

# Modern Manufacturing and Automation Technology Approach for Rubber to produce Tire and Safety With Pollution Control Guide

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**Abstract** – Tire or Tyre Automotive Industry has emerged as an important field of research under manufacturing and automation technology with environment pollution factors in the last few years. Vehicle Tire Automotive Industry is a set of processes that seek to change the automotive market pattern of knowledge processing to enhance both it and its outcomes. Tire Industry is a core concept involving manufacturing and automation technology and various management practices working for the betterment of the Automotive Industry market are becoming more knowledgeable about technology intensive; they are hiring “minds” more than the hands. The tire industry has become one of the critical approaches for the automotive market as a manufacturing sector and business scenarios. So that many definitions and history of describing a vehicle tire, manufacturing and automation technology Industry has been discussed in the first chapter. A literature review of the process has been discussed in the chapter second. The process is affected by various factors that support and hinders the automotive Industry. These factors were implemented in small and medium levels of the working of technology for tire manufacturing process and their importance has been found out in the research. These factors were mentioned in the chapter third. A Modern Manufacturing & Automation Tire Technology, under in process, today used the latest machines technology for manufacturing of tires with help of automation technology. These factors are mentioned in chapter fourth. In chapter five, tire terminology is very important factors discussed for tire performance and accuracy for working on the road or off-road. A tire is depending on raw- material based upon natural, synthetic rubber and others material, so these materials mentioned in chapter six. The tire is related to rubber, in that case, recycling time many types of pollutions work in at surrounding, these concepts discussed in chapter seven. It was the first rubber tire developed in the 1800’s after the analysis and various important factors related to work performance. The important parameters are identified and self-interaction matrixes proposed with the help of Interpretive Technology structure modeling which evaluates the inhibiting power of these parameters. This index can be used in the comparison of different factors responsible for manufacturing processes. Eight chapter of the research includes concluding Remarks of the study, Limitations of the study and Scope of the future work.

**Keywords** – Tire, synthetic rubber, others material, vehicle.

## I. INTRODUCTION

### 1. Tire or Tyre

**1.1 An Emerging Research Area:** MMAT- Modern manufacturing and automation technology in tire introduction and its definition “A Tire consisting of a rubber ring around the rim of an automobile wheel “A word "Tire" is American and "tyre" is British.

The first rubber Tires appeared in the mid-1800s. Most Tires, Example such as those for bicycles, aircraft, and automobiles sector and pneumatically



Fig.1 Vehicle Tire

### 2. Tire Components

- **Bead** – The part of the tire, which is so shaped as to fit the rim and hold the tire on to it.
- **Sidewall**- The part of the tire between the bead and the tread, which flexes in service

- Tread – This is the part of the tire which comes in contact with the ground and through which the driving, braking, and cornering forces are transmitted.
- Ply – Layer related to rubber in the shape of coated fabric cords.
- Carcass – A rubber bonded cord structure provides the requisite strength to carry a load of a tire integral with the bead.
- Breaker (Diagonal) - It helps the casing from road shocks done this process tread and Intermediate rubberized fabric layers/plies between the carcasses.
- Belt (Radial) –Belt (radial) related to tire term under work, in this tire layers work as a rubberized with tread and cords in practically in a particular direction of tread center-line that restricts the carcass in the circumferential direction and stiffens the tread area.

Layers of rubberized material underneath the tread with cords laid substantially in the direction of the tread center-line that restricts the carcass in the circumferential direction and stiffens the tread area.

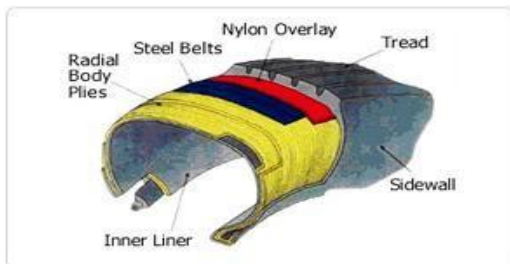


Fig.2 Carcass ply cords run at 90 degrees to Carcass ply cords run circumferential axis.

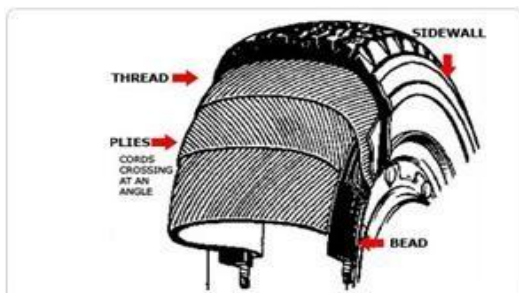


Fig.3 Carcass ply cords run at an angle with respect to 90 degrees to the circumferential axis of the circumferential axis.

