CHAPTER 4

TREND AND PATTERN OF PRODUCTION AND PRODUCT SEGMENTATION OF INDIAN TYRE INDUSTRY

4.1 TECHNOCLOGICAL BREAKTHROUGHS

Tyre manufacturing technology is continually undergoing rapid changes. The objective is to make cost effective and more uniform products through innovation. Some of these include modular manufacturing systems. Many leading tyre makers have come with manufacturing solutions based on their research competence. A few of the exemplary techniques that are claimed to have been adopted successfully are noteworthy. Some of these are undergoing continuous improvements. Such technologies include C3M (command, control and communications, counter-meaures) by Michelin, the modular integrated robotised system or MIRS of Pirelli and BIRD (Bridgestones innovative rational development).

Goodyear came up with IMPACT (Integrated manufacturing precision assembly cellular tech). Its tyre-making system is a new machine that creates and assembles up to seven carcass components into one large system component. The unit saves space, reduces time, improves quality and slashes manufacturing cost. innovative Z, environment manufacturing technology offers proof that technology can greatly enhance tyre performance while delivering better results with regard to the environment. Through advanced tread designs, compounds, casing construction and manufacturing processes. Z, environment does more than reduce fuel consumption, waste and pollution. It can reduce costs to the customer significantly.

The funnel-shaped grooves are wider at the top for enhanced traction, yet narrow at the base to prevent stones from travelling to the bottom. In addition, the design provides superior comfort and increases block rigidity for further resistance against uneven wear. The all new compound utilises Z, environment technology to produce stronger and more pliable rubber. claims that its compound has significantly reduced heat build up and improved rolling resistance. In years to come many more manufacturing technologies are expected to come into effect for innovative tyre manufacturing resulting in improved
uniformity and productivity. Using techniques of continuous production in place of batch production system bring better products.

Carbon black developed by a plasma process and nano structure black are new significant development in filler technology. Carbon black silica dual phase fillers reduce hysteresis while maintaining or improving abrasion resistance. This technology is less expensive, as the coupling agent requirement is less, and it produces a semi conductive product compared to a full silica filler system. The dual phase filler is less abrasive to the processing equipment compared to the usage of silica filler alone. But, the use of dual phase filler increases the cost of a compound compared to traditional carbon black.

Nano structure black is a family of new carbon blacks characterised by a rough surface and enhanced filler polymer interaction. It hinders the slippage of polymer molecules along the rough nano structure surface and reduces the hysteresis significantly. This type of black ideally meets truck tyre requirements, as it provides improved tread wear in addition to low hysteresis. In the next five years a sizable replacement of carbon black would take place by silica especially in western countries as well as in China due to the fact that China will be compelled to adhere to strict norms of EU labeling.

Technologically it is the radialisation drive that needs special mention. If we look at the past 20 years, we have come up a long way on the technology ladder. Radial tyres, which were a rarity 20 years ago have become a standard in today’s cars. While in passenger cars it has gone up from 10% to almost 100% currently, in LCVs it has gone up from 5% to 30% and in Truck & Bus tyres it has gone up from 1% go 15%. 
1844 - Charles Goodyear invents and patents the rubber vulcanization process.

1846 - Robert William Thomson invents and patents the pneumatic tire.

1880s – John Boyd Dunlop begins taping pneumatic tires to bicycle wheels.

1882 – Thomas B. Jeffery patents an early clincher tire.

1888 - First commercial pneumatic bicycle tire produced by Dunlop.

1889 - Dunlop patents the pneumatic tire in the UK.

1889 - Adolphe Clement sees a Dunlop pneumatic tire in London and acquires the French manufacturing rights for 50,000 francs.

1890 – Dunlop, and William Harvey Du Cros begin production of pneumatic tires in Ireland; thickened beads, wire retainers, and shaped rims make taping tires to rims unnecessary.

1890 – Bartlett Clincher rim introduced.

1891 - Dunlop’s patent invalidated in favor of Thomson’s.

1891 – The Michelin brothers patent a removable pneumatic tire, used by Charles Terront to win the world’s first long distance cycle race, Paris-Brest-Paris.

1892 - Beaded edge tires introduced in the U.S

1893 - Cotton reinforcing cords have appeared.

1894 - E.J. Pennington invents the first balloon tire.

1895 - Michelin introduces pneumatic automobile tires;Andre Michelin uses corded tires in Paris-Bordeaux-Paris rally; by 1897 they are standard racing tires.

1898 – Schrader valve stem patented.

1900 - Cord tires introduced by Palmer (England) and BF Goodrich (U.S)
• 1903 - Paul W. Litchfield of the Goodyear Tire company granted patent for the first tubeless tire, which was introduced in 1954 by Goodyear on packards. (Litchfield would go on to become Goodyear’s president and board chairman.)

• 1904 – Goodyear and Firestone start producing cord-reinforced tires.

• 1904 – Mountable rims introduced, allowing drivers to fix their own flats.

• 1906 - first pneumatic aircraft tire.

• 1908 – Harvey Firestone invents and patents “no skid” tread for improved traction.

• 1908 – Frank Seiberling invents grooved tires with improved road traction.

• 1900s - Tire companies experiment with adding leather, wood, and steel to improve durability.

• 1910 - Silver town Rubber company (London) adds carbon black to white rubber, increasing durability: now universal.

• 1919 – Goodyear and Dunlop announce pneumatic truck tires.

• 1923 – First balloon tire, named for larger cross section and lower pressure, introduced by Firestone: debut on the first Chrysler, the 70, in 1924.

• 1929 – Solid automobile tires cease to be used.

• 1937- BF Goodrich introduces the first commercial synthetic rubber tire.

• 1938 – Goodyear introduces the rayon cord tire.

• 1946 – Michelin introduces the radial tire.

• 1947 - Goodyear introduces first nylon belted tires.

• 1947- BF Goodrich announces the tubeless tire.

• 1963 - Use of polyester cord introduced by Goodyear.
1965 – Armstrong Rubber introduces the bias belted fiber glass tire.

1967- Poly/glass tires introduced by Firestone and Goodyear.

1968- United states Department of Transportation (DOT) numbers required on new tires in U.S.

1974 – Pirelli introduces the wide (low aspect ratio) radial tire

1975 ¬- Michelin very first American–built radial passenger tire.

1977 - Good year introduces the first all season radial tire, the Tiempo.

1992- Michelin introduces the first durable silica–filled tire, also known as “green tires”.

1998 - Michelin develops tire that’s vertically anchored and unscatable, allowing it to run flat after a loss of pressure.

4.3 OFF THE ROAD TYRE SECTOR

The OTR tyre sector is passing through a phase of contradicting features when the positives look good for faster growth while companies are playing it safe with a high degree of caution that pulls them away from any rash move. While the demand is high and growing there is no rush to hike up production to exploit the situation. Caution has become the key word. This is obviously because all leading OTR producers still remember what happened two years ago when the business suddenly stopped and crashed without warning .after the downturn in 2008-09, the mining business, for example, has been steadily picking up and the demand for mining, tyres has also been up. This gives a bright prospect in the near to middle term, for the sales of OTR tyres. The average growth rate of OTR tyres in the recent past has been in the range of 40-50%. This growth trend is to stay as infrastructure and industrial developments are bound to continue. Major investments are flowing into the mining sector. The huge escalation of commodity prices also augurs well for the sectors long term potential. BKT’s major OTR tyre markets have been Asia, Latin America,
the Middle East and North America with radial OTR sales growing more than 100%.

