% to 11.6% through popularizing low noise bearings and entering into new markets 3.Increase market share in replacement market from 9.8% to 13.2% by increasing auto market share from 23.9% to 32.3% and industrial market share from 5.3% to 7.2% 4.Scale up large dia business & increase market share from 2.6% to 6.1% by focusing on power and steel segment 5.Scale up Rly Brg business by increasing market share in locomotive, coach & wagon segments from 34.0% to 39.6%; increasing export sales; developing bearings for higher axial loads, metro rails etc.	Revenues from domestic Market-Non-Railways	ND	ND
			Revenues from Railways domestic Market (Cr. Rs.)	ND	ND
	1.Having resident Sales managers and offices in EU and Europe 2. penetration in LATAM market in select countries and expand business in Private Label in USA 3.Increasing Overseas Presence 4.RFQ Participation 5.Promotional Activities- 6.Strengthening Team 6.Inception of Special Tools	Target Auto OEMs & Tier 1 Suppliers to achieve sales of Rs 590.0 Cr from Rs 157.5 Cr by FY '19 by – keeping a healthy RFQ pipeline, NFD Project Implementation for DAIMLER, MX65 Project Management GETRAG, LITENS resource project, supplies to DANA, USA, having resident Sales managers and offices in EU and Europe	Exports - Railways (Cr. Rs.)	ND	ND
			Exports - Non-Railways (Cr. Rs.)	ND	ND

*ND- Not to be Disclose

CHAPTER 3 – TQM SCHEMES FOR THE REALIZATION OF MANAGEMENT STRATEGIES

3.1 Purpose & Role of TQM

3.1.1 Purpose of TQM is to achieve business goals through effective and efficient continuous improvement in quality of products and people and develop suitable systems to sustain the results and meeting the growing customer requirements.

3.1.2 Role and expectation from TQM is to integrate all organizational functions (Marketing, Manufacturing, Research Development, Finance, QA and HR etc.) to focus on meeting the business goals & customer needs through Customer focus, QC ways of thinking (i.e. fact based control of processes and standardization), Quality Management Systems, Policy Management, Product & process design, Human Resource Management, Daily Work Management and Total Employee Involvement.

3.2 Explanation of NEI's TQM Model

Under the top management's leadership and guidance NEI has formulated the framework of TQM which is the combination of the elements of TQM and overall business performance as displayed in the NEI TQM Model, Fig

3.1.

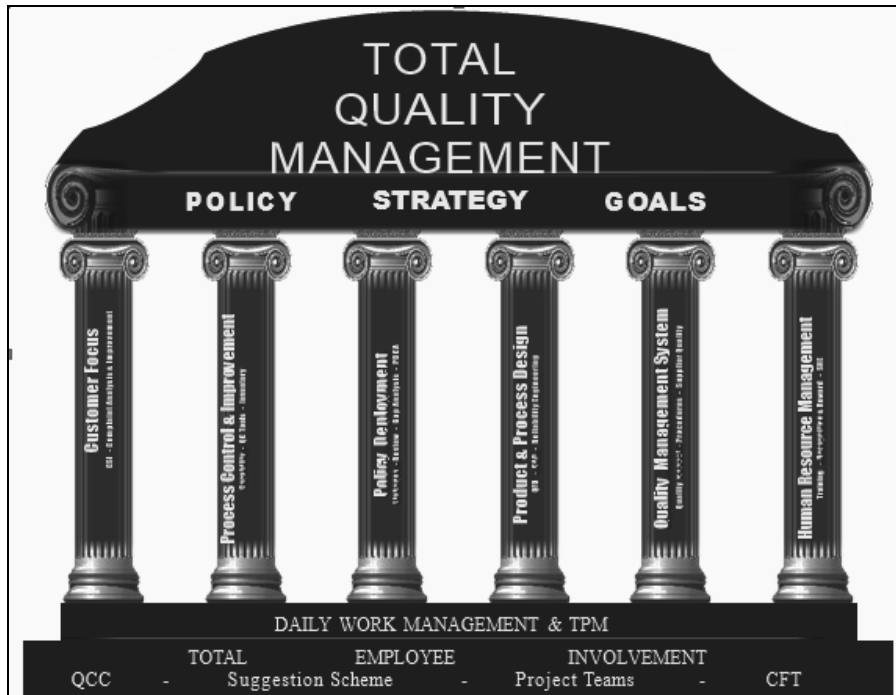


Fig 3.1 NEI TQM Model

The TQM framework is established with an objective of achieving overall business goals through improvement in the following three key elements:

- a) **Customer satisfaction:** Is important as it measures our product quality and service quality with our competitors. Use of customer satisfaction information provides a focus and direction for continuous improvement through out the organization. It gives important feedback covering important key elements such as quality, delivery, cost, technology, management and brand Image.
- b) **Employee satisfaction:** To achieve excellent performance in an organization it requires employees who are satisfied, motivated and committed. NEI periodically evaluate the employee satisfaction level and suitable initiatives are planned and implemented. NEI has developed necessary systems to improve employee satisfaction through performance evaluation, recognition and reward systems, promotion opportunities, career development etc.
- c) **Business Excellence:** NEI has improved the business planning process to forecast, study, and identify the business environment. Based on the study long term and short term business goals are arrived. This is the highest level of

reflection of a firm's performance implementing TQM. Excellent results of annual sales, annual sales growth, profits, market share and exports are the measurable objectives that NEI has to achieve.

Explanation of Six Pillars: The above three objectives of overall business performance are achieved with the support of following six pillars:

1. Customer Focus
2. Process Control And Improvement
3. Policy Deployment
4. Product And Process Design
5. Quality Management System
6. Human Resource Management

3.2.1 Customer focus

(i) Customer Satisfaction: Annual customer satisfaction survey is conducted by sales and marketing to measure the customer satisfaction level. NEI has utilized its own team/external agency to conduct this exercise in the past. The current CSI track is being conducted by M/s IMRB.

The Satisfaction survey covers the important parameters as shown in form for Customer Satisfaction Index (CSI) Survey (Table 3.1). Customer rating is obtained on the various parameters like quality, cost, delivery, technology, management and brand image. These data are collected from the actual user of the customers like purchase, production, R&D and Quality representatives. These ratings are compiled using the weightage assigned to each parameter on a separate format to arrive at a final index. Market research activity is done to identify customer needs and change in needs. These are addressed to the design & development department for product development as Voice of Customer.

Table 3.1 Customer Satisfaction Index (CSI) Study for 2013-14 by IMRB: Parameters of Study]

Product Features	Performance	Availability and Delivery	Customer Service and Communication	Technical aspects
Dimension as per drawing	Life of the bearing in warranty	Range of bearings that the brand has	Accessibility of the vendor personnel	Engineering capability
Load rating/bearing capacity	Line rejections	Price	Speed of response	Response towards new product development requests
Quality of material used	Traceability in case of failure	Lead Time	Quality of response	New product development speed
Quality and quantity of lubrication		Accuracy of delivery timing	Company related updates from vendor – newsletter, emails,	Performance during testing of new products developed
Quality and adequacy of marking		Accuracy of delivery quantity	Technical shows and meetings conducted	Support to improve product quality and efficiency
Finishing of the bearing		Payment Terms	Adequate amount of visits made by vendors – sales/R&D	Support towards cost reduction
Quality of packaging		Ability to meet emergency requirement		Technical competence of personnel on vendor side
				Quality of compliant resolution

(ii) Quality Improvement: NEI has focused on quality improvement across entire supply chain through monitoring of Process and Gap analysis identified in various DRMs & management reviews. The quality assurance is being driven through process approach. Every scope of improvement is looked at as 'Continues improvement' opportunity and Root cause analysis (RCA) is done and countermeasures are implemented with an aim of prevention of occurrence. Continuous improvement projects are taken up every year on severe & chronic problems.

(iii) Customer Complaint Resolution: Customer complaint resolution is considered as opportunity for immediate customer satisfaction enhancement. Hence Quality improvement division plays central role in resolution of customer complaints. Customer complaint resolution is taken up on high priority and NEI QA drives for faster resolution of complaints. The resolution duration is measured & monitored for each complaint.

In QA division, Customer Service Cell (CSC) team is dedicated for this activity. Complaints from customers (Both OEM & Trade) are routed to this cell directly or through sales and marketing where they are centrally compiled. The complaint is acknowledged promptly to the customer by CSC team. Under CSC leadership, a CFT is formed which does RCA for Arriving at the root cause & is fixed through a validated corrective action. Corrective actions are

implemented and standardized by respective process owners. Mainly 8-D technique is used to resolve any complaint thoroughly.

For ensuring effectiveness of actions taken, planned audit is done by CSC for verifying actions taken. '3A' (Absence, Adequacy & Adherence) principle is used to monitor each complaint resolution for one year to avoid repetition & for effectiveness of action taken.

(iv) Reduction in Warranty Returns: Warranty claims are handled by the R&D team; they verify the authenticity & claim is settled with customer. Warranty is analyzed for failure, Root cause is identified & eliminated, it is monitored for a specified duration, and then standardization of related processes and documents is done.