## II. LITERATURE REVIEW RELATED WORK

### 1. Tire Technology Phenomena

A tire is a much more complex object than it looks: Actually, a tire observation related to vehicle tire and

tire industry that time many things included that like mechanical terms, performance parameters, materials compositions, and structure area.

Actually, a tire is many things work on this process:

- Geometrically terms
- Torus: mechanically
- Flexible-membrane pressure container
- Structurally a high-performance composite
- Chemically
- A tire consists of materials made up from long chain macromolecules.

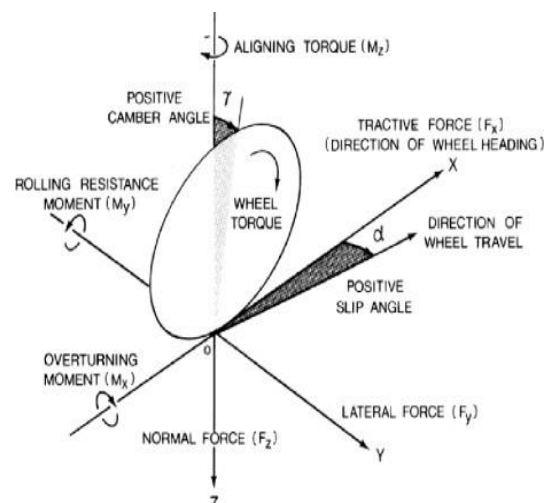


Fig. 4 Functions of Tire Technology.

The functions of a tire can be considered in relation to three basic roles:

- Vehicle mobility
- Performance and integrity
- Comfort, Performance, including driving and braking torque and rolling resistance, exerts or transfers forces or moments in the forward direction. Vehicle mobility, including cornering, steering response, and abrasion, acts in the lateral direction, and the forces involved in comfort act vertically.

Too many parameters in that work done by application of forces and its moments of characteristics of the tire are given a description on it. It is necessary to define an axis system reference by the definition of various parameters in fig.4 To description forces, characteristics of a tire and moments acting on it

### 2. Tire Technology Term & Components

In a tire component, radial tire of passengers vehicles many components under in that like sidewall, tread, rim strip, liner, steel belt, fabric cap and metal bead etc. so its show in fig.5.

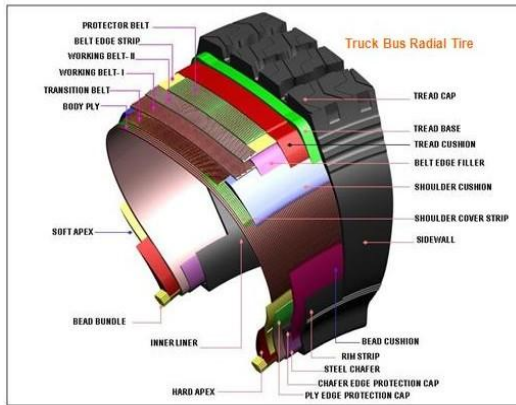


Fig. 5 Passenger cars radial (PCR) Tire Technology  
Term & Cons

Radial tire comprises of different components include Points in the fig: 5 regarding passenger car.

- Fabric body ply
- Apex, rim strip
- Inner Liner
- Fabric cap ply thread
- Sidewall, steel belts
- Metal bead

In truck-bus radial tires fabric body is replaced by a steel body and additionally, shoulder cushions and belt edge filler are also included and as shown in Fig 5. Tread is the topmost abrasion resistant rubber component of the tire with a different pattern which comes in contact with the road; it forms the protective coating for the carcass.

Tire many terms in that traction, handling, braking, rolling resistance, and indicators. A most important component responsible for main tire performance indicators like breaking, handling, wear traction, and rolling resistance.

**3. Tire Nomenclature-** The tire designation system is written on the tire sidewall, it is as described below. If the marking reads 205/65R15 V it implies the following

- 205 is section width in mm
- 65 is the tire aspect ratio (Aspect ratio= Section height/section width)
- R represents radial construction
- 15 is nominal rim diameter in inch
- V denotes the speed rating of the tire

#### 4. Modern Manufacturing and Automation Technology term for Tire

- The rubber exterior of a pneumatic tire is merely a flesh for a skeleton of fabric; this skeleton and the manner in which it is constructed are of fundamental importance in establishing the tire's characteristics.
- The tire's characteristics establishing in the fundamental of the tire is under flexibility, tropical, compressed gas and mechanically to the outer circumference of the rim.