The developments in infrastructure and other industrial sectors, particularly in mining and agriculture, are picking up after the slowdown during the recession two years ago, leading to increasing activity in the transport industry. This has resulted in considerable surge in demand for OTR tyres of all varieties. Domestic and export markets of major producers, including Bridgestone, Michelin, Good year and BKT, have very active with the order books filling up fast. After the crash of 2009, this is a hugely positive turn a round. The interesting feature is that apart from the supply and demand cautiously bridging the gap, there is no perceptible hurry on the part of anyone to go on overdrive and make a kill in the market. Obviously, they now realise that this was precisely what stopped them on the track two years ago.

While it is generally easy to presume that as long as long term economic growth continues in fast emerging economies in Asia and Latin America, the market for OTR tyres will remain vibrant, although the ground reality has always been one of fluctuation. The trends have been cyclic, according to some experts. A boom time has always been followed by a slowdown, What happened two three years ago provides a typical example.

Easy credit and a will to invest brought in an economic boom during mid-2000s on a scale unparalleled in post World War II World. The OTR sector had it so good that companies such as Bridgestone and Michelin went on hiking production and launching new OTR plants to meet the surging demands.

Tyres- small to large and extra large-rolled out in unprecedented numbers while the demand still remained unmet. It was at this stage in late 2008-2009 that the balloon burst and the assembly lines suddenly halted with very little warning. Nothing was moving while the inventories piled up and tyres remained on machines. The business plunge was by almost 38%. Slowly, the production lines started moving again, thanks mainly to emerging economies like India and
China. Their major focus on infrastructure developments boosted demand for OTR tyres.

Today the only difference is that the manufacturers are cautious not to fall into another trap of stepping up production. The target has changed from short term gains to steady long-term growth. The OTR tyre market, however, looks quite strong now also because of the continuous flow of foreign direct investments into emerging economies. The growth of the mining industry in mineral rich countries, particularly in BRIC economies (Brazil, Russia, India and China), is also contributing to the good times for the OTR sector.

Even while being cautious, the tyre companies are aware of market possibilities as the mining industry is a niche that needs special attention. The industry needs very large tyres like the 53s upwards, which calls for specific production technology. The sustainability of the industry has promoted leading producers to focus on this factor.

**Demand and Supply of OTR Tyres**

Regarding the management of demand and supply of OTR tyres, given problems such as high rubber price lack of enough NR, companies such as BKT follows a strategy that includes price increases wherever possible as well as proper purchase planning. However, since there are increasing demands for these tyres, especially the large OTRs, supply is becoming very critical, BKT has been developing the range as well as ramping up the capacities with the required investments in plant and machinery. Bridgestone, the manufacturer of tyres for the world’s biggest mining trucks, has well established leadership in the OTR tyre business with a variety of brands in key size categories, including 53/80R63, 55/80R63 and 59/80R63. The company is continuing its research and development of 63 inch and larger tyres. The potential in the market is reflected in the strategies of the companies.
There are still uncertainties in the OTR tyre sector because some sectors like housing remain slow while others like mining and gold are doing fine. However, sees 2011 as a good year for OTR tyres, especially radials. The market demand is 70% for radials and 30% for bias. Due to the high cost of raw materials, the prices are also likely to go up. The general perception is that a booming tyre sector, particularly OTR sector reflects the overall health of an economy. It shows how focused and careful development are planned and how well priorities are placed. Also, caution is not a bad word because it shows how well lessons are learnt from the past.

Against this backdrop it is gratifying to see that for the next Five year Plan currently under formulation, working groups on different sectors of industry have been formed under a steering committee on industry. The move is certainly laudable as the writing on the wall is clear that industry is not a homogenous entity as it normally considered to be. Even different sectors in manufacturing have different dynamics, growth patterns and respond to similar stimuli very differently. Having observed tyre industry closely, how variations in economic growth could have much farther reaching consequences for the tyre industry in comparison to many other sectors of industry. There are several aspects that put tyre industry in a league of its own. Tyre is a heavily capital intensive industry. Investments required are to the tune of Rs 70-100 million per tonne of radial capacity. It takes 3-4 years to set up a plant. Under such circumstances, clear projection of adequate demand for tyres when a capacity goes on stream is a must for sustainable operations. Any slowdown could severely impact the planning process. What makes the job all the more difficult is the fact tyre is among the most low margin industries entailing operational and logistic efficiencies. Any idling of capacity during slowdown could further squeeze the profitability. At the same time a long gestation period means the capacity cannot be enhanced to meet sudden rise in demand.
Another aspect that exposes the industry to greater vicissitudes of fortune is the fact that it is raw material intensive and the key raw material i.e. natural rubber is of agricultural origin. The shortage of domestic natural rubber during high octane growth in automobile growth in the last two years has been keeping the tyre industry on its toes with industry resorting to high priced rubber imports to fill the gap. In fact, high demand has led to unprecedented rise in prices of natural rubber in recent times. This has discouraged the rubber re-plantation activity as the growers wish to make the most of existing trees even when the trees are past their prime and should be replanted. This is likely to lead to a situation of further shortage of rubber as the output from old trees will dwindle with every passing year.

The reverse is equally true. Any slackening in demand for rubber could lead to a grower substituting land for some other crop or any other activity such as a tourist resort. It is not feasible to grow rubber again as it takes seven years for a newly planted rubber tree to start producing rubber and that’s a big deterrent. Such unique features require a careful understanding of the special needs of the industry and creation of an enabling policy framework so that impact of volatility in economy could be buffered. After all tyre industry sustains a rich value chain from small rubber growers to global automobile majors, state transport undertakings to critical defence sector. As much as 65% of total natural rubber consumption in the country is by the tyre sector. In other words, of the total 1 million small natural rubber growers in the country, an estimated 650,000 NR growers owe direct dependence on tyre industry.

4.4 ROLLING ON THE GREEN

The rising demand for hybrid and electric vehicles, which offer zero or low emission, is boosting demand for eco-friendly automobiles and tyres. Efforts are under way in many countries to educate motorists on green mobility. There is a new emphasis on building infrastructure for alternative fuels and charging points for electric vehicles that run on clean and renewable energy.
sources or drive lines powered by batteries. Sensing this demand, there tyre industry is taking up appropriate technological initiatives in line with the market trends. Most hybrid/electric vehicles will be using some sort of low rolling resistance tyres. Now have to concentrate more on low aspect ratio tyres for reduction in air resistance and optimise the design of the sidewalls to minimise energy consumption due to cyclic deformation.

Technologically this is not a completely new field, with low rolling resistance tyres there have been some complaints from hybrid vehicle owners about tyre handling characteristics on the road. As a result Toyota, for example, has backed off from very low rolling resistance tyres and settled for better road handling tyres. For improving rolling resistance, tyre makers are using lighter materials. Other improvements will be in terms of lower stopping distance. To translate these features into tyres, there is a need to have larger rim diameters so that the traction, demand on the tyre is greater.

In future, engine power and torque will increase – so the stress will be on better ride and handling. Tyre labelling which will allow customer to quickly determine performance, will be driving the market in Europe and the US from 2012 onwards. Basically, tyre development will be driven by the consumer who will want more fuel efficient, higher-performance and environment friendly tyres. Tyre labelling will determine his purchase decision, Labelling has shown a very a positive impact on other industries, and this is coming to the tyre sector. This trend will benefit the entire humanity. This will increase tyre producers drive for new, better products to achieve better grades. This will reduce CO2 emissions owing to lower rolling resistance. So, more people will become mobile without increasing the overall carbon emission.