3.2.2 Process Control and Improvement

The processes are monitored and maintained using Process Quality Check Sheets and Control Plan. For improving processes various improvements are done through Quality Circle activity, Poka-Yoke, daily Autonomous Maintenance (Jishu Hozen) activity of TPM. The improvements are also carried out based on feedback received from customers. The relevant documents are revised after making any such improvement.

1. Process Stability & Capability: To take care of variations, Run Charts are installed on critical processes and out of limit points are analyzed and actions taken, operators fill this chart on hourly basis. SPC studies are also carried out on regular basis to evaluate the process capability and maturity status. For improvement of processes, projects are taken by teams based on these studies.

2. Equipment maintenance: Preventive/Predictive maintenance is done to avoid failure by taking care of physical facilities pro-actively in a planned manner. Detailed analysis is done for Break downs repetitive or more than one hour, and permanent corrective actions are taken on the root cause to avoid any recurrence. Corrective maintenance is carried out for improving maintainability, production ability & safety. Predictive maintenance is done on select critical machines. To maintain product quality of critical operations periodic “health check” is carried out for ensuring the basic accuracies of the Equipment.

3. QC tools: Seven QC tools such as Pareto, cause and effect, stratification, histogram, scatter diagram, check sheet & process control chart are being used for monitoring and improving the processes. Higher level tools such as DOE and PM analysis are also being used for resolving chronic problems.

3.2.3 Policy Deployment

The policies developed using the mechanism explained in chapter 2 are deployed throughout the organization at all levels using structured Policy Development and Deployment process which is documented as a part of quality management system. The flow chart of development and deployment process is shown below in Fig 3.2. The details of the process are explained in the policy management (Chapter - 4). All policies are deployed to all the functional heads / departmental heads using a software application. This is also part of the daily Work Management system (DWM). The DWM covers all the managing points of the process owner. All the managing points are having appropriate metrics to ensure the continuous improvement approach forming as a part of culture.

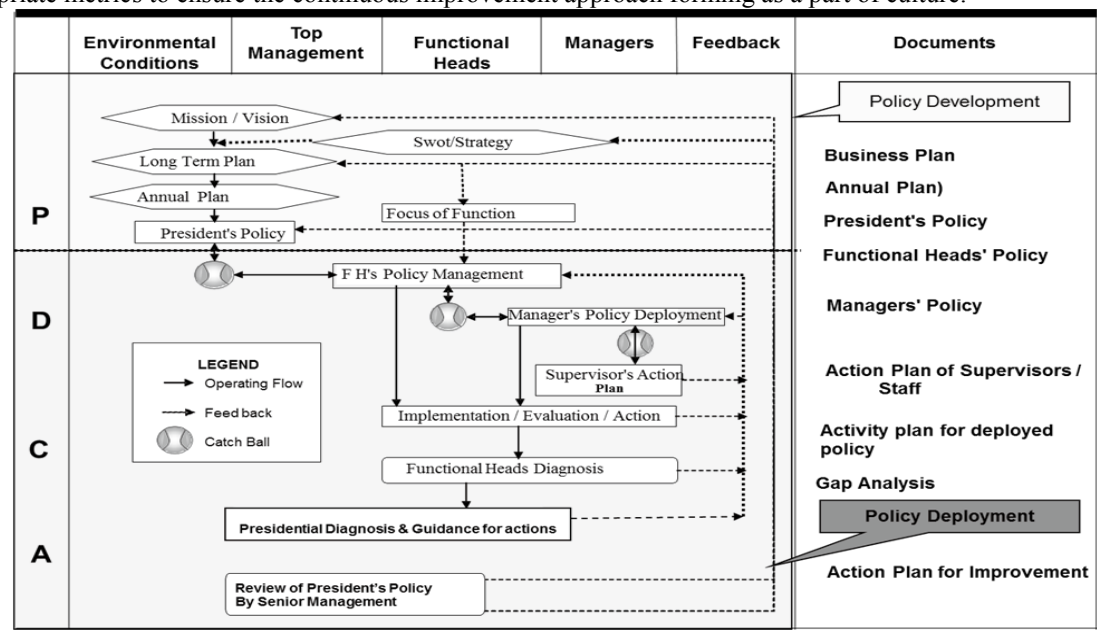


Fig 3.2 Policy Management process flow chart

Policy Deployment Process: Policy Deployment is done on line with help of a new software named I-bhar which is under advance level of implementation. This software is synonymous to PD forms which were being used earlier. This module is an effective tool for planning and tracking the progress of deployed policy items. The review mechanism is used for identifying gaps and giving feedback on barriers and bottlenecks.

3.2.4 Product and Process Design

The effectiveness of customer satisfaction is achieved by the effectiveness of the product & process design. NEI has exclusive R&D department responsible for meeting the product design requirements as per customer needs or as per national /international standards. The R&D is equipped with latest Soft wares for design and simulation. The Design department uses effectively tools such as QFD for translating customer's voice to technical specification of the product and advanced software for designing simulation.

3.2.5 Quality Management System

NEI extensively embarked upon system improvement and implemented modern concepts of Total Quality Management. NEI has a well-established quality assurance system covering all stages of the business process viz. Planning, Design, Procurement of materials, Production, Customer Service and Quality audits. A detailed quality assurance system Flow chart is shown in chapter-4

In the Planning part the accuracy of inputs from the Customer and market is taken care of by taking data from established and authentic sources. The R&D takes care of Product and Process design quality taking reference from International / National standards, customer requirement and stage wise design reviews. The DFMEA preparation takes care of all potential failures due to design. The CFT of preparing DFMEA consists of members from Design, Production, Quality, Logistics, and Marketing so that no potential failure is missed. Regarding the Quality of input Material / Components, the selection of suppliers is based on established Supplier selection procedure, which covers the assessment of capabilities regarding Producing Quality, Adequate capacity expansion and skilled workmen.

Production Quality is monitored as per the control plan which is available at all the machines and is one of the guiding documents for the production staff and workmen. To attain consistency in quality, the machines are set as per the established processing conditions and the setup is approved by a setup approval document. Skilled workmen as per the requirement of the process and equipment are deployed. All the inspection Gauges and Masters are calibrated periodically as per their schedule as covered in gauge calibration procedure. NEI has a well-equipped Tool Room which supplies quality tools for production machines which plays a key role in product quality.

Quality system audits are carried out by internal and external auditors periodically as per plan. Quality system audits cover adherence to ISO / TS, EMS, IRIS & AAR Procedures wherever applicable.

3.2.6 Human Resource Management

The Human Resources Management (HRM) function includes a variety of activities, and key responsibilities among them are Recruitment & Selection, Training and Development along with leadership development and Employee Involvement and Motivation. The Human Resource Department has initiated a unique activity, On Line Performance Management System. In 2013-14, NEI has improved on the paper and pen system of Performance Management System and migrated to an online digital system. This new system while keeping the essence of policy deployment, facilitates online review of all managing points and check points for the entire staff at any given point in time. It enables managers to assess performance and review as and when required.

3.2.7 Daily Work Management

NEI has replaced the e-Log book and PD forms, with a software application which handles shift supervisors log, daily production and Policy deployment. The software enables manufacturing to log production and losses on hourly basis. Repetitive routine problems are taken up by QC teams, un-solved problems are compiled by the general Shift supervisor and are discussed with production manager in the meeting where all the departmental heads (production, maintenance, grinding, heat treatment etc.) are present. Solutions are discussed and decisions are taken by the team accordingly. Major problems or repetitive problems are assigned to members as a part problem solving projects.

A Structured review mechanism for Daily, Weekly, Monthly & Quarterly review is followed by the employees. Display of performance graphs and charts on the shop floor are some of the means of communicating to the workmen. Other initiatives taken for DWM are development and usage of Production Planning Sheets (PPS), Work Instructions, First Piece OK , Visual segregation of rejection on production line. These initiatives will be covered in detail in chapter-4.

3.2.8 TPM

While practicing all 8 pillars of TPM simultaneously, the major thrust area is Autonomous Maintenance. Through TPM, NEI has established a structured planned maintenance system, education and training, Safety, Health and environment, leading to many improvements through regular Kaizen activity.

All manufacturing areas perform daily autonomous maintenance activity in which the operators clean, lubricate and inspect their equipment. Regular audit of autonomous maintenance is done in a 3 tier system in which the circle leader, TPM Secretariat and the head of the division, audit the equipment. This has helped in reducing the breakdown of equipments. NEI received TPM awards for Newai and Jaipur Plants in 2007 & 2008 respectively.