- A tire is an integral component of a vehicle and is the intermediary between the vehicle and the road.

#### 5. Modeling Tire-Road Noise with Data Mining Techniques:

**5.1 Tire-road noise modeling overview:** A model to predict the tire-road contact noise should integrate parameters describing the road pavement surface and the tire. A noise of tire-road overview: Tire-road parameters of a road surface and tire. The interaction mechanisms between the pavement surface and tire are complex, which makes the use of extremely complicated mathematical expressions to model them difficult.

So there are models able to predict noise simulating only some of its mechanisms and others to simulate all mechanisms. These models can be classified into simple empirical models, semi-empirical and theoretical models, and complete models. The simple empirical models simulate the impact of tread blocks on the road surface or simulate the noise due to pavement characteristics, or both, which is the case of the model developed by Mak and Hung 2014.

The semi-empirical and theoretical models can predict noise considering air pumping and vibration of the tire carcass. This model considers tire visco-elastic characteristics and a noise propagation prediction module close to buildings facades. It was adapted to be used as a design tool (Deufrako, 2009).

**5.2 Data mining (DM)** definition and application to road transportation/highway engineering, it's helpful for Tyre life on the road. The capability to automatically learn from data is a very attractive approach to extract useful knowledge. Therefore, in the last decades, the use of data mining (DM) has spread rapidly throughout computer science and beyond. In effect, DM techniques have been applied successfully in different knowledge domains, e.g., web search, spam filters, recommender systems, and fraud detection.

Taking advantage of its strong flexibility to deal with high dimensionality problems, DM techniques were applied to solve complex problems in the civil engineering field as well as road construction.

This means that DM is not a straightforward computation of predefined quantities, such as computing the average value of a set of numbers. DM is interactive and iterative, involving numerous steps with many decisions made it.

The full DM process can be resumed in five main steps:

- Data Selection,
- Pre-processing, transformation
- Modeling
- Interpretation

DM is under work of computer science work in some process done by data management, Intersection of statistics, Database, pattern recognition, machine learning.

DM allows finding trends and relationships between variables with the objective of predicting their future state. Despite their potential, DM techniques are not yet widely used in transportation.

## 6. Materials and Methods

### 6.1 Tire depends upon road section and tire terms

Selection of testing sites, this study considered nine 200 m long straight road sections, located in national roads, covering a wide set of pavement surfaces used in Portugal, whose superficial layers are described as follows:

- Open texture asphalt-OTA
- Gap-graded asphalt rubber (GGARm)
- Gap-graded asphalt rubber- GGAR
- Dense asphalt- DA
- Slurry seal- SS
- Open-graded asphalt
- OGA

Selection of model variables, the target dependent variable is the noise level. The independent variables of the model are related to vehicle's travel characteristics (speed – V), climatic conditions (air temperature – Temp), test tire and surface characteristics (unevenness, texture, absorption, damping). Hub Geometry (Diameter, Width).

- Overall tire Geometry (Diameter, Width)
- Mass
- Stiffness (Vertical, Lateral, and Longitudinal)
- Ground Contact Pressure (Average and Peak)
- Rolling Resistance
- Durability
- Maximum Speed
- Impact Resistance At a minimum, the designer must define the following parameters:
- Ring Shear Layer Material Modulus
- Ring Shear Layer Thickness
- Spoke Modulus
- Spoke Thickness
- Spoke Count
- Spoke Curvature
- Spoke Length

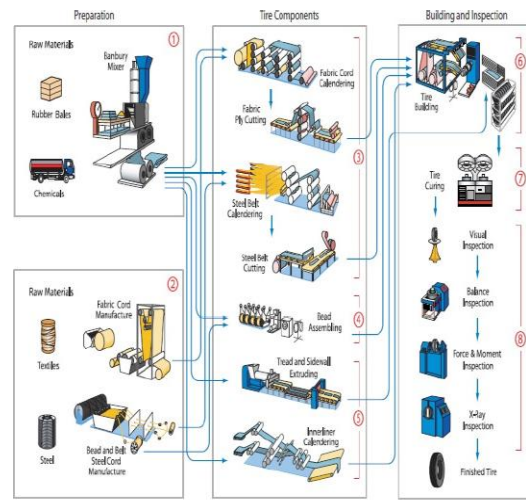


Fig.6 Tire Manufacturing Process Chart.

