

Product Designing through Conjoint Analysis and Curve Fitting of Financial Data: A Case of Birla Tyres

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Abstract This case study focuses on the product designing of domestic bias tyres of trucks and bus. There are some attributes of tyres by which potential customers are focusing on these attributes but by taking the most significant attributes like “Application”, “After sales service” and “Rim size” and using the conjoint analysis technique the best combination has been selected. For financial data the curve fitting method of least square of straight line parabolic curve methods are applied for forecasting for the next 10 years and the comparative study also carried out for managerial implication of this company.

Keywords: product design, conjoint analysis, utility, curve fitting, straight line, parabolic curve

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1. Introduction

From the financial point of view it is observed that the financial drives of Birla tyre that is sales, gross profit, net worth and EPS are not in stable position. By applying forecasting techniques with comparative studies it can be suggested that whether straight line or parabolic curve fitting of least square is more appropriate for the company. It has been approved the formation of an internal group to “develop the strategies and tools necessary to accomplish Birla Tyres vision of sustainable sourcing.” As described in its latest Report and internal documents, Birla Tyres envisioned a sustainable supply chain of the product “we continue to operate in certain sectors where our customers trust our strategic vision. Cement and tyres, the two significant business of Kesoram have seen a mixed year. To meet the challenges of these dynamic markets and to continue on our journey of success, we have necessary foresight, strategy and preparedness.” They believed that Birla Tyres’ existing product and its design efforts led the tyre industry; however, it also identified many issues Birla Tyres still needed to address in order to achieve its vision.

The company declares that from motorcycles to farm tractors, millions of people rely on Birla tyres for their everyday needs. So the product designing of Birla tyre focuses the system of designing with the best combination of significant attribute of appropriate levels by which it can satisfy the potential customers’ demand. Ultimately the financial fluctuations of the company can be retrieved to stable in competitive globe. The product designing constitutes a very pivotal role for the effective functioning of the financial fluctuations of the company. Selection of

design of the product depends upon the nature of the product, target customers, supplier base etc. The product design should always be selected carefully based on the strategy the company wants to follow and the risks it wants to take. Operation control of production of these products may be executed by Company’s own staff or by hiring professionals.

Birla Tyres had successfully influenced many of its suppliers to improve their social, environmental, and economical impacts. This will ensure a beneficial experience for all their stakeholders, customers, employees, bankers’ dealers and suppliers. So that Birla Tyres has built a solid reputation for quality and is now recognized as one of the best tyre manufacturers around. In the process, Basant Kumar Birla CEO (see Exhibit-3), and his worldwide team would have to answer some difficult questions:

- How should Birla Tyre prioritize for product design of domestic bias tyre (e.g. providing the right thing at right time and minimizing cost) with the most significant attributes like “Application”, “After sales service” and “Rim size”? What should be the best combination out of different levels of these three significant attributes.
- How should Birla Tyre frame and revise the financial fluctuations which can be predicted or forecasted by different techniques and which curve fitting is the best for different financial data like sales, gross profit, net worth and EPS so that the optimum production can be achieved with minimum cost which impact the global brand?

2. Company Profile

Kesoram Industries Ltd. is a Public Limited Company promoted by Late G.D. Birla in the year 1928 having its Corporate Office at Kolkata. Under the Company's Banner first a textile business (manufacturing of textiles) was started. Thereafter in course of time different units were developed and inducted. Presently, the company is controlling the business of cement, tyres, rayon, chemical, paper etc. with an annual turnover exceeding Rs.7000.00 Crores (see Exhibit-2).

Birla Tyres, under the Kesoram's umbrella was born in the year 1988 at Chhanpur, Balasore, Odisha. After the demise of Late G.D. Birla, Syd. B.K. Birla took over the charge of the company and under his initiation Birla Tyre was established. Originally, the unit was started for manufacturing of automobile tyres, tubes and flaps with installed capacity of 120 M.T. per day. Commercial production was started in the year 1992. Since then the unit has increased its capacity by adding machines at different times. Presently, the installed capacity has been increased to 272.5 M.T.