Fig 3.4 TPM Awards

3.2.9 Total Employee Involvement

The strength to all the above six supporting elements is built on strong base of employee involvement using Quality Circles, Suggestions, Project teams and Cross Functional teams. Problems taken up by these teams & circles are derived from tools of daily work management and TPM activities. Some of the tools used are

- a) **Quality Circle:** One of the team work approach to continuous improvement is involvement of workmen through formation of groups called Quality Circles. These groups are specific to a work area and are brought together to identify potential improvements. The NEI approach is as follows. Education and awareness program is done for workers on improvement through Quality Circles. Identification and formation of groups is done. Registration of groups is done followed by training on simple problem solving tools. Problems are identified and taken as small improvement projects. Projects after completion are presented at divisional level. Selected Groups are awarded at the company level. And finally new project is taken by the group. Presently, NEI has 152 Quality circles involving 100% workmen covering all three plants. 50 % of the total circles completed one project each in year 2014-15. Various circles have won state and national level prizes in the same year organized by Quality Circles Forum of India (QCFI) and Confederation of Indian Industries (CII).
- b) **Suggestion scheme:** Suggestions for improvement are actively sought and rewarded by the company Management, with the support of front line supervisors which make every effort to encourage employees to submit valuable ideas they might have for improvement. In this way a strong culture of continuous improvement which enlists the active participation of all employees has been established. The suggestion scheme process has been updated as follows. Suggestion day plan for each department, once in a quarter (which was earlier once in a year) is planned as per the monthly plan and Suggestion day is conducted. Received suggestions are registered and Distribution of Token money is made to the employees as per entitlement. Evaluation of all suggestions by Evaluator for Acceptance or Rejection is done. Distribution of Accepted Suggestion Award for Accepted Suggestions as per entitlement is done followed by implementation of accepted suggestions by concerned department. The number of suggestions received from the employees has remarkable increment showing greater involvement of the employees against previous years. Also the number of suggestions per man per year target has also increased along with the amplification in percentage of implemented suggestions against the accepted suggestions. Employees are awarded after the implementation of suggestion as per the entitlement. This process has led to better Cost saving in the company.
- c) **Project & Cross Functional Teams:** Big problems or challenging task achieving problems are assigned to project teams and Cross functional teams. Cross functional teams are formed for involving managerial staff from different divisions, such as production, design, marketing, maintenance, logistics and purchase. Projects are identified through Gaps in Policy deployment Items and Daily Work Management and assigned to project teams. The problem solving projects are carried out methodically using 7 QC tools & SPC techniques. Cross functional teams are formed for process improvement, New Product Development and Customer feedback.

3.3 Outstanding TQM Activities (Unique Activities) - Summary

Activities are planned and done for improvement of Quality at all levels, and some of these activities can be listed as unique activities of NEI, which are mentioned below. These activities are explained in detail in Chapter 4.

3.3.1 Daily Work Management

The Daily Work Management (DWM) system in NEI is followed across all manufacturing locations of NEI with similar activities. The DWM takes care of the maintenance function as well as improvement function which has

resulted in achieving desired operational excellence parameters. The DWM in manufacturing covers complete PDCA cycle. The cycle starts from daily production plan, hourly recording, 3 levels of meetings between operations, maintenance and engineering on daily performance, gap analysis, if any, and finally taking corrective actions are done. Quality related recordings like daily filling of Process Quality Check Sheets, Poka-Yoke checking, Run chart filling are also part of DWM. To collect the rejections sorted on its place of generation Physical Pareto initiative is taken with color coding for better visual where the operator sorts the rejection according to the defect.

As part of the DWM, in the final level Meeting, the Managers meet at the DWM gallery and plan out improvement actions besides analyzing the gaps in Production, quality, breakdowns, absenteeism, & safety.

This activity is unique because it involves not only manufacturing function but support functions also like Purchase, Marketing, and Stores etc. and wherever necessary other functional representatives are also called.

3.3.2 Customer participation in NEI Supplier Meet

Starting year 2011, NEI started organizing supplier Meets to have close interaction with its suppliers.

The objective is to communicate fast changing customer expectations from NEI and hence the need to keep pace with the change. The uniqueness is that NEI invites senior representatives of their customer to participate in the meet and address their expectations to the suppliers

3.3.3. Product reliability testing-NEI's uniqueness is that, it is having its own Product life testing facility and is one of the first such facilities in India. This gives an advantage to NEI over competitors who depend on third party or on their principal facilities located elsewhere. This facilitates NEI to test & validate the developed products as per customer needs, thereby ensuring customer satisfaction, minimizing product risks and meeting warranty targets. NEI has capability to carryout Endurance testing for Ball Bearings, DRAC Bearings, Tapered roller Bearings and Cylindrical roller Bearings. NEI also have capability carry out system level testing for various applications like Transmission, Axle, differential, Engine Auxiliary drive and Railways.

3.3.4 Partnership projects with customers-To build customer relationship and understand customer needs in better way NEI has initiated this unique activity of partnering projects with customers which is a step forward towards 'Customer delight'. NEI Application Engineering team collaborates with customer during project initiation stage. It helps customers to select the right bearing solution based on understanding of their requirements. This is helping to gain customer confidence on the technical aspects of the application and thus NEI plays the role of a solution provider which is also one of the company Policies.

3.3.5 Flexi Work timings policy – Flexi Work Timings with the objective to enable a better work life balance for our employees as well as to provide flexibility to cater to individual needs, company has introduced the 'Flexi Work Timings Policy' along with changed work hours.

Flexi-time is a variable work schedule, in contrast to traditional work arrangements. According to policy, an employee can choose the Punch-In time with a flexibility of maximum 1 hour prior or post general office hours while ensuring 9 hours completion in a day excluding lunch break.

This is a unique initiative in a manufacturing industry where employees work generally as teams and good amount of internal communication is required between each other. As NEI has kept one hour flexibility it does not adversely affect the company output, rather releases pressure from employees as he can now cater to his personal needs also more conveniently.

CHAPTER 4 – IMPLEMENTATION STATUS OF TQM

4.1 Policy Management

NEI adopted the concept of management by policy as shown in Fig 4.1, the policy management process flow diagram, is consisting of both development of policy and deployment of policy differentiated by two different colors, yellow for development and blue for deployment.

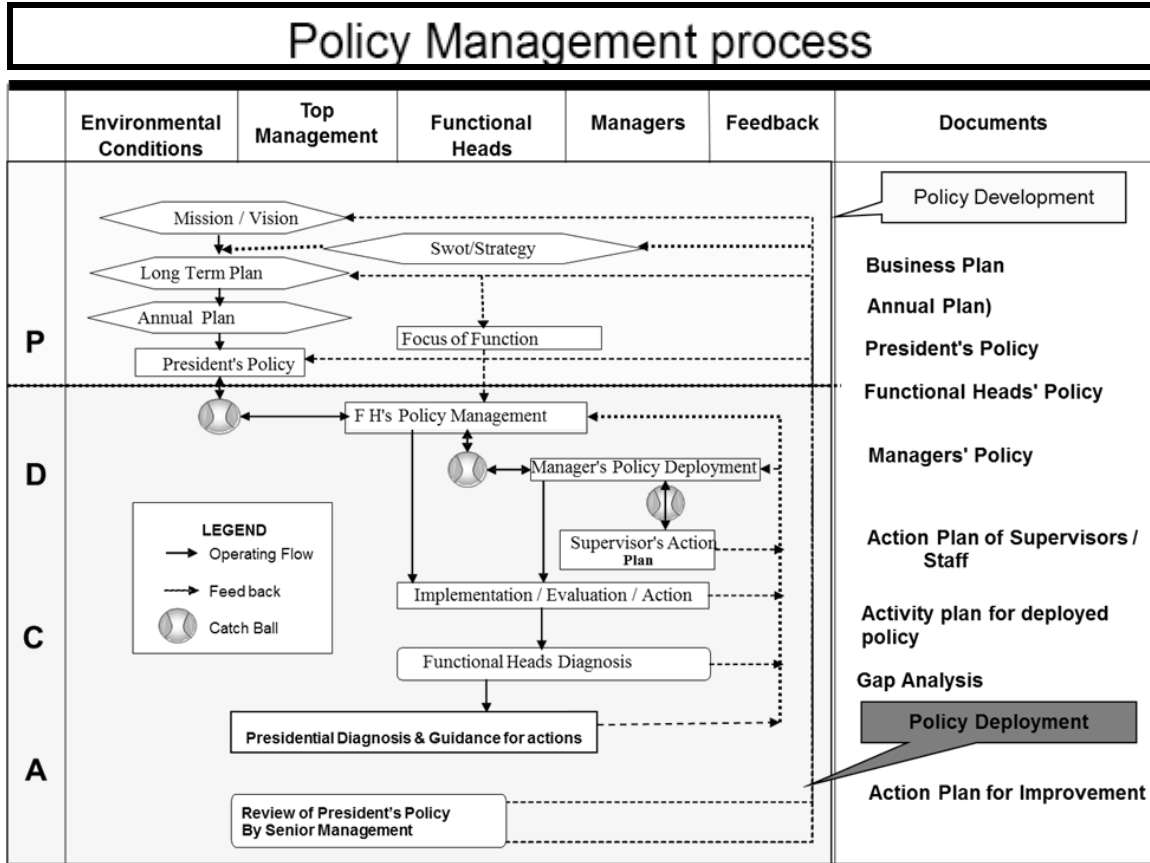


Fig 4.1 Policy Management Process Flow Diagram

The policy management process at NEI is to formulate the Policy development and deployment system leading to long term business plan and Annual plan and its implementation in the organization. This process is applicable to all divisions of Jaipur, Newai and Manesar Plants and is approved by Functional Head (Finance) and issued by TQM Secretariat. All Functional Heads and Departmental Heads are responsible for implementing this process. The President defines a Core Team for the Policy development and deployment Process and identifies a Business Planning Manager (FH Finance) from the Core Team members. This team reviews the Mission & Vision statement and modifies the same if required. The process involves a number of meetings and discussions and after the team agrees the statements/statement is changed.