**Performance indicators**

The three important tyre performance properties – rolling resistance, wet grip and wear characteristics – are interrelated through a triangular relationship, which tyre designers call Magic Triangle. It means that achieving any one of
these normally will be at the cost of other benefits. However, in tyre compounding we can achieve low rolling resistance without compromise over traction in many ways. Many manufacturers of passengers car tyres have adopted the partial or full replacement of carbon black by silica in combination with silane and solution SBR, the so-called green tyre, to achieve lower rolling resistance. The most important factor is the creation of special solution styrene-butadiene rubbers with exact control of micro structure by synthetic rubber manufacturers.

But tyre makers are optimistic that there are ways to find a compromise solution to this issue. They know that the green theme is the unique selling point of successful companies. The green tyre label is currently used for tyres designed to improve fuel economy. But there is a perception among some consumers, who have driven these low-rolling-resistance tyre, that they are hard and provide firmer ride without the same handling performance and grip as conventional tyres. But tyre-makers are constantly working on addressing these concerns as that would promote green mobility.

The tyre industry is committed to meeting sustainability issues because of consumer demand and stricter environment regulations. At the management level, many companies now require sustainability action across social, environmental and economic sectors. This is turn calls for steps to integrate and analyse data to achieve new green goals and transform internal organisational cultures of tyre companies. These can be used to build competitive advantages – driving increased brand value through innovation and improving internal efficiencies and accountability. It helps in building loyalty among consumers, employees and other stakeholders.

**Tread design**

Another major development towards sustainable mobility is to produce tyres with enhanced fuel efficiency through tread design. Tyre design more specifically tread pattern design plays a critical role in the safe and efficient
operation of a vehicle. The trade pattern can improve vehicle performance by reducing road noise, providing superior grip capabilities in both wet and/or dry driving conditions, as well as minimising rolling resistance to increase the overall fuel economy of the vehicle. The more detailed is the tread design, the more likely will it grip the road better thereby make the tyre less efficient on fuel. Tyre companies work to balance the rubber compounds and tread patterns to find the most efficient combinations that would enhance fuel-efficiency and reduce CO2 emission.

During the design of efficient tread pattern, several factors have to be kept in mind. These include industry standards, government regulations, customer specifications, marketing requirements etc. The complex mechanisms which are taken into account in the design of the tread pattern include, among other things, stresses generated upon the tyre during driving conditions, every losses due to rolling resistance and sidewall flexing. Good design contributes to sustainable mobility. Today emphasis is on producing environment-friendly tyres because of growing awareness about climate change.

**Triple indicators**

Sustainability management enables an organisation to measure, manage and report on the Triple Bottom Lines-environmental, social and economic indicators- and determine business strategies that reduce risks and increase shareholder value. At the end of the life-cycle analysis, which is standard in judging whether the tyre adheres to sustainability, the corporate leaders can demonstrate that such practices help contribute to the environment. The important technical challenges facing sustainable mobility need to be addressed properly for successful organisations to remain on top of the competitive market. These would require development of environment-friendly materials in tyre-making.

Successful companies demonstrate that they are in compliance with various current and forthcoming, global laws and regulations. It is important to
track the product throughout its life-cycle in order to measure its impact on the environment at every stage—from raw material suppliers, tyre production, its use, reuse and disposal. The major steps in such processes include measuring key sustainability activities using industry-accepted methodologies and protocols. Corporates should report ongoing performance to ensure transparency with key stakeholders and work towards compliance with regulatory agencies.

Table 4.1

Regression 2000-01 to 2011-12

<table>
<thead>
<tr>
<th></th>
<th>APOLLO</th>
<th>MRF</th>
<th>CEAT</th>
<th>JK</th>
</tr>
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<tr>
<td>Net worth</td>
<td>Constant</td>
<td>-68.43</td>
<td>16.258</td>
<td>556.116</td>
</tr>
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<td></td>
<td>Year (β)</td>
<td>166.5</td>
<td>182.57</td>
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<tr>
<td>Total Assets</td>
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<td>-203.295</td>
<td>-0.215</td>
<td>935.31</td>
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<tr>
<td></td>
<td>Year (β)</td>
<td>310.445</td>
<td>291.837</td>
<td>23.813</td>
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<tr>
<td>Sales Turnover</td>
<td>Constant</td>
<td>284.868</td>
<td>-326.466</td>
<td>573.171</td>
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<tr>
<td></td>
<td>Year (β)</td>
<td>532.117</td>
<td>901.918</td>
<td>281.829</td>
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<tr>
<td>Total Income</td>
<td>Constant</td>
<td>-139.237</td>
<td>-557.882</td>
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<td></td>
<td>Year (β)</td>
<td>552.653</td>
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<td>Total Expense</td>
<td>Constant</td>
<td>-73.528</td>
<td>-497.366</td>
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<td></td>
<td>Year (β)</td>
<td>678.169</td>
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<td>Operating Profit</td>
<td>Constant</td>
<td>-20.552</td>
<td>-76.558</td>
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<td></td>
<td>Year (β)</td>
<td>58.774</td>
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<td>Net Profit</td>
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<tr>
<td></td>
<td>Year (β)</td>
<td>39.055</td>
<td>49.184</td>
<td>6.121</td>
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</table>

Source: Balance Sheets of 4 leading Companies

The above table shows that the regression values of four leading tyre companies from the period of 2000-2001 to 2011-2012 with following equation as:

Regression = Constant + [Regression Coefficient] t
Trend Analysis: Interpretation

The following equation shows the results of running a regression of the net worth of Apollo Tyre Company against time with an assumed linear trend.

\[ \text{Net Worth} = -68.43 + 166.5 \times t \]

The results show that the time variable is statistically significant at the 5 percent level (because the p-value for time is below 0.05). This equation shows that during the sample period, the net worth of Apollo Tyre Company grew by an average of Rs. 166.5 per annum because 166.5 is the coefficient of \( t \), and net worth is measured in rupees.

MRF is leading compared to other three leading tyre companies, especially by examining the sales turnover we can see the value as 901.91 it is far above the other three companies and in the case of Apollo tyres, every year net worth is changed by 166.5 %. Only JK shows negative trend of net worth (-16.21)

The automobile industry is where the most intense technology innovations happen, naturally because, according to studies, this is among those sectors that have been causing maximum damage to environment and contributing to global warming. Almost all segments of the industry play major roles in causing pollution and health hazards. R&D efforts by automobile, automotive equipment and tyre companies to find environment friendly alternatives have resulted in a larger number of products that are now in use and leave comparatively less impact on nature and human health.

The use of aluminum in an automobile will increase from 148 kilogrammes (327 pounds) in 2009 to around 249 kilogrammes (550 pounds) in 2025. The aluminum use as a percent of the overall automotive materials mix will double, reaching 16% in 2025. The use of aluminum in a vehicle has been 156 kilogrammes (343 pounds) in 2012. There is currently a section of experts who believe that it is time aluminum or aluminium aolly replaced steel on
wheels. Both have unique metallurgical qualities and both could be affected by adverse operating environments, and corrosive chemicals. However, both aluminum and steel wheels will perform acceptably when properly maintained. The difference in the final impact on performance is what matters.