## 7. Tire Manufacturing Process with Tire Building Machine (TBM):

A Tire Building Machine (TBM) cycle is programmed to various operation automatically and, its working balanced and single operator working cycle. In this TBM is many manufactured term in that like cord-body, inner liner, side-wall, tread and bread work for green tires under industries policy.

All sequences are controlled by a PLC system. TBM Situation Multiple machine parts need to be coordinated from points Tire Manufacturing Process Chart fig6:

- Drums
- Conveyors rollers
- Joint-less belt array unwinding
- Cutter laser mark
- Correction system pneumatic valves
- Complicated sequencing and logic linking
- Motion control
- Drive control safety interlock
- Human machine interface (hmi) requirements including
- Recipe alarm
- Diagnostic operation

### 7.1 Key success Factor Technology up-Gradation

In Tire Industry technology up-gradation is an absolutely critical issue. In the era of modernization and globalization, there are difficult to find a place or exist into the business without innovations or up-gradation of technology. So, many companies are come by the certain technological innovations and newer things.

In the Tire Industry now a day we find concepts of Tube-less Tires, Environmental Friendly Green Field Tire, and Anti puncture Tires and So on. We can put

this technology up-gradation as a major Key Success Factors in the Tire Industry.

### 7.2 Radial Tires

Industry likely to focus on the manufacturing of high-performance Radial Tires, Radial Tire provides long life in comparison to the other basic tires. And there is a threat from the China and South Korea who are providing the Radial Tires with the high amount of efficiency with the low prices. Some companies are now realizing the importance of this technology and they start working in this area. If the companies are successful in the production of Radial Tire with high efficiency and low price then it will drive the growth rate of Tire Industry at new levels. So, Radial Tire will be a one of the major Key Success Factor for the Industry.

### 7.3 Introduction of New Concepts

Another major Key Success Factor for the Tire Industry will be a degree of introduction of new concepts by the players. The pace of the introducing newer concepts will certainly help to the Tire Industry. New concepts like Puncture proof tires, Low Rolling resistance tires, Environmental Friendly Green Field Tires and so on.

### 7.4 The growth of the Automobile Industry:

Tire industry is work with a ratio of the Automobile industry production, so we can say automobile industry an important role for tire industry production factors. So, that we can say about this thing if the automobile industry very important role do for key success factors in the vehicles tire industry. In India, there is constant and steady growth seems in the Automobile Industry. So we can put this factor as a key success factor in the tire industry.

### 7.5 Tire Rolling Resistance

Vehicle manufacturers are required to maintain an average fuel economy for the fleet of new vehicles they sell each year. In 2009, the government Corporate Average Fuel Economy (CAFE) mandate was 27.5 miles per gallon (mpg) for cars and 23.1 mpg for light trucks (including minivans, vans and most pickup trucks and sport utility vehicles).

However because it's an average fuel economy, in order to sell large cars or trucks (that use more fuel), the vehicle manufacturer must also sell small cars and trucks (that are fuel- efficient) the vehicle manufacturer can be fined if their annual vehicle fleet uses too much fuel.

A tire's rolling resistance affects fuel economy A working of vehicle manufacturing supplier's deployments in low resistance tires used to original equipment for the new vehicle, using the help of average a CAFÉ. In order to meet the manufacturer's demands, these tires are often designed with a priority on reducing weight and rolling resistance and are

molded with slightly thinner sidewalls, shallower tread depths analysis, and low rolling resistance constructions and tread compounds of tire terms.

However, in order to understand CAFE tests and the role that tires play, it is important to recognize that CAFE tests are conducted in a laboratory and not on the highway. Many aspects that affect fuel economy in the real world are reduced to constants incorporated into the formulas specified.

During stop-and-go city driving, it's estimated that overcoming inertia is responsible for about 35% of the vehicle's resistance. A property of inflated done by fuel economy and reduce rolling resistance is to make it.

A vehicle that requires its tires to be inflated to 35 psi (based on the vehicle's tire placard) will have an increase in rolling resistance of approximately 12.5% if the tires are allowed to become under-inflated to just 28 psi. Therefore, maintaining the vehicle manufacturer's pressure recommended for light load and heavy load conditions may almost be as important as the tires being used.

## III. METHODOLOGY

**1. A without tire is the automobile sector is incomplete so that tyre industry or vehicle tyre term need to methodology term under some concepts**

A methodology study about tire industry under with six-sigma DMAIC phase applied to process for bead splice done by enhancing the process capability.