NEI's Mission and Vision are as under:

MISSION

- Grow in the business of anti-friction bearings and other allied engineering products and services
- To deliver superior value to our customers, suppliers, shareholders, employees and society at large.
- Pursue excellence through total quality management.

VISION

- To become a preferred antifriction bearings supplier in domestic market and focus on select export markets.
- To enhance our presence in allied engineering products and services.
- To attain Gross turnover of INR 50 billion by Yr. 2020
- Driven by the Mission and Vision statement, development of President's policy takes place as per the detailed process below.

4.1.1 Policy Development

The policy development is shown by yellow color in Policy Management Process Model of Fig 4.1. Policy & Strategy Development Model, Fig 4.2, describes the process of development of Policy & Strategy along with annual plan. The basis of the development process is formed on data collected and presented by marketing and Finance teams. The marketing department presents the data on the business environment vis a vis Demand, Supply, Demand supply gap, competition and market forces. The finance department presents the data on industry performance and Business unit operating performance.

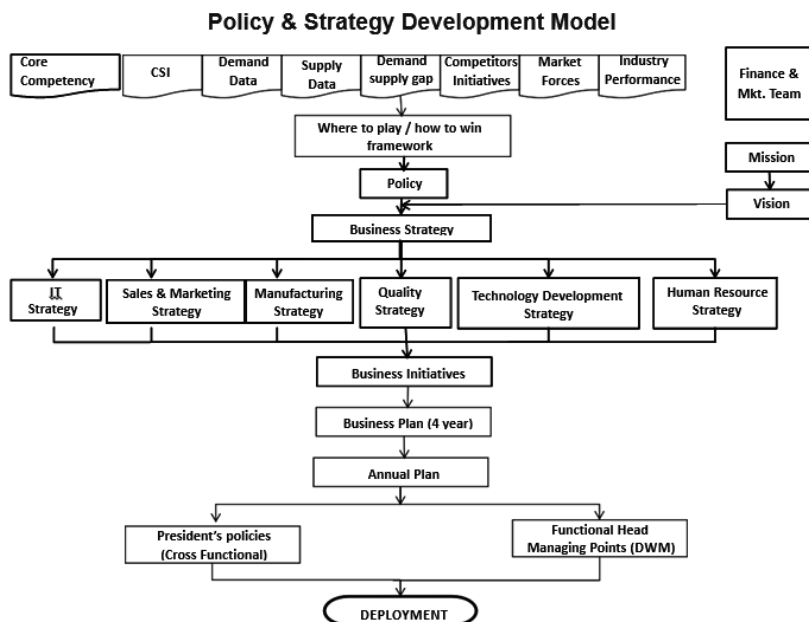


Fig 4.2 Policy & Strategy Development Model

The presentations by Marketing and Finance department cover both external and internal business environment. Along with the above external data and internal performance indicators where to play analysis is done and themes are framed for formation of strategy on how to win.

4.1.2 Policy Deployment

The Presidents Policy items derived from the development process are further deployed down the line as shown in blue color in policy management model Fig 4.1

The Policy deployment method using Excel has now been computerized using customized software called I-Bhar, thus enabling seamless integration of policies and goals down the line. With the help of computerization, It is now easy to track gaps identify cause and record tasks and actions to bridge the gaps. This system is a web based application which is accessible any time anywhere to the Management & has been developed post Deming Prize Award. This system has helped in eliminating excel based Policy Deployment forms. The figures 4.3 & 4.4 below explain the various features of deployment, review and gap analysis of goals.

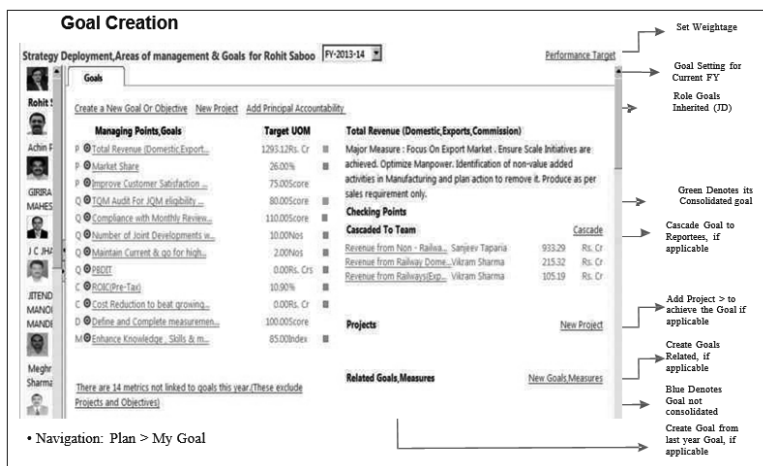


Fig 4.3 Snapshot of Policy Deployment (PD) of the President and CEO in I-bhar System

Explanation of Review and gap analysis:

The Snapshot shown below contains results against plan and is checked. For identified gaps, the root cause analysis is carried out and a detailed action plan is drawn to achieve the target. This form also contains the name of responsible person and implementation status of the planned activity as shown below in Fig 4.4

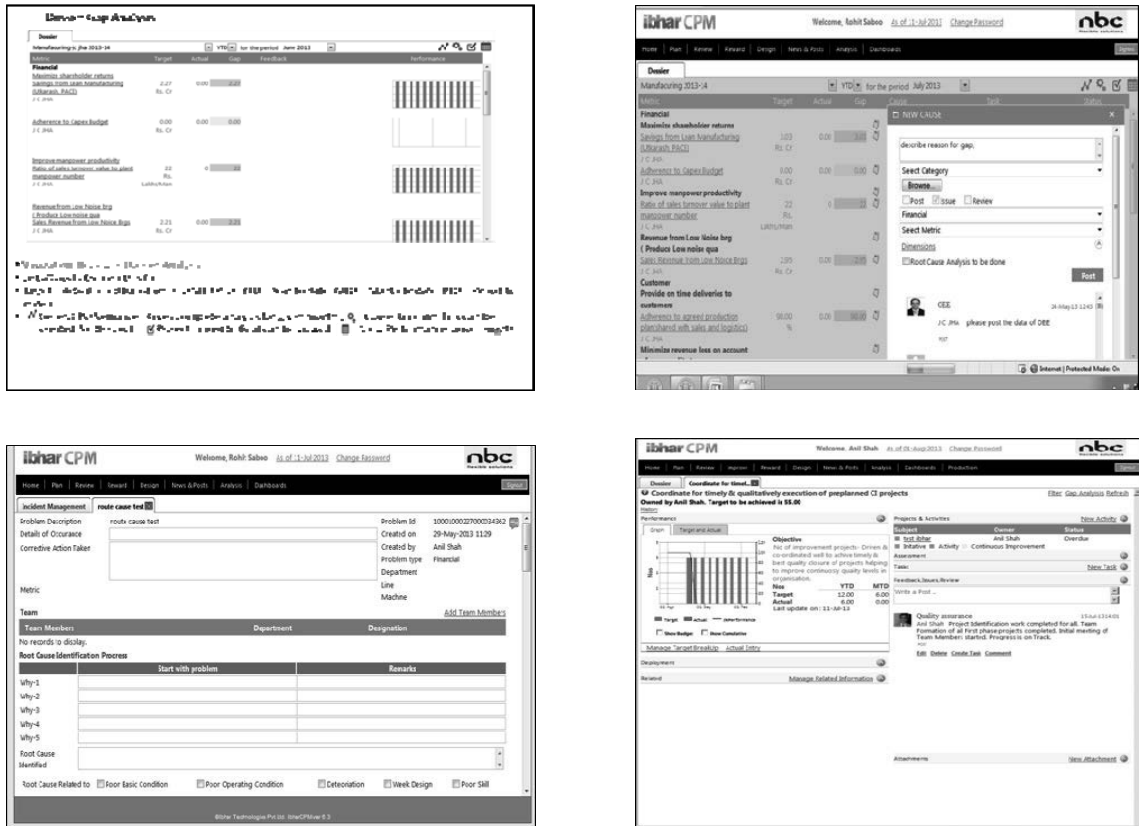


Fig 4.4 shows pages for reviewing and gap analysis

4.2 Daily Work Management

4.2.1 Production recording and problem analysis

In all manufacturing plants production and loss is recorded on hourly basis. The production recording sheet contains hourly standard production value and actual production numbers. The sheet also contains space for recording loss time and its details. All this is filled by the operator. The shift supervisor checks the filled data hourly and initiate any correction or corrective action as per requirement. Once in every shift a "Performance Dialogue"(PD) session is done between operator, production supervisor and maintenance supervisor to check and ensure smooth production. The PD session is done on the shop floor and findings or actions are recorded in the production recording sheet at specified location as shown in Fig. 4.5.