**Fuel economy**

Fuel economy, longer life span and increased productivity are the most important factors that drive anything moving on four wheels. It is thus natural that efforts to find solutions to these critical areas will be of top priority for companies. Recycling aluminum only uses 5% of the energy required to make new aluminum. In addition, recycled aluminum creates 95% less greenhouse gas emissions than new aluminum, further reducing the carbon footprint of products that use the recycled metal.

Aluminum is naturally lighter in weight than steel and aluminum wheels have been proven to be stronger, which increases a vehicle's load carrying capacity. Aluminum wheels are also cheaper to maintain, thus cutting overall lifetime operating costs. The sustainability value of aluminum tyres on trucks has been widely approved because of their lighter weight, which enhance fuel efficiency. The overall positive environmental impact that the fleet industry can achieve is considerable. The US Environment Protection Agency (EPA) has determined that certain wide base tire models can reduce emission and fuel use by 3% of more. Also, when tyres with low rolling resistance are used on lightweight aluminum wheels, fuel efficiency can be further improved.

It has been found out that lightweight, wide base aluminum tyres can deliver remarkable fuel efficiency. Which reduce costs and enhance productivity for fleet operators. The new 14-inch wide base aluminum wheels by Alcoa are considered to be lightest in the market-58 pounds per wheel and an excellent performer on the sustainability scale. Since aluminum has remarkable cooling effect. Aluminum wheel base can increase tire life and reduce the risk of
puncture. There are other advantages like increased brake fluid life and reduction of breaking overheating and break failures.

Because of their popularity, there is an extremely large selection of alloy wheels to choose from, Aluminum alloys are better looking than standard steel wheels. They come in a wide variety of finishes. Including polished, chromed and painted. One can also order custom alloy wheels from some companies with the made to order finish. Many believe that installing a set of alloy wheels will usually improve the value of the vehicle, or at least its desirability, making it potentially easier to sell. Because alloys have multiple benefits, from increases performance to better looks, they are generally considered a plus when fitted to a car.

On the flip side is the complex process of manufacturing, including material composition, casting technology, mold design, heat treatment process, cutting and coating process. Another problem is the high initial investment. An aluminum wheel costs about 1-7 times higher than steel wheels. Despite these downside points, aluminum wheels are generally considered more suited for the current environment that stresses more on sustainability than any other factor.

It is in this context that tyre researchers are continually coming up with innovative solutions, from the standpoint of fuel-efficiency and wet grip performance, use of silica as a filler is an indispensable technology for high-performance fuel-efficient tyre. silica, due to its typical chemical nature, is not well accepted by the polymer. This required the development of coupling agent. With the introduction of the green tyre, development of new silane coupling agents has also accelerated. Another breakthrough research is the multifunctional polymer. Lanxess, AG, the global speciality chemicals company has come out with a technological solution by developing neodymium-based performance butadiene rubber (Nd-PBR). It is accepted as the major ingredient in the manufacture of green tyre.
The company aims to seize the emerging market opportunities in Asia by setting up the world’s largest plant for Nd-PBR production in Singapore. At an investment of US$260 million, the plant will produce 140,000 metric tonnes of Nd-PBR rubber per annum. The use of this speciality synthetic rubber can reduce RR by 20 to 30 per cent in a tyre and save energy. ND-PBR is used in the treads and sidewalls of green tyres. Green tyres using ND-PBR will drastically cut cost of motoring and reduce carbon dioxide emissions.

It is, therefore expected that the green tyre—the fastest growing segment in the tyre industry that is booming at 10% annually—will be in great demand in the years to come. The company forecasts that the demand for such fuel-efficient tyres will rise around the world by 77% from 2010 to 2015. The company has demonstrated the advantages of Nd-PBR rubber by producing a concept green tyre with the world’s highest rating of AA.

Some of the top companies that are producing low RR tyres with lower weight include Bridgestone, Goodyear, Continental and Michelin among others. They are able to grapple with issues such as lower RR, fuel efficiency, abrasion resistance and find a compromise to achieve better durability which otherwise comes at the expense of either RR or wet grip.

**Green Mobility**

Worldwide the focus is on green mobility with the emphasis on producing sustainable products such as green tyres. They are getting considerable boost with mandatory regulations such as tyre labelling, whose main objective is to achieve fuel efficiency and reduction in CO2 emissions. Environment friendly tyres are the fastest way to achieve a green return, the point at which the upfront financial and environmental costs of green vehicle technologies are recouped, and savings begin to happen. It revealed that green tyres return their investment much quicker than some of the most popular green technologies, such as stop/start tech.
The task before tyre engineers is to keep improving the performance of green tyres by using more renewable materials, emerging nanotechnology and innovative designs. With the market for fuel efficient eco tyres, which is expected to grow double-digit, green tyre makers have a great challenge in satisfying the demand from consumers.

Relevant technological advances should be introduced as soon as available. The advantages of each technology will accumulate with time and will be accelerated when other technologies are implemented. The need for widespread use of green tyres in developing countries such as China and India because of the massive rise in vehicles on roads. The pace of growth has implications for all aspects of automotive transportation—for traffic management systems, for future design of cars and for planning of cities and roads, etc.

No single technology will achieve sustainable transportation. No combination of foreseeable technologies in automobile design, tyre improvements, light-weighting, hybrid engines, etc by themselves can get us to sustainable transportation goals. This is because the amount of fuel consumed by an automobile, say in a year of use, is dependent not only on the rated fuel-efficiency of the vehicle but also on patterns of its use. As is well known, the fuel consumption of an automobile is much higher in congested stop-and-go traffic than in free flowing, constant speed travel. This emphasises again that any serious effort towards reducing the total fuel consumption of a nations’ fleet must include improvements in all the relevant factors and not depend solely on advances in tyre or vehicle designs. Advanced technology evaluation and implementation such as hydrogen fuel cell vehicles telematics systems, pre-crash sensing and smart systems for vehicle safety.

**Anova One Way Summary**

The ANOVA test carried out to verify the difference that we observe holds in the population was not found to be significant as the \( p \) value is 0.083.
The coefficient of variation \( CV = \frac{SD \times 100}{\text{mean}} \) is very high indicating high within variation of the growth over the years of study.

\[
\text{(Coefficient of Variation} = \frac{SD \times 100}{\text{mean}} \text{)}
\]

By looking difference between f value and critical value we can decided that whether the value is significant or not. The ‘critical value’ is very low means that it is not significant and vice versa. From the net worth it is seen that the variation is very high and ‘critical value’ is not significant. And from the total income we can see that the significant value is only .39 (not much variation).

In the case of total assets value f an critical value variation is seen, sales turn over shows .848 and total income seems almost significant.

**ONE-WAY ANOVA: INTERPRETATION**

One-way ANOVA compares three or more unmatched groups, based on the assumption that the populations are Gaussian. The P value tests the null hypothesis that data from all groups are drawn from populations with identical means. Therefore, the P value answers this question: If all the populations really have the same mean, what is the chance that random sampling would result in means as far apart (or more so) as observed in this experiment? If the overall P value is large, the data do not give any reason to conclude that the means differ. This is not the same as saying that the true means are the same. We just don't have compelling evidence that they differ. If the overall P value is small, then it is unlikely that the differences observed are due to random sampling. We can reject the idea that all the populations have identical means. This doesn't mean that every mean differs from every other, but mean only that at least one differs from the rest.