**2. Define** In the first phase, the goals were defined to improve the current process. The most critical goals were acquired using the voice of the customer (VOC) method. In this down a defect level and output increase done by a specific process for achieves goals for company betterment. Measure without measuring the performance attributes, the process cannot be improved.

Therefore, the ultimate target of the measured phase was to establish a good measurement system to measure the process performance. Process capability index Cpk was selected to measure the process performance. The process complete help with the observation of bead splice variation and capability index.

**3. Analyze** In this fig: 7, graph we analyzed that, a process gives a gap data related to a performance of process and performance of quality.

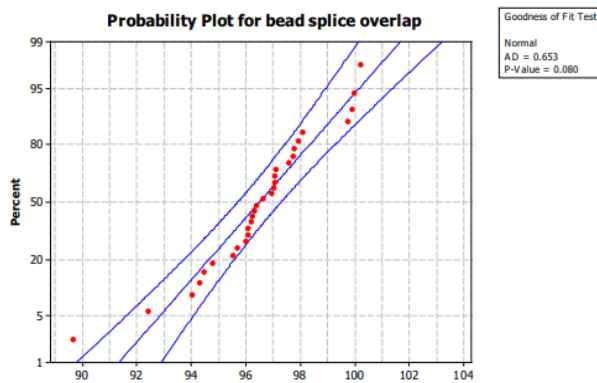


Fig.7 Normality test of bead splice.

Table 1 Bead splice specification.

Tire produce is a range of Bead splice	92 ± 17 mm
Average bead splice of tire	97 mm
Material loss due to Shifting of Splice from Target Specification	93–100 kg/month

In this a calculating the performance of statistic help by obtained six- sigma tools The further analysis of these data was done for finding the root cause of the problem using the diagram.

**4. Improve** In the improvement phase, the alternative ways were searched creatively to do things better and faster at low cost. Different approaches (i.e., project management, other planning and management tools, etc.) were used to establish the new approach and statistical methods were proposed for continuous improvement.

**5. Control** An improvement passing though, previous step done with the help of maintained by the continued success of the organization, Control phase was used to maintain these improvements in the process. The new process/improved process was proposed for sustaining the quality control in the organization.

**6. Methodology:**“The Future of Global Tires to 2022”

The tire industry as global view and finical valued in 2017 approx term \$225 billion, but some come global issues create the front of this in tire type matrix, end use, and region foam.

The marketplace is highly diversified, dominated by the mass market of passenger car and light truck tires, with significant markets also in trucks (medium and heavy duty), buses, and specialty applications such as motorcycles, off-the-road (OTR) equipment (e.g. mining, construction, ports, agricultural, industrial), and aviation.

All tire end uses and types are expected to grow in volume and value terms through 2022, with specialty applications like motorcycles, high-performance tires, and OTR leading the market.

### 7. Content

- A highly diversified marketplace, all tire end uses and types are expected to grow in volume and value terms through 2022.
- Changes in tire design/capabilities, manufacturing, and raw materials are accelerating to meet many new and historically contradictory demands.
- A future of global market related to tire in 2022 is based upon primary research, figures, and tables.

### 8. Methodology used

A future of global tires 2022 is base-upon information and generated data related term done with help of sources of primary and secondary in term of government sector, technical study and business factors. So that its give result about the global view, related to supply chain of characterizing vehicle and tire industries.

Perspectives from all lifecycle participants are taken into account from raw material suppliers to OEs, manufacturers, distributors and marketers, motorists and fleet managers, and government sources.

### 9. Methodology Discover

A vehicle tire industry gives a information about the marketplace in the volume of growth and value terms with the application of passengers tires and leads the market. Its work for every region for deep analysis of tire market help by trends and raw-material, use and type of terms in that:

### 10. Who should buy this report?

- Raw material suppliers
  - OEMs and tire manufacturers
  - Rubber, chemical and equipment suppliers
  - Vehicle services, tire distributors, Industry consultant and analysts
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## IV.EXPERIMENT AND RESULTS

### 1. Important experimental Safety Maintenance and Care- Tire and their results:

- A performance of tires done followed by manual guidance related to tires.
- Tire not operates, when higher loaded in that, structural stress on the tire, it makes a high risk produce on that.
- Proper monitoring rim and tire, it’s done help with a qualified tire professionals
- The tire is not done in the sense of driving on wet

roads.