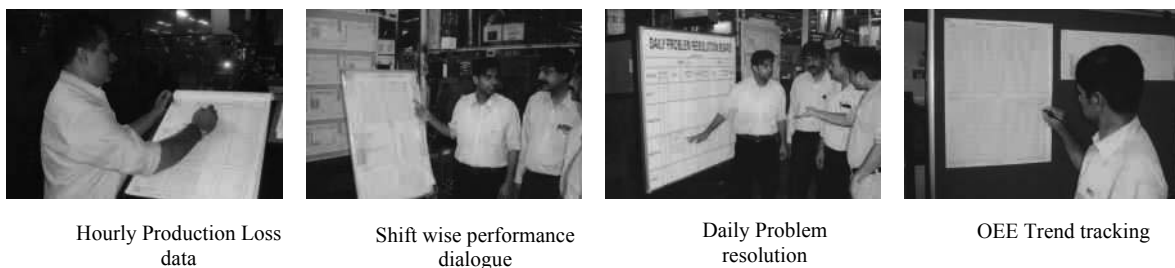


Fig.- 4.5 Views of production recording & problem resolution activities on shop Floor

Use of the Quality Assurance Matrix shown in Fig. 4.6, is done for spot analysis. This Matrix is available on production lines at suitable locations and is prepared in local language also.

QA MATRIX FOR BORE OPERATION															
4M	CAUSES	DEFECTS	BORE SIZE VARIATION	BORE TAPER	OUT OF ROUND IN BORE	BORE ROUGHNES S NOT OK	BORE CHATTERS	BELL SHAPE IN BORE	BARREL SHAPE IN BORE	GRINDING BURNS IN BORE					
MAN	FINGER REMAIN LOSE ON FINGER MOUNTING BRACKET		●												
	LOSENESS OF GAUGE HEAD ON GAUGE BLOCK		●												
	LOSENESS OF GAUGE BLOCK		●												
	LOSE CLAMPING OF WHEEL BY WHEEL HEAD BOLT			●			●								
MACHINE	REPEATIBILITY OF GAUGE HEAD IS NOT CONSISTENCE		●												
	WORK HEAD BEARING IS NOT OK			●	●	●	●								
	SPINDLE BEARING IS NOT OK			●	●	●	●								
	GRINDING WHEEL BEHAVING SOFTER			●		●									
METHOD	GRINDING WHEEL IS BEHAVING HARDER				●	●									
	DIAMOND POINT OF GAUGE FINGER IS NOT TOUCHING THE BORE		●												
	SHOE IS NOT HAVING A SINGLE BLUE LINE		●												
	POSITION OF BACKING PLATE WITH RESPECT TO SHOE IS NOT OK		●												
MATERIAL	LESSER SPARK OUT TIME		●	●											
	HEAVY SIZE VARIATION IN INFEEED MATERIAL		●												
	INFEEED MATERIAL IS HAVING A HIGHER SIDE OVALITY			●											
	INFEEED MATERIAL IS HAVING HIGH OUT OF ROUND PROBLEM				●										
	FINGER IS HAVING A WRONG FIXING OF DIAMOND		●												
			●	MOSTLY LIKE CAUSE TO BE ATTAIN FIRST WHILE PROBLEM RISES							●	LIKE CAUSES TO BE ATTAIN AFTER MOSTLY LIKE CAUSES WHILE PROBLEM RISES			

Fig.- 4.6 View of QA Matrix

Everyday a shop floor meeting is done by the General shift Managers in shop floor near a Problem Resolution Board. The meeting is attended by production, maintenance, tool room managers and problems of previous day are discussed and resolved. For any higher level unresolved problem root cause analysis is done and the actions arrived there of are taken up by responsible persons.

These activities on the shop floor with involvement of first line employees motivates them and helps in immediate resolution of problems. Any further unresolved shop floor issue is discussed in the daily Divisional level meeting chaired by the Plant head. Problem solving projects are taken for higher level / chronic problems and is assigned to specific Teams.

The data of production and loss time is transferred in computer in software named I-Bhar which is the main data base. Using this data, trends of production, line wise/ machine wise/ loss wise data is summarized and reports are generated which are used for taking any corrective action required. Trend of OEE is plotted daily on shop floor board by hand which gives immediate feedback to all operations staff about the performance.

4.2.2 Segregation of rejected parts on production line- Physical Pareto

The rejection (scrap and rework) on a production line were earlier segregated off line for knowing the next level defect. A new initiative have been taken wherein the operator segregates the rejects defect wise on his line and keeps the parts on pre marked location near the inspection table as shown in Fig.4.7. This way the operator immediately knows the defect data and takes immediate action, also additional segregation activity is eliminated



Fig. - 4.7 View of defect Wise segregation stand

NEI - Maintenance Management System

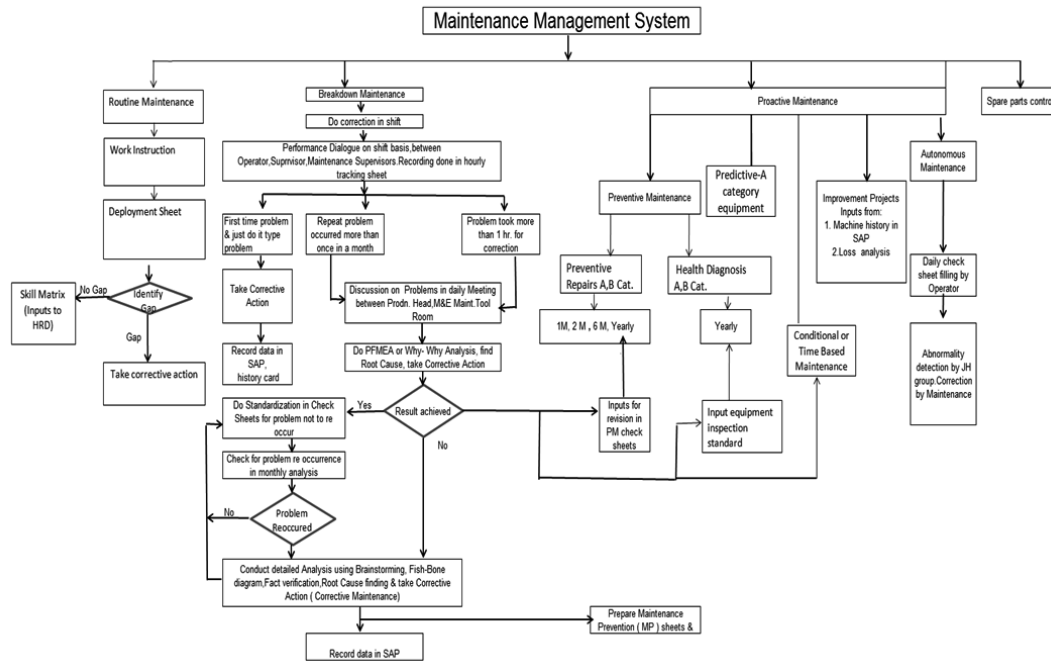


Fig. - 4. 10 Maintenance Management system

4.3 Process Control

Process control in an engineering Industry is essential for controlling the output of a specific process. The bearing manufacturing technology involves automated processes, batch process and also discrete processes. Process Stability and Capability studies are carried out for all the divisions. Whichever process is unstable necessary corrective measures are carried out to bring the process under control. Improvement projects are also taken for improving process capability of processes. All critical processes are monitored through statistical control methods. Quality control plans are developed and implemented across all processes.

4.4 Cross Functional Activities

To facilitate certain important activities, Cross Functional Teams (CFT) are formed in NEI, they are for:

- a) New Product Development
- b) Customer Returns
- c) Preparation of DFMEA document
- d) Preparation of PFMEA document
- e) Cost Reduction
- f) Problem Solving projects
- g) Global enquiries received for Purchase of Bearings
- h) Any other issue- which would be temporary

The above teams include members from Manufacturing (Production, Production Engineering, Maintenance ,Tool Room etc.) , R&D, QA, Logistics, Finance and others , as the need be.

4.5 Problem Solving Activities

NEI is giving major thrust on Problem solving through scientific approach. Projects are identified by various departments and Project Teams are formed to solve the problem. Following structured steps are adopted for Problem solving:

4.5.1 Training

Technical (Engineering) staff from all the Functions viz., R&D, QA, Production, Maintenance, Production Engineering, TQM were trained by very renowned trainers from Industry and Quality Institutions. The training included class room sessions which covered very basic contents followed by on the job trainings with actual problems taken on the shop floor. The formal was imparted in many sessions and levels from Functional Heads to shop supervision were covered.

4.5.2 Identification of the Problems

The problems are identified from recurring issues from daily routine activities regarding Production, Quality, analysis of Policy Deployment points where targets are not met, customer return issues, study of process maturity status and any other direction given by the Management.

4.5.3 Problem solving methodology

A team of concerned persons from same or different area is formed to solve the problem in a given target time.