In these results, the null hypothesis states that the mean values (of Net worth, Total Assets, Sales Turnover, Total Income, Total Expense, Operating Profit, and Net Profit) of 4 different tyre companies are equal. Because the p-
value is greater than 0.05 in all the cases (of Net worth, Total Assets, Sales Turnover, Total Income, Total Expense, Operating Profit, and Net Profit), the null hypothesis can be accepted and conclude that the data do not give any reason to conclude that the mean values of Net worth, Total Assets, Sales Turnover, Total Income, Total Expense, Operating Profit, and Net Profit for four different tyre companies differ significantly.

Table 4.2
One Way Anova

One way ANOVA (Net worth)

<table>
<thead>
<tr>
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<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
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<td>Within Groups</td>
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<td>325.194</td>
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<td>Total</td>
<td>15337.259</td>
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One Way ANOVA (Total_assets)

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<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
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<td>Within Groups</td>
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<td>Total</td>
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One Way ANOVA (Sales Turnover)

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<td>Total</td>
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### One Way ANOVA (Total Income)

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<tbody>
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### One Way ANOVA (Total expense)

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<tr>
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<tr>
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<td>21653.658</td>
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<tr>
<td>Total</td>
<td>21951.658</td>
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</tbody>
</table>

### One Way ANOVA (Operating Profit)

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<tr>
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<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Between Groups</td>
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<tr>
<td>Within Groups</td>
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<td>Total</td>
<td>160097.851</td>
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</table>

### One Way ANOVA (Net Profit)

<table>
<thead>
<tr>
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<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
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<td>.573</td>
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<td>Within Groups</td>
<td>53804386.345</td>
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<td>1345109.659</td>
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<tr>
<td>Total</td>
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</tbody>
</table>

In the above tables all $f$ values are insignificant, means it shows the industry behavior of all most same performance of four Tyre companies.
4.5 CHALLENGES OF TECHNOLOGY

Synthetics that have the same/almost same characteristics of NR and could become a choice for tyre makers. Various synthetics (Pus, solution elastomers, etc.) have been touted as the answer over several decades. Ultimately they all seem to come into a symbiotic relationship with NR. The relative share of NR in the tyre industry has, if anything, improved over the last two decades and in the current climate change concerns scenarios, it holds the upper hand over the oil derived synthetics. While advances in biotechnology and nanotechnology can pose serious challenges, natural rubber will also benefit from applying these advances selectively. Successful techno-economic re-commercialisation of products such as ENR, DPNR, and TPNR applying advances in processing and combinatorial compatibilisation technology could in fact pose challenges to established synthetics in meeting the demands of the modern tyre designers.

Introducing to India technically specified NR in the 1970s. The growth of the indigenous TSR industry has been very disappointing. Consistent quality as required by the tyre industry is hard to come by on a diet of aged/dried cup lump as the main input materials and produced in low capacity (poor consistency) TSR plants. The producing and consuming sectors with their institutions and Associations need to come together and brainstorm, in order to usher in a new input mix, which factors in the latex now being converted into the lower RSS 3&4 grades used by most Indian tyre companies. If a win-win technology-cum-pricing strategy can be evolved for using fresh deliberately coagulated field coagulum (which now goes to conversion to RSS sheets for the industry) there can be substantive growth of TSR. These problems have been very effectively resolved in other major NR producing countries.

It is possible to increase the percentage of recycled rubber in the production of new tyres. It’s on the agenda of most major tyre companies. There is, however, a great need for the standardisation of the grades (work has
been initiated in the ISO TC45-Rubber and Rubber Products Group involving tyre and reclaim producers), R&D spending to evolve high performance recycled and preblended materials should be encouraged by the tyre companies to back the agenda. Recycled rubbers have a significant unrealised potential as a key input material for the entire rubber products manufacturing industry. Global annual recycling of end-of-life-tyres is probably less than 25% of what is discarded.

The 1990’s saw the emergence of the Asian rubber industry to counter the sunset effects in the developed countries. Malaysia became a front-runner in latex products. Sri Lanka in solid tyres and gloves. Thailand in auto components and condoms and India and Indonesia in tyres and GRG’s. However, the first decade of the 21st century has seen the emergence of China (not an ANRPC member at the time of the ADB studies) as the significant force in rubber products, not least of all in tyres, for which anti-dumping duties have been imposed in some countries. The Chinese industry seems to favour topline turnover/sales growth irrespective of the red ink of the bottom line—undoubtedly aided by incredible infrastructure, manufacturing subsidies and attractive financial and banking conditions. Readjustments in the Chinese economy with greater emphasis on growth of domestic consumption might offer palliative comfort to others in the region if competition moderates.

In the overall perspective, Asia as the hub of rubber production and products manufacture will be sustainable. In this context the APEST initiative to bring in UNCTAD on developing sustainable development guidelines in the rubber industry is getting underway, and another UN agency is also willing to support this. Involvement of the producers and consumers, if forthcoming, could usher ion a prosperous era for the Asian tyre and rubber industry.

The tyre industry’s progression towards development of eco-tyres has graduated beyond mere hype and theory. The process of making a truly eco tyre is a work-in-progress. The percentage usage of eco-sustainable materials in
these tyres is slowly creeping up and one manufacturer has claimed over 80% eco friendliness. No universal guideliness are yet available on what would constitute a truly eco-friendly tyre, so the eco tyre of today is a composite hybrid, much like the automobile on which it is fitted. Of course the tyre must also become friendly on the consumers pockets to be able to rise above the confines of a niche market.

The current trends in the use of nano materials in tyre manufacturing could contribute to development of green tyres. Nano materials are yet to make significant in roads into tyres on the road. Safety concerns on the incorporation of nano materials in dry forms, is attracting a lot of regulatory attention. Safe incorporation via the latex route could become a techno commercially attractive alternative. The Cabot latex –carbon Transfinity, high dispersion level master batch process using conventional carbon black grades (now being brought to commercial scale production) points the way for the future incorporation of nano materials. Silica/NR without the silane coupling agents is one such green and sustainable option which should interest tyre companies, as it can give customised high performance materials. Nano fillers which impart impermeability characteristics to conventional polymers could be part of inner liner and inner tube compositions especially when made available in Master batch form,. Globally technology fine-tuning is on-going in a number institutions and tyre R&D establishments.

Close cooperation

The AITDF’s policy statement for last almost three decades has been that tyre dealers are equi distant to manufacturers and consumers. Tyre dealers would alwyas like to work in close cooperation with tyre manufactrers in the larger interest of road transport industry and the economy. AITDF has always stated that the fixation of price of tyures and tubes in prerogative of each tyre maker and tuye dealers as well consumers cannot arrogate the authority to fix the price ofd the product. However, blatant price rigging and exploitation of
hapless tyre dealers and transporters is making the relationship with some of the manufacturers uneasy. Therefore, the ball lies in the court of tyre manufacturers in the long term interest of industry and trade.

There are very positive moves from the industry to modernise tyre manufacturing technology that is based on environmental sustainability. With the entry of global tyre majors in India by setting up their production facilities in our country, the prospects of greener technology in tyre are very positive because players like Michelin, Continental, Bridgestone, Yokohama etc. have technology, resources and intent to bring in green technology to India. As far as domestic tyre majors at present are concerned, they hardly do any genuine and serious R&D to achieve such goals. For the present set of tyre makers in India, gimmickry in marketing for green tyres is nothing but fashionable jargon. While vehicles are certainly not the only source of air pollution in India, they are one of the main sources of air pollution responsible for poor urban air quality in the country. Transport sources account for 20-40% of particulate matter emissions and 50-90% of NOx emissions in major Indian cities.