- The guidance in this manual followed for the performance of the tires.
- Don't operate the tires in an overloaded condition, it is higher structural stress for the tire and represents a significant risk of tire failure, then the risk of human factors.
- Do not over-inflate the tires.
- Proper mounting of the rim and tire and it's done by qualified tire professionals related to tire.
- The tire is not optimized for driving on wet roads.
- Low speed of the vehicle, when driving on wet roads.
- Excessive aging of the tires may lead to loss of traction. Tire Set-up for Circuit Driving.

## 2. Tire Heat Cycling Service Tire Tips:

- Tire maintenance inflation pressure
- Tire Mounting and Dismounting Mounting
- Dismounting Speed Symbol

## 3. Tire Pollution Study & Guide

Statement: Tire Problems Statement, The following are problems that might be caused by waste tires:

- Human health problems
- Fire Hazard Air Pollution
- Water Pollution Soil Pollution
- Tire Policy Environment
- Environmentally Friendly Tire Technologies Eco-Friendly Tires- Raw Materials
- Rolling Resistance

## 4. Recycling

- All categories of tires can be exported freely.
- All categories of new tires can be imported freely. No WTO Bound Rates for tires and tubes.
- Imports of Secondhand/Retreaded tires (major categories) are restricted under EXIM Policy and can be done against an import license.
- Tires imports under Regional Trade Agreements (Asia Pacific Trade Agreement, Indo-Sri Lanka, SAFTA, India- Singapore, ASEAN, India-Malaysia etc.) allowed at preferential rates of import duty.
- All tire industry related raw-materials can be imported freely (under OGL).
- Tire Industry relicensed in September 1989.

## V. CONCLUSION

The tire industry has been playing a vital role in contributing industrial production and automobile sector. The major factors affecting the performance of the tire industry are the fluctuation in fuel prices, natural rubber prices and import duty on rubber. The permanent reduction in rubber import duties is required to ensure long-term health of the Indian tire industry as price volatility of key raw materials could return and clearly, there are limits to how as much of such cost escalations can be passed on to the end customers, especially to

OEMs and institutional buyers, who are extremely priced sensitive. The demand for tires depends upon many external factors like economic growth and infrastructure development in the country. The tire industry is also directly affected by the performance of the vehicle manufacturing sector which in turn is dependent on the overall economic growth.

Maintaining continued edge in technology through innovation and creativity in R&D has been the focused area attire industry in India. Reduction in excise duty and an imposing ban on import would encourage their survival. The government should encourage the export of tires.

The challenge for tire technologists and marketers is to develop tires that efficiently perform all of these functions for as long as possible, to continuously improve their ability to do so and to sell them at a price that is both affordable for the customer and profitable for the Company. Meanwhile, every user is concerned about protecting the environment. Meeting these expectations demands tire solutions that are dedicated, differentiated and increasingly technology and innovation-driven.

The second is a source of solutions for OEM and subsequently for replacement markets'. The original equipment segment accounted a sizeable market share of total global tire production. Leveraging expertise, it is necessary to work jointly with car makers and other original equipment manufacturers to develop innovative solutions for safer, quieter and more environmentally friendly vehicles. As the modern day tires should have low rolling resistance, tire manufacturers must help OEMs cost-effectively reduce their vehicles 'carbon footprint with tires whose technology truly makes a difference. High-performance tires have been significantly reducing CO2 emissions. This type of performance is required to be delivered by the tires that need to be developed especially for new generation electric vehicles.

The third is a high value-added service'. In the replacement tire market, which accounted for largest part of total tire consumption, tire makers serve all types of user needs with a comprehensive brand portfolio marketed through a diversified array of channels, including specialty wholesalers, dealers, auto centers, service stations, and superstores.

The optimize customer relation'. An automobile tire is a highly involving, high risk-prone, and high monetary product. Hence, it requires high customer relationship marketing emphasizing customer service. To improve further customer service, an innovative integrated customer relationship management application needs

to be deployed with the company's sales representatives across the marketing value chain. In addition to above four major concerns of tire marketing with detailed study and analysis of Indian tire industry in the light of global perspective, this study unveils one major critical aspect that the domestic tire industry is in a structural inflection in the market from cross-ply nylon bias tire to steel radial tire in the mainstay truck and bus tire segment.

Radialisation in this segment is picking up momentum which has already acquired 18% market share in 2017-18 (ATMA, 2017-18). A customer's high-value realization done under market radicalisation and other side the global market phenomena This market radicalisation is a force which is onset of aligning with the global market from where customers (both OEMs and replacement markets) will avail full value realization from tire in terms of greater mobility of people and goods by facilitating higher safety, efficiency, and enjoyment of travel, besides holding on their value for money expectation.

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