The following steps are followed by the team for solving the problem:

1. Background / Scope of the Problem – This includes what / where is the problem, when it was first occurred, who is complaining, why is the person complaining, how big is the problem, why this project / problem selected etc.
2. Observing the Current Status - In this step various statistical tools are used to identify the current status of the problem.
 - a. Analysis of Factors - In this process we analyze the cause of the problem and also verify the cause by experimentation or by collecting data. Why- why analysis is carried out to find out the root cause (s), if necessary DOE tools are also used.
 - b. Countermeasure – This step shows the countermeasure (s) taken for pin pointed root cause (s). These include Immediate Action and Permanent Corrective Action.
3. Confirmation of Effect – Shows the comparison of the target in the Objective Statement and the actual results.
4. Implementation to Process / Standardization – After the confirmation of effect the result is implemented in the process. Standardization is carried out by modifying the check sheets, FMEA, control plan etc. Horizontal Deployment is also done in this phase.
5. Future Plan - Next issue for improvement or the list of possible next projects are identified for future.

4.5.4 Status of Problem solving projects

Problem solving projects is part of routine activities being done at NEI.

In the year 2013-14, 103 projects have been completed and results achieved. 9 projects were in progress & including them NEI has a target of completing 57 projects in the year 2014-15. Projects are being reviewed by respective Functional Heads and progress is monitored on a Tracking sheet which contains all steps of project methodology. All completed projects are then loaded on a common server which can be accessed by all and is part of knowledge sharing activity.

4.6 Quality Circle Activities

Quality Circle is now the part of manufacturing; it will be centrally monitored by manufacturing head. Quality Circles (QC) concept has been thoroughly absorbed into the culture of our organization. It helps operators in solving shop floor problems through the QC story approach. Employees' attitude has shown a visible paradigm shift from just being participative to shouldering responsibility and belongingness. The employees are demonstrating enthusiasm and motivation towards continual improvement. It helps in reducing cost, increase productivity and provides some potential benefits.

The activity planning of the quality circle system is elaborated in the following flow chart shown in Fig. 4.11.

In order to monitor the involvement of employees in quality circle, record of each employee is being maintained including the division and department. Presently 152 circles are registered across three plants, out of which 75 circles completed their projects this year. To promote the quality circle activity, yearly divisional level presentations are organized regularly; selected quality circles are promoted to state & national level competitions.

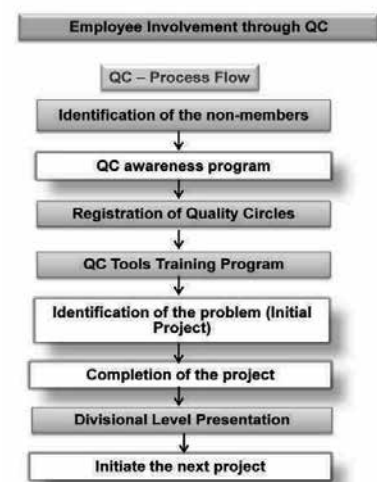


Fig 4.11 Quality Circle Flow chart

We held the internal quality circle competition in November last year for nominating best projects for participation in events organized by Quality Circle Forum of India (QCFI) and Confederation of Indian Industry (CII). Total 17 teams were given an opportunity to fight in state and national level competitions in 2014-15.

Also the achievements of quality circles are regularly highlighted in in-house magazine. Some of the glimpses are as follows shown in Fig. 4.12.



Fig. 4.12 showing some of the state and national level awards received from 2012 to 2014

4.12 Outstanding TQM Activities (Unique Activities)

4.12.1. Daily Work Management (DWM)

Daily Work Management is a unique activity for NEI Limited and horizontally deployed across all department. We are following DWM activities across all divisions as a path for perfection. Daily Work Management is the system that provides the ability to manage departments, functions, and processes where in processes are defined, standardized, control and improved by the process owners. It prevents backsliding by making control and improvement of the norm. Daily Management applies at all levels.

Level 1- Workers/Operators – Work for Retention/maintenance

Level 2- Engineer/Supervisor- Work for Continual Improvement

Level 3- Top management – Work for Breakthrough

4.12.1.1 DWM - Operator

Hourly Production Monitoring- In all manufacturing plants production and loss is recorded on hourly basis. The production recording sheet contains hourly standard production value and actual production numbers. The sheet also contains space for recording loss time and it's details. All this is filled by the operator. The shift supervisor checks the filled data hourly and initiates any correction or corrective action as per requirement.

Process Quality Check Sheet – To ensure quality operator checks quality parameters in sample as per control plan and records in PQCS shift wise

CLIR – Operator checks daily Cleaning, Lubrication, Inspection & Retightening points for individual machine

Run Chart – Operator fills run-chart in each hour for critical operation which increases operator's accountability and ultimately reduces process variation

First Piece OK – First Piece OK system ensures quality before start of shift which enhances workforce ownership. In each shift operator checks all quality parameters and keeps piece as first piece OK before starting shift

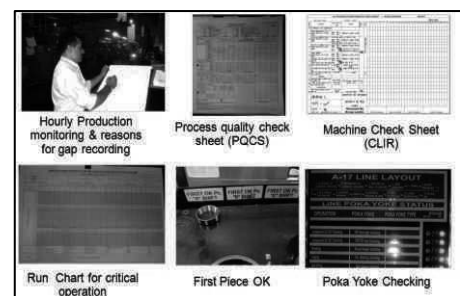


Fig. 4.13 operator daily routine

Poka-Yoke Checking- At the end of day status of each item on Poka-Yoke Board is switched to red by operator. Next Shift operator confirms status and switches on Green Light. If Poka-Yoke is not working, operator records non-working Poka-yoke in files and informs maintenance/ Production. Shift wise Poka-Yoke checking helps in assurance of OK material dispatch.

4.12.1.2 DWM – Supervisor

Once in every shift a “Performance Dialogue” (PD) session is done between operator, production supervisor and maintenance supervisor to check and ensure smooth production. The PD session is done on the shop floor and findings or actions are recorded in the production recording sheet at specified location. Everyday a shop floor meeting is done by the General shift Managers in shop floor near a Problem Resolution Board. The meeting is attended by production, maintenance; tool room managers and problems of previous day are discussed and resolved. For any higher level unresolved problem, root cause analysis is done and the actions arrived there of are taken up by responsible persons. These activities on the shop floor with involvement of first line employees motivate them and help in immediate resolution of problems.

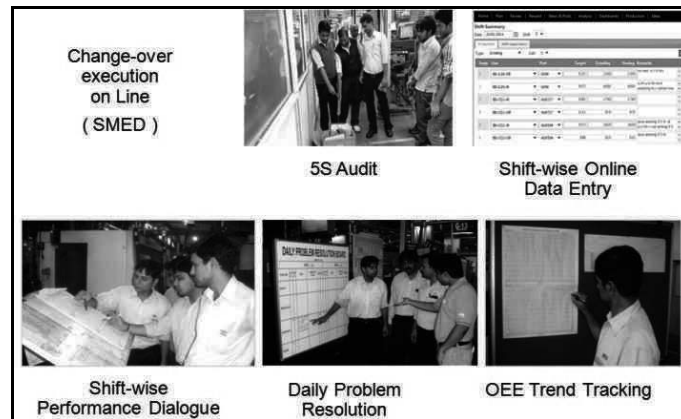


Fig. 4.14 Supervisor’s Daily Routine

4.12.1.3 DWM – Managers

Daily Meeting with Department Heads (Production, Maintenance, LPE and HT) is being done at DWM gallery with duration of 60 min. Gap analysis on all 8 Parameters of the Gap analysis wheel (shown in Fig. 4.15) is being done to arrive at root cause and plan Corrective actions.



Fig.- 4.15 Gap Analysis Wheel



Fig. 4.16 DWM Gallery – Location for Manager’s Daily Meeting

Problem solving projects are taken for higher level / chronic problems and are assigned to specific teams.

For sustenance we focus on Standardization, Exactness (Gap Analysis), Simplification & Visual Management.

Standardization: Standardization helps to minimize variations in materials, methods, equipment, and strategies. It establishes the base from which improvement is to be launched. After improvement it again standardized in processing condition, accuracy standard and other reference documents which gives continual improvement.

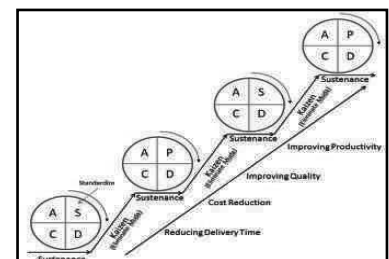


Fig. 4.17 Continual Improvement

After standardization data management comes which includes data monitoring and control to maintain performance levels and prevent backsliding.

Exactness: Exactness means “Do exactly what standard says” and do gap analysis wherever it is required.

Supplier Meet. In his presentation he conveyed the requirements related to quality, cost and deliveries as desired by the end users. The suppliers took the challenge on a very serious note since it was conveyed directly by the OEM. Many suppliers had a one to one interaction with the Maruti Suzuki Management and got to know the importance of their role in the final product quality and vehicle performance.