With increased economic activity, use of personal and freight vehicles is rapidly growing in India, and unless urgent actions are taken, the emissions of particulate matter from on-road vehicles are expected to double in the next decade. Vehicles emission standards in India lag standards in Europe by five to ten years, so there are significant opportunities for improvement in reducing vehicular emissions. There is a need to formulate an Auto Fuel Policy roadmap for the next decade (2013-2025). The roadmap should aspire to adopt the state-of-the-art vehicle and fuel stands. This means achieving Euro 6/Vt emission standards along with ultra-low sulphur fuels (10 ppm sulphur) as quickly as possible, coupled with tighter durability and in-use emissions requirements.

Wherever feasible, leapfrog in advancing the policy framework since public health benefits obtained relative to the cost of leapfrogging are
substantial. “Potentially, this means skipping Euro V altogether, and advancing to Euro 6/VI emission standards as soon as ultra-low sulphur fuels are available.

Tyre testing will take a leap in the next couple of years. This will be through new test machines that will run at much higher speeds and generates much more accurate data which will be used in developing and validating new simulation tools. A unique test trailer that could be used to test tyres in actual road conditions, facilitates researchers to study the stability of vehicles and measure with a greater degree of accuracy conditions that could cause vehicles with specific tyres to roll over. Based on such data, design engineers and manufacturers can develop and produce control systems for better stabilisation of vehicles.

Encompass automotive engineering from tyres to active safety systems is to make accurate tests that he is working on better test machines that will run at much higher speeds enabling them to generate much more accurate data. This can be used in developing and validating new simulation tools. Tyre force’ and ‘moment test’ machines as well as machines that will characterise the tyre properties at higher speeds will become a reality in 2.5 years. Whether, in the absence of a universally acceptable ‘test certification’, customers could choose suitable tyres from the aftermarket, very often such tyres meet or exceed OEM specifications. Although having a universally accepted test certification is the ideal solution to after market tyre compatibility, tyres designed for the after market meet or exceed most OEM specs for the given platform.
Figure 4.1 TECHNOLOGY LADDER

- Super Single Radial Tyre (Truck)
- Radial OTR Tyre
- Radial Aircraft Tyre
- Energy Efficient Tyre
- Run Flat Tyre (Passenger Radial)
- Intelligent Tyre With Pressure Warming
- Eco-Friendly Tyre (Passenger)
- Textile/ Steel Belted Tyre
- Racing Car Tyre
- High Performance Radial Tyre
- Low Aspect Ratio Radial Tyre
- Radial Tubeless tyre
- All steel Radial Tyre
- Textile/ Steel belted Radial Tyre
- Bias Nylon Tubeless Tyre
- Low aspect ratio Bias Tyre
- Textile/ Fibre Glass Belted Tyre
- Textile/ Steel Belted Radial Tyre
- Textile/ Textile Belted Tyre
- Bias Nylon Reinforced Tyre
- Bias Rayon Reinforced Tyre
- Bias Cotton Reinforced Tyre
4.6 TYRE TECHNOLOGY

1. Tyre with Cotton (reinforcement) Carcass:

In the starting phase of proper Bias or Cross ply tyre, cotton plies were used as main reinforcing material (end of 19th and early 20th Century). Cotton reinforcing material had inherent problems of low strength and high moisture regainer. Leading to large number of plies to get the requisite casing strength for the tyre weight of the tyre and poor heat dissipation. This, in turn, gave an adverse impact on Tyre weight and buck rendering poor performance.

2. Tyre with Rayon (reinforcement) Carcass:

With the development of viscose and rayon the strength of reinforcing material went up and found application in tyres in early 20th Century. Due to higher strength of rayon it was possible to reduce number of plies and weight of the tyre. Since less number of plies were needed to match cotton strength, concept of ply rating developed. It was also possible to have higher ply ratings now.

3. Tyre with Nylon (reinforcement) Carcass:

Persuent to development and introduction of Polymide (Nylon) the strength and flexing behavior of reinforcing materials improved substantially resulting in further reduction of number of plies, consequently the weight of the tyres. This development substantially improved the heat and impact resistance of the carcass leading to better tyre performance and higher durability. Nylon casing gave a boost to retreadability. Thus effective cost of the tyre in operation became much more economical.

Development of Tyre Technology due to change in Reinforcing material is basically in the case of Cross Ply or Bias Tyres. Bias tyre has cotton, Rayon or Nylon Cords, bound as plies and each ply (i.e. Cords) cross each other at a definite angle anchoring at the bead.
4. **Radial (Construction) Tyre - Textile/Textile belt (Rayon/Nylon/Polyester)**:

Inspite of continuos development in Bias Tyre Technology, inherent problem of high heat development and poor life remains a continuos challenge. In early 1950s new concept of Tyre design was developed namely "RADIAL" wherein plies were made highly flexible by keeping the cords at 90 and in order to improve tyre life, inextensible (stiff) belts were placed on the top of the Carcass under the tread. This led to stiffer tread portion, leading to higher Tread life (Mileage) and much more comfortable ride due to flexible carcass. This was the beginning of 'Revolution' in tyre technology. Initially Radial tyres were introduced with Casing Plies as well as belt material of textiles. Continuos development in Radial Concept led to further improvements as explained below.

5. **Radial (Construction) Tyre - Textile/Steel belts**:

Once Steel Tyre cord got developed it found its immediate application in Belt material, keeping casing plies of Textile, to further improve durability.

6. **Radial (Construction) Tyre - Textile/Glass Fibre Belt**:

Similarly, development of glass fibre which is practically inextensible, led to application in passenger and Light Commercial Vehicle tyres with Textile Casing, providing corrosion free radial Tyre belt material.

7. **Low Aspect Ratio (Cross Ply or Bias) Tyre**:

A new concept of low aspect ratio (ratio between section height and section width) of the tyre in cross ply construction was introduced for higher speed and better performance.

8. **Tubeless Tyre (Cross Ply)**:

Concept of tubeless tyre in cross ply construction wherein an inner liner compound based on chloro butyl or Halo Butyl which is impermeable to gases, was introduced eliminating the usage of tubes. This concept could not find sustained
application in India due to bad roads and poor handling/maintenance of Rims other than in OTR range. However, Tubeless tyres are produced for Export Market.

Gradually this concept will become fully acceptable with the advent of new generation vehicles and improved service facilities.

9. *Radial (Construction) Tyre - Textile/Aramid Belt* :

Due to poor roads and inadequate vehicle maintenance, Steel belts had corrosion problem due to cuts and chips in the tread. This led to trials with Aramid belt (Textile material with very high strength and Low extensibility). However, this could not find any sustained use.

10. *Radial (Construction) Tyre - All Steel* :

In developed countries, Radial Truck/Bus tyres use steel wires in casing as well as in Belts to achieve the optimum advantage of radial construction. In India also this construction was tried since late 1970s by Indian Companies using tyres of collaborators. This could not succeed. Indian companies started experimentally since late 1980s (themselves or with collaborators) which continues and the product has found gradual entry into low load application.