Similar exercise was repeated in year 2015 when V.P. Supply chain, TAFE India joined the NEI Suppliers Meet.

4.12.3 Product reliability testing

New product development demands reliability to be ensured in the products very first from prototype stage to the production stage so that the functionality can be ensured before the product submission to the customer. Therefore NEI equipped itself with system level test rigs to check bearing performance at prototype stage and therefore to save overall cost of development.

System level testing can produce more realistic environment and conditions to check the functionality of bearings when fitted in actual parts and run with actual test conditions. All system level test rigs have been developed on same approach. NEI is only bearing company in the country to have these kinds of test setups.

NEI testing lab has capability of system level testing which can simulate the duty cycles for wheel hub, live axle, idler pulley and transmission.

Wheel hub and live axle test rigs simulate running vehicle condition with cornering effect on the wheel hub. The hub performance along with the bearing can be analyzed as a whole. These rigs are capable of individual as well as resultant loading (Fig. a).

High speed high rpm test rig can simulate seal effectiveness under hot chamber conditions with mud ingress or dusty environment. The wrap angle can be maintained as in actual conditions and life assessment of the whole system can be analyzed (Fig. b).

Transmission test rig can simulate duty cycles for gear boxes, differential and transaxles as provided by the customer. This type of testing can estimate bearing performance in complete system.

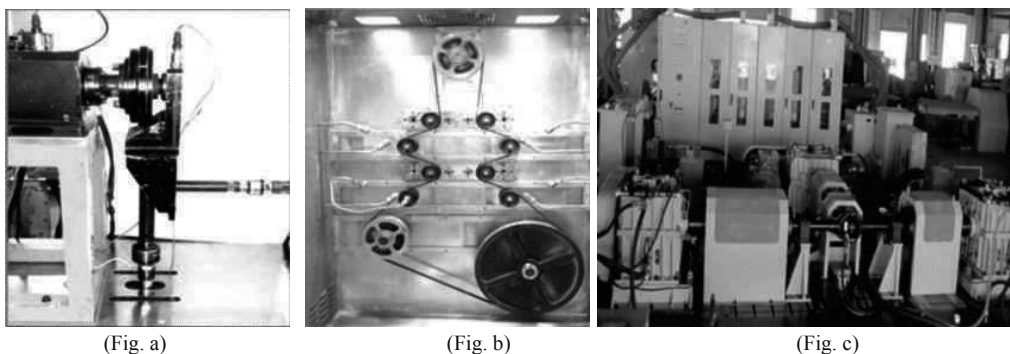


Fig 4.21 View of life testing machines for bearings

4.12.4 Partnership Projects with Customers

Fig.4.35 Customer Partnership Projects to build customer relationship and understand customer needs in better way an organisation needs to work closely with its customers.

NEI Application Engineering team collaborates with customer during project initiation stage. It helps customers to select the right bearing solution based on understanding of their requirements. This is an iterative process which involves both teams (at customer and NEI) to narrow down to a solution meeting requirements of both parties.

This has become a unique activity at NEI and is helping to gain customer confidence on the technical aspects of the solution. Fig. above shows the status of various partnership projects of NEI with its customers. The “Approved” and “In progress” projects for various business segments have been depicted in the fig.4.22.

The activity is helping NEI earn new business in Indian and overseas markets and also increase presence in existing customer base.

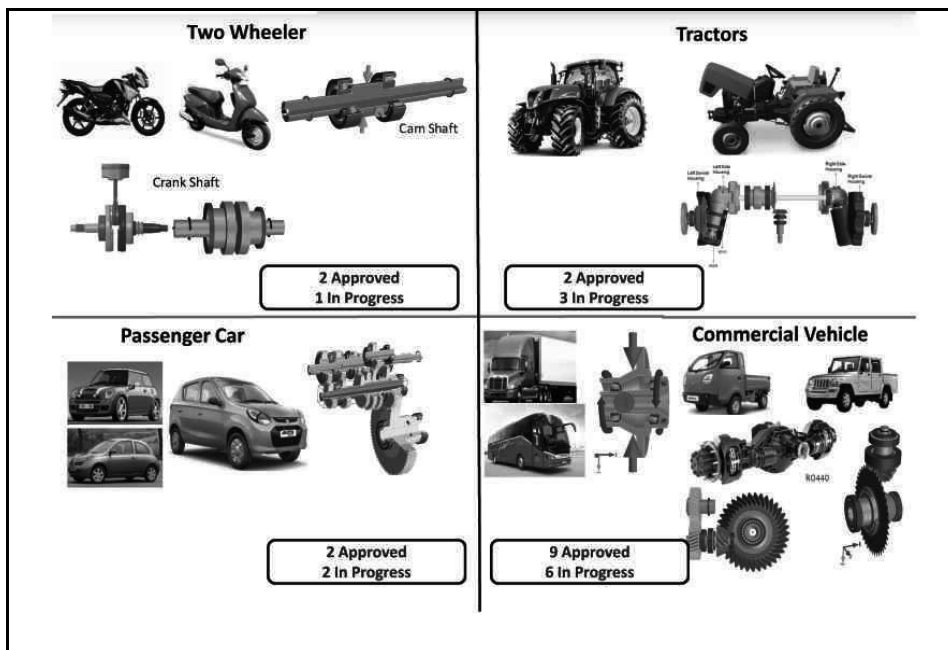


Fig.4.22 Customer Partnership Projects

4.12.5 Flexi Work timings policy

Policy – Flexi Work Timings

With the objective to enable a better work life balance for our employees as well as to provide flexibility to cater to individual needs, company has introduced the 'Flexi Work Timings Policy' along with changed work hours.

Flexi-time is a variable work schedule, in contrast to traditional work arrangements. According to policy, an employee can choose the Punch-In time with a flexibility of maximum 1 hour prior or post general office hours while ensuring 9 hours completion in a day excluding lunch break.

The policy also observes a core period of the day, when employees are expected to be at work, while the rest of the time is "flexible time", in which employees can choose when they work, subject to achieving total daily, weekly or monthly hours in the region of what company expects, and subject to the necessary work being done.

Through this policy, employees are given greater scheduling freedom in how they fulfill the obligations of their positions which gives workers far greater leeway in terms of the time when they begin and end work, provided they put in the total number of hours required by the company.

This policy is governed by business needs and usage of flexi timings is in alignment to the business requirements and in consultation with the Reporting Manager. This policy has a positive impact on the productivity of employees. Research also supports that employees who are better able to attend to personal needs through flexi time are more likely to be contented and productive and have increased morale, engagement, and commitment to the organization.

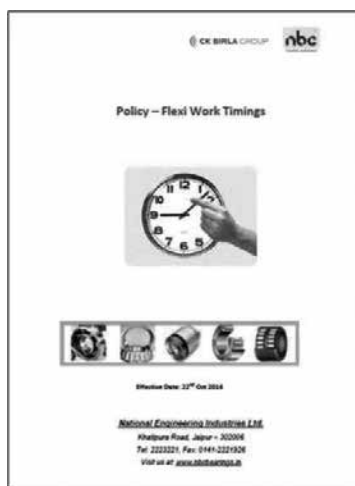


Fig 4.23 View of Flexi Work Timing Policy

CHAPTER 5: OVERALL EFFECTS

The process of arriving at Key Business Strategies up to financial year 2014-15 was through inputs from the external and internal environments which includes demand and supply data, competitor's initiatives, market forces, industry performance, economic scenario, internal performance, Customer satisfaction survey data and Core Competencies. These inputs were analyzed and “where to play / how to win” framework was prepared before freezing the Long and short term strategies.

Driven by 5 Strategies, 21 strategic initiatives were derived covering all Functions of the Business. The President's managing points takes care of all the Strategic initiatives and are deployed to all Functional Heads through the newly introduced Computerized Policy Deployment and review process.

Chapter 3 contains how the Business objectives are achieved through the 6 pillars and the Base activities (DWM, total employee involvement, TPM) of the NEITQM Model.

With effect from financial year 2015-16 the Model for Policy and Strategy Development has been modified as shown in chapter 2 as per the recommendations received in the TQM Diagnosis in Oct.2013.

The Effects shown ahead are the results of following key activities:

Key Activities to achieve goals:-

To achieve effective results following base activities are being performed on regular basis:

- a) Quality Circle projects, b) JH and Kaizen activities c) Employee suggestions

With the support of the above following activities under the continuous improvement Vehicles (pillars) of NEI'S TQM model are being performed:

1) Customer focus:

- a) Introduced Key Account Management (KAM) process.
- b) Introduced Grievance portal
- c) 24X7 Toll free number installed
- d) High focus on RCA for complaint resolution.
- e) Solution providing through Partnership projects with OEM Customers

2) Process control Improvement:

- a) As part of DWM-Introduced QA/QM Matrix, Process Planning Sheet (PPS), Pictorial work instruction, first piece check.
- b) Hourly production recording followed by performance dialogue & gap analysis on shop floor
- c) Problem solving projects with CFT for higher & chronic problems d) Use of Run-chart for process monitoring on critical operations
- e) Use of SPC for process capability calculation
- F) Training and usage of PM Analysis
- g) Process Action Teams (PAT) formed for taking up process improvement projects
- h) Focused approach implemented for Lean initiatives viz.- Lean manufacturing, Lean Design and Lean procurement

3) Policy Deployment: Computerized deployment done of Goals and Measures with linkage of upper

Level Mangers to lowest level staff. The system also contains on line review and gap analysis feature, thus completing the PDCA cycle.