11. *Tubeless Tyre - Radial Construction* :

As in the case of Bias Tyres, the concept of tubless tyre was extended to radial construction and introduced in later half of the century in Developed countries. A tubless tyre not only has tube eliminated but provides for smoother ride and vehicle handling. This is slowly entering into the Indian market with the advent of new generation vehicles.

12. *Low Aspect Ratio - Radial (Construction) Tyres* :

The concept of low aspect ratio tyre, after gaining the experience from cross ply construction, was introduced in Radial construction also. The present trend of tyre development for high speed tyre is being pursued in this direction. Tyres with
aspect ratio upto 0.65 are being manufactured today enabling Indian Industry to adopt high speed rating e.g. 190 kmph, 210 kmph etc.

13. **High Performance Passenger Car Radial Tyre**:

High Performance Passenger Car radial tyres not only have very low aspect ratio (0.65 - 0.35) but also have substantial changes in construction. Very low aspect ratio enables use of large diameter wheels which, in turn, allows better stability at high speeds. The tyre contour is based on the cross section of a fully loaded tyre and this reduces the energy losses within the tyre and reduced dynamic fatigue. High performance Passenger tyres are made with speed rating upto ZR indicating speed capability in excess of 240 kmph. In India, this concept has not yet been found popular though customers are demanding tyres upto 220 kmph (V Rating).

14. **Run Flat (Puncture Proof) Tyre - New Concept**:

A new concept of run flat tyre (puncture proof) was introduced by Continental in early 1980s wherein the basic construction of the rim and bead was changed by which on loosing air the tyre tread sits on the rim thus enabling one to drive at a reasonable speed for a long distance till the flat tyre could be attended to.

This revolutionises the OE need for a new vehicle as the Stepney tyre can also be dispensed off. However, there is very slow progress of this concept. This has not been tried in India so far.

15. **Fuel economy/low rolling resistance tyre - special compound**:

Tremendous work is being carried out towards the development of tyres with modified special compounds, besides tyre construction aspect, to reduce rolling resistance thus gaining in fuel consumption. However, the ultimate advantage is obtained by Radial Construction which is gradually finding its well deserved place in Indian Industry.
16. Green Tyre (Environment Friendly):

This is the latest development in Passenger Radial tyres. These tyres have a rolling resistance appreciably lower than normal tyres. These tyres have high proportion of non petroleum based material used in their construction and are called environment friendly or 'green tyres'. This concept is well perceived and will gradually find its application world over, including India.

'Radialisation' in India - Current Status & Future Trends

Rate of radialisation is actually an index of the status of road development, vehicle engineering and the economy in general". Notwithstanding the problem areas, constraints and limitations, the tyre companies have kept pace with the technological improvements that radialisation signifies and offer state-of-the-art product (tyres), comparable to the best in the world.

- Radialisation can be aptly classified as the most important innovation in tyre technology. Despite its several advantages (additional mileage; fuel saving; improved driving) radialisation in India earlier did not catch on at a pace that was expected, since its introduction way back in 1978. This could be attributed due to several factors, viz. Indian roads generally not being suitable for ideal plying of radial tyres; (older) vehicles produced in India not having suitable geometry for fitment of radial tyres (and hence the general, and wrong, perception that radial tyres are not required for Indian vehicle; unwillingness of consumer to pay higher price for radial tyres etc.

- However, the situation has radically changed in recent years, especially for the passenger car tyre segment where radialisation has crossed 98% mark and is expected to reach 100% in two to three years. In the Medium and Heavy Commercial vehical segment current level of radialisation is upto 15%, and that in the LCV segment is estimated at 18%.

- A few years back a beginning was made in Radialisation of truck and bus and LCV tyres and this process is gaining momentum.
Future of Radialisation

The future of radialisation will be governed by the following factors:

- Cost - Benefit Ratio
- Road Development
- Overload Control
- User Education
- Retreading Infrastructure.

4.7 RETREADING INDUSTRY IN INDIA

In the manufacture of a new tyre, approximately 75%-80% of the manufacturing cost is incurred in tyre body and remaining 20%-25% in the TREAD, the portion of the tyre which meets the road surface. Hence, by applying a new TREAD over the body of the worn tyre, a fresh lease of life is given to the tyre, at a cost which is less than 50% of the price of a new tyre. This process is termed as 'tyre retreading'. However, the body of the used tyre must have some desirable level of characteristics to enable retreading. Retreading cannot also be done if the tyre has already been over used to the extent that the fabric is exposed/damaged. Retreading could be done more than once.

Types of Retreading

Retreading can be done by the following two processes:

1. Conventional Process (also known as 'mould cure' or 'hot cure' process) - In this process a un-vulcanized rubber strip is applied on the buffed casing of the tyre. This strip takes the pattern of the mould during the process of vulcanization;

2. Precure Process (also known as 'cold cure')- in this process a tread strip, where the pattern is already pressed and precure is applied to the casing. It is bonded to the casing by means of a thin layer of specially compounded uncured rubber (known as cushion or bonding gum) which is vulcanized by the application of heat, pressure and time.
The present all India pattern, by type of retreading, is as follows: Precured - 50%, Conventional 50%. Retreading is primarily done in the Truck and Bus trye segment. On an average a Truck/Bus trye is retreaded 1.5 times.

At present only 3-4 large companies are in the organized sector of tyre retreading. Organized sector is classified as that comprising of companies which operate through the franchisee route.

**International vs. Indian Experience in Tyre Retreading: Similarities & Differences**

**Similarities**

As is the experience in other parts of the world, tyre retreading in India has gained greater acceptance in the commercial segment, especially truck/bus and light commercial vehicle (LCV) tyres, due to operational savings. The share of passenger car tyre retreading is on the decline due to several factors, viz. fitment of radial tyres as OE fitment giving increased mileage (encouraging owners to go in for new radial tyres at the time of replacement, strong preference of improved aesthetics of new generation of passenger cars (and hence new tyres) and above all, a growing concern for safety (due to driving at increased speeds).

**Differences**

In the developed countries retreading, by and large, is only through precured methods, whereas the share of hot/conventional retreading in India is high 50%, with the share of hot/conventional retreading in select segments, like farm tyres, being considerably higher.

**Expected Future Trends in Tyre Retreading in India**

Tyre retreading in the commercial vehicle segment is poised for growth in the future. This growth will be aided by the following favourable factors and major developments taking place:
• Increased level of Radialization in the commercial vehicle segment (due to reduced incidence of overloading of commercial vehicles);

• Growth in and increased share of multi-axle trucks (with the catching up of the concept of 'hub & spoke' transportation, long distance movement of road freight will be by multi-axle trucks whereas distances within and around the cities will be catered by smaller commercial vehicles);

National Highway Projects, especially Golden Quadrilateral Project and Highways connecting North-South and East-West corridors (coupled with reduction in overloading and improved condition of road network, higher level retreading will offer added financial benefits).

4.8 REGIONAL TRADE AGREEMENTS (RTAs) AN OUTLINE WITH REFERENCE TO TYRE INDUSTRY

Trade Agreements are broadly on the following lines:

• RTAs (Regional Trade Agreements, can be bi-lateral or plurilateral)

• RTAs aim to establish a Preferential Trade Area (PTA) and/or a Free Trade Area (FTA)

• Framework Agreement (setting the ground for establishing a Free Trade Area) generally precedes complete FTA.

• In case of simultaneous applicability of more than one RTA, trade can take benefit only under one Agreement

• RTAs are WTO compatible.