4) Product and Process design:

- a) Strengthen R&D facilities with latest design and simulation software
- b) Installed proto type facility for manufacturing for New Product Development
- c) Installed Research Labs for Tribology, advance materials and advance manufacturing d) Induction of employees having done Masters and Doctorates.

5) Quality Management system:

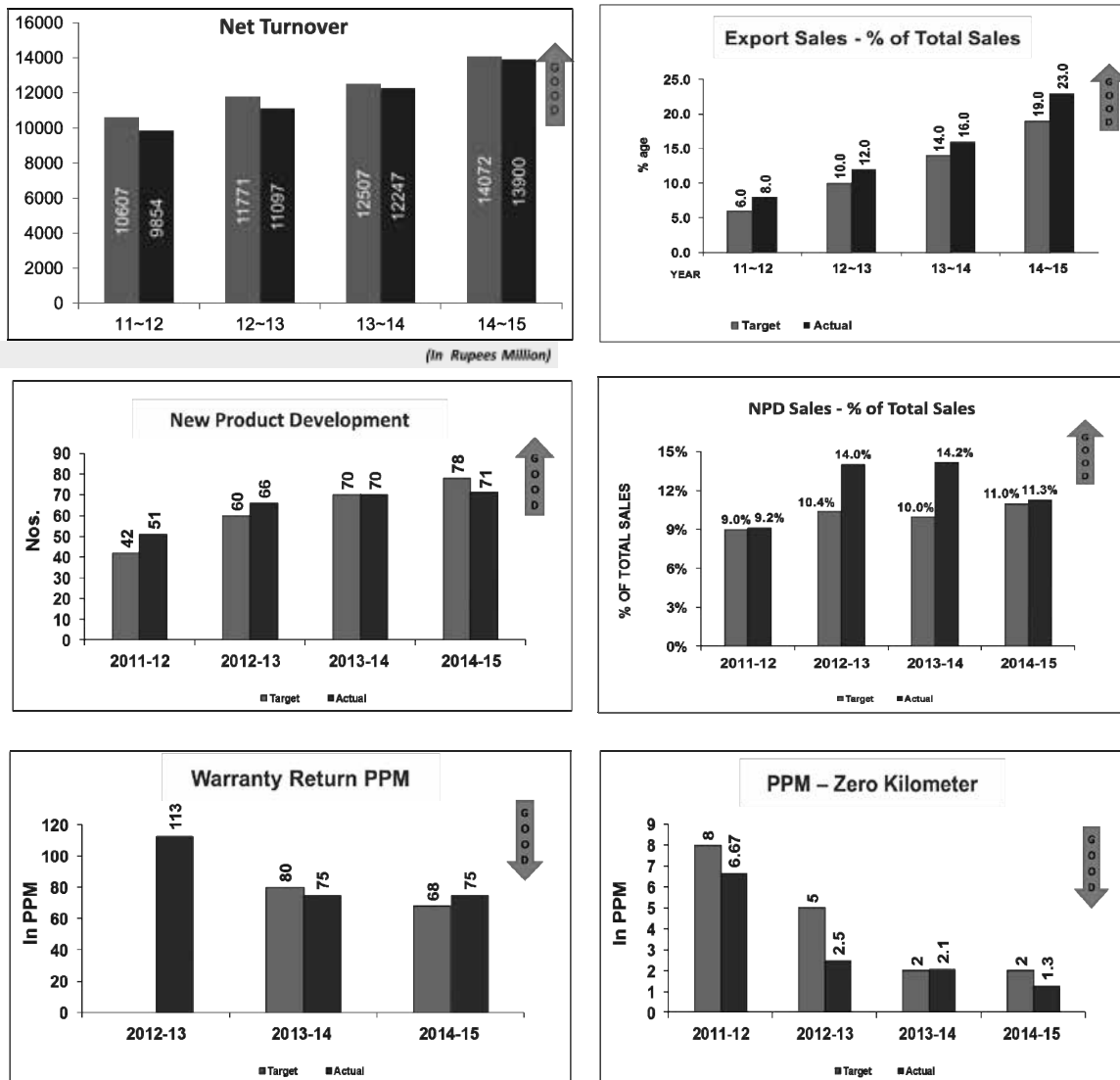
- a) Vendor development initiatives taken includes, technical training on PPAP,FMEA, SPC, problem solving etc.
- b) Installed system and trained Vendors for becoming "Direct-On- Line"(DOL) suppliers c) Vendor rating method made more stringent and focused
- d) Cost Of Poor Quality (COPQ) capturing improved, added more parameters
- e) Quality Management system documents standardized and all learning from Deming, TPM, Customer audits included

6) Human Resource Management:

- a) Re- structured job roles at all levels
- b) Performance Management System (PMS) computerized and linked with the Policy deployment goals.

5.1 Overall Effects-

The overall effects of TQM implementation are shown in the following graphs Fig. 5.1:



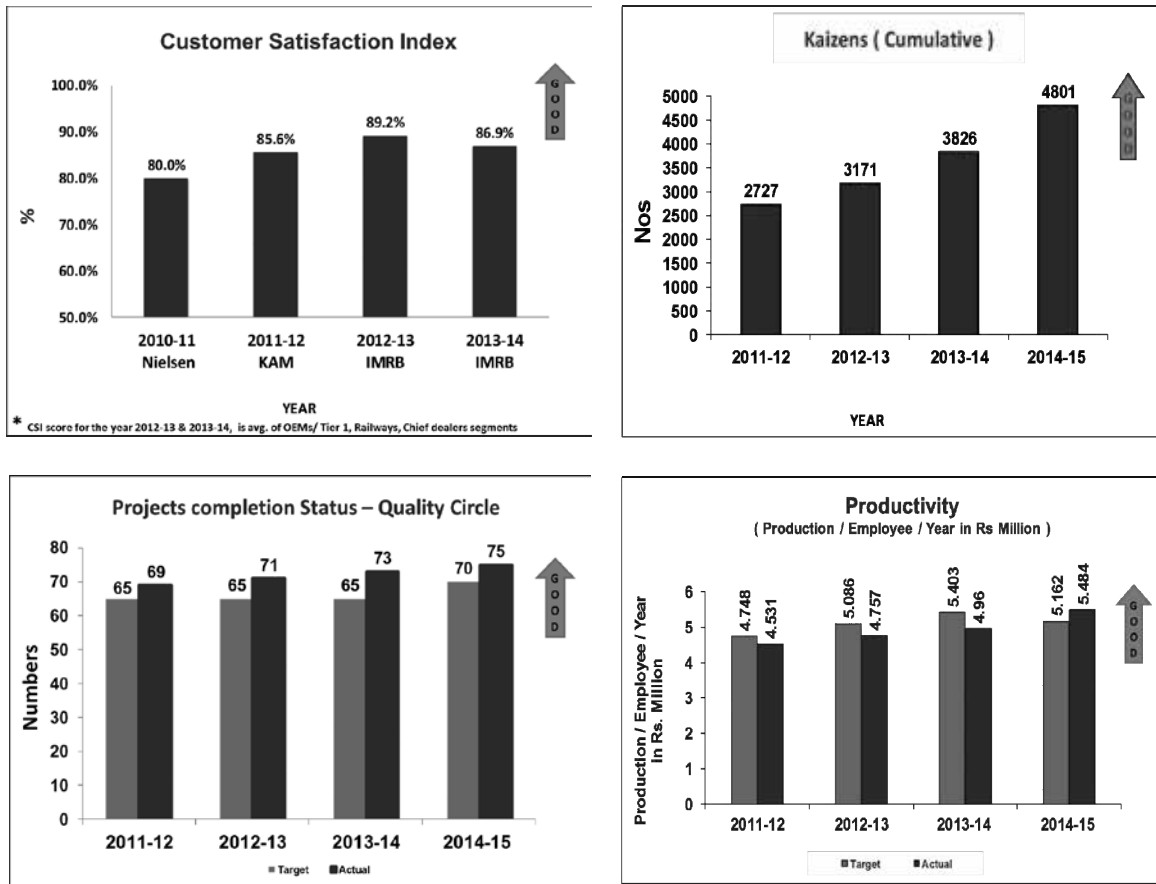


Fig 5.1 Overall effects

CHAPTER 6: FUTURE PLAN

1. Grow domestic business from INR 1087 Cr to Rs 2085 Cr by FY'19, beating market growth rates and hence gaining market share across all segments
2. Grow Export sales from INR 304 Cr to INR 865 Cr by FY'19
3. Develop Integrated Solutions for Passenger Cars and Trucks
4. Export to contribute 29% of NEI's turnover over the next four years
5. Acquire Small medium size Company for gaining access to market & Product Range INR 1500 Mn