The following are the important and integral components of any RTA:

• Rules of Origin: prescribing minimum value addition in exporting country; Preferential/Concessional Rate of Import Tariff: specified as
extent/percentage of concession on the MFN rate (i.e. applied/basic rate of normal customs duty);

- RTAs have assumed added significance due to slowdown of trade talks at multilateral platforms (WTO), each industry/sector trying to source/sell globally, intense competition, progressive reduction in import tariffs etc.

**Tyre Industry Related (key features and practical dimension)**

The following RTAs concern tyres and raw materials of tyre industry:

a) **Asia Pacific Trade Agreement (Bangkok Agreement)** Tyres and inner tubes can be imported from signatories to the Bangkok Agreement (please see list attached) at concessional rate of customs duty for signatories to the Agreement and specific details, please refer to the statement given below.

b) **Indo-Sri Lanka Free Trade Agreement** Tyres can be imported at nil customs duty. Natural Rubber is in the Negative List of India. Several other raw-materials of tyre industry are eligible for duty concessions of varying magnitude.

c) **SAPTA (SAARC Preferential Trading Agreement)** Truck & Bus, LCV and Jeep tyres and select raw-materials of tyre industry can be imported into India at concessional/Nil rate of duty from signatory countries, (viz. Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka) Reference statement given below.

d) **India-Singapore Comprehensive Economic Co-operation Agreement:** Truck bus, passenger car (bias) and other Bias tyres can be imported into India at Nil custom duty.

e) **India-South Korea CEPA:** Tyres in the Negative List (Excluded from Tariff Concession).

Select raw materials of tyre industry eligible for Nil/Concessional Customs duty from 2015 onwards.

f) **ASEAN Agreement:** Key tyre categories tariff to be brought down to 5% by 2016.
## Table 4.3
PREFERENTIAL TARIFF FOR TYRES / RAW MATERIALS OF TYRE INDUSTRY
Under Bi-lateral / Regional Trade Agreements

<table>
<thead>
<tr>
<th>HSN Classification</th>
<th>Product/Category</th>
<th>Customs Duty in % (Basic)</th>
<th>Asia Pacific Trade Agreement (Formerly Bangkok Trade Agreement)</th>
<th>Indo- Sri Lanka Free Trade Agreement</th>
<th>SAFTA - Pakistan, Sri Lanka</th>
<th>SAFTA - Bangladesh, Bhutan, Maldives, Nepal, Afghanistan</th>
<th>India-Singapore Economic Comprehensive Agreement</th>
<th>India-South Korea (CEPA)</th>
<th>India - ASEAN</th>
<th>India - Mercosur</th>
<th>India- Japan CEPA Agreement</th>
<th>India - Malaysia Trade Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>40112010</td>
<td>Truck/Bus (Radial)</td>
<td>10</td>
<td>8.6</td>
<td>Nil Duty</td>
<td>6</td>
<td>Nil Duty</td>
<td>Not covered</td>
<td>7</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
</tr>
<tr>
<td>40112090</td>
<td>Truck / Bus( Bias)</td>
<td>10</td>
<td>8.6</td>
<td>Nil Duty</td>
<td>6</td>
<td>Nil Duty</td>
<td>Nil Duty</td>
<td>7</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
</tr>
<tr>
<td>40111010</td>
<td>Motor Cars (Radial)</td>
<td>10</td>
<td>8.5</td>
<td>Nil Duty</td>
<td>6</td>
<td>Nil Duty</td>
<td>Not covered</td>
<td>7</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
</tr>
<tr>
<td>40111090</td>
<td>Motor Cars (Bias)</td>
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<td>Nil Duty</td>
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<td>Aircraft</td>
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<td>0</td>
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<td>8.6</td>
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<td>6</td>
<td>Nil Duty</td>
<td>Nil Duty</td>
<td>7</td>
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<td>Not covered</td>
<td>Not covered</td>
<td>7</td>
</tr>
<tr>
<td>40114020</td>
<td>Scooter</td>
<td>10</td>
<td>8.6</td>
<td>Nil Duty</td>
<td>6</td>
<td>Nil Duty</td>
<td>Nil Duty</td>
<td>7</td>
<td>Not covered</td>
<td>Not covered</td>
<td>7</td>
<td>Not covered</td>
</tr>
<tr>
<td>40119300</td>
<td>Industrial/Const. Tyres</td>
<td>10</td>
<td>8.6</td>
<td>Nil Duty</td>
<td>6</td>
<td>Nil Duty</td>
<td>Nil Duty</td>
<td>7.81</td>
<td>5</td>
<td>Not covered</td>
<td>7.3</td>
<td>5</td>
</tr>
<tr>
<td>40119200</td>
<td>Tractor/(Agricult ure)</td>
<td>10</td>
<td>8.6</td>
<td>Nil Duty</td>
<td>6</td>
<td>Nil Duty</td>
<td>Nil Duty</td>
<td>7.81</td>
<td>5</td>
<td>Not covered</td>
<td>Not covered</td>
<td>7.3</td>
</tr>
<tr>
<td>4012 20</td>
<td>Used Rubber Tyres</td>
<td>10</td>
<td>Not covered</td>
<td>Not Covered</td>
<td>6</td>
<td>Nil Duty</td>
<td>Nil Duty</td>
<td>Not covered</td>
<td>7</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
</tr>
<tr>
<td>4012 10</td>
<td>Retreaded Tyres</td>
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<td>Not covered</td>
<td>6</td>
<td>Nil Duty</td>
<td>Not covered</td>
<td>7.81</td>
<td>7</td>
<td>Not covered</td>
<td>Not covered</td>
<td>Not covered</td>
</tr>
</tbody>
</table>

Source: Automotive Tyre Manufacturer’s Association (ATMA) 2011-2012
In a pre-budget submission to the Finance Ministry, the domestic tyre industry has sought review of India’s regional trade agreements which are adversely impacting the domestic tyre industry.

According to Automotive Tyre Manufacturers Association (ATMA), tyres in large volumes were entering India, while import of raw materials was restricted as a direct outcome of these agreements.

Basic customs duty on tyres is 10 per cent, however under various trade agreements the duty on tyres ranges between nil and 8.6 per cent facilitating tyre imports into India. While tyres (finished product) can be imported into India at preferential/concessional duties under various trade agreements, the basic raw material Natural Rubber (NR) falls in the negative list (no duty concession) across most trade agreements.

Under ASEAN FTA, Indo-Sri Lanka, India-Singapore or India-Malaysia trade agreements, NR is in the negative list leading to no duty concession. On the other hand, tyres can be imported at nil rates of duty under Indo-Sri Lanka, India-Singapore while 6 per cent duty under ASEAN FTA and 8.6 per cent under Asia Pacific Trade Agreement.

The government can increase the customs duty on tyres from existing rate of 10 per cent to a higher rate of duty without contravening WTO provisions as there is no bound rate on tyres. ATMA has asked for increasing customs duty on tyres from 10 to 20 per cent, the same rate as its principal raw-material. The natural rubber production and consumption gap was 1,33,400 tonnes in 2013-14. Not only rubber, significant gaps exist between domestic demand and supply of critical raw materials such as Nylon Tyre Cord Fabric (NTCF), Rubber Chemicals, Steel Tyre Cord, Polyester Tyre Cord, Polybutadine Rubber and Process Oils varying between 12 and 70 per cent.