In the year 2008, a second tyre plant was established by the same promoter at Laksar, Uttarakhand, Haridwar with installed capacity 320 M.T. per day to manufacture automobile tyres, tubes and flaps. In the year 2010 the 3rd unit was set up for the manufacture of truck radial tyre with capacity 150 M.T. Subsequently, a 4th unit has also started simultaneously for two wheeler/three wheelers with capacity of 80 M.T. In the year 2011 passenger car radial was under construction at Balasore with installed capacity 70 M.T. per day. At present the same is under project stage and likely to be completed by 2013. Birla Tyres has an annual turnover Rs.3800.00 Crores from all units. It spends about Rs.34.00 Crores towards inbound logistic and Rs.74.00 Crores for out bound logistic. For different channel function and operation Birla Tyre is spending about Rs.58.00 Crores.

Birla Tyres a unit of M/s. Kesoram Industries Ltd. was set up to manufacture Automobile Tyres, Tubes and Flaps in the District of Balasore, Orissa started commercial production with effect from 01.03.1992. The plant was set up in Technical Collaboration with "M/s. Pirelli Ltd., U.K." A subsidiary of International giant Pirelli group of Italy being one of the largest manufacturer of tyres in the world. Birla Tyres, part of Kesoram Industries Limited, was founded in 1991. Birla Tyres manufactures tyres for automobiles, trucks, buses, motorcycles, heavy machinery vehicles, tractors and other farm machinery. Birla Tyres set up its first tyre manufacturing plant in Balasore in the Indian state of Orissa in 1991 alongside Italian tyre manufacturer Pirelli.

In a span of two decades, Birla Tyres has become one of the most well-known tyre manufacturers in India. With its new manufacturing plant in Laksar-Haridwar, Uttarakhand, the company has surged ahead in the tyre business. Built within a record time of a mere 10 months, Birla Tyres plans to invest a total of approximately INR 2300 Crores in the state-of-the-art Haridwar factory which has a production capacity of 44,00,000 truck tyres per annum. Birla Tyres exports to more than 50 countries and reported a turnover of over INR 350 Crores earned from exports alone between 2009 and 2011. On the domestic front, Birla Tyres has a 3200 strong network of dealers spread across the length and breadth of the country to cater for the Indian tyre market. Birla Tyres employs over

170 sales officers and engineers, stationed at strategic locations to offer round the clock Claim Settlements and unparalleled customer services. Birla Tyres has earned various national and international accreditations including the ISO 14001 certification. It has a broad product range, with the Victus series for truck and bus radials and Road Maxx series for motorcycles being the latest offerings from the company.

Birla Tyres had to face difficulties as well such as the increase in natural rubber prices or labour unrest in the manufacturing plant in Balasore. The profits too have taken a severe toll in 2011. Compared to a profit of about INR 237 Crores in 2010, Birla Tyres has suffered losses to the amount of 210 Crores in 2011. In a move to correct the situation, the company is in the process of revamping and reorganizing its management operations. With a new management strategy that intends to focus on better usage of the capacity of manufacturing plants together with aggressive marketing and an altered product mix with a shift towards the more profitable passenger car and two-wheeler tyres products, Birla Tyres hopes to recover from the losses in the near future.

The Indian tyre market for truck and bus radials is set to grow at a tremendous rate owing to the infrastructure development in India. In a bid to enter and win the Indian radial tyre market segment, Birla Tyres is set to increase the production of truck and bus radials by a whopping 85 tonnes per day in the manufacturing plant at Haridwar in a move that would require an investment of INR 350 Crores. The tyre manufacturing plant in Balasore is slated to receive an investment of INR 450 Crores to increase the output of passenger car radials by a figure of 80 tonnes a day.

The plant is equipped with best and sophisticated advanced machineries from world leaders of tyres machinery manufacturers such as Berstorff, (Germany) C.A. Litzler, (U.S.A.), Comerio (Italy), Pirelli (Italy), Mitsubishi (Japan), Spadone (U.S.A.) along with indigenous machineries from L&T McNeil, Farrel Anand and Alferd Herbert etc.

The Company has been awarded the ISO 9001 Certificate in December, 1994 in recognition of its Quality Management System. It is the first tyre Company in the history to be awarded ISO 14001 Certificate in recognition of its Environment Management System in the year February, 1998. The Company has also won QS 9001 Certification in March, 1999. The Company has started Total Productive Maintenance (TPM) activities for further strengthening the quality of product and personnel increasing efficiency and controlling cost and awarded the Certificate in October, 2001.

The Plant was initially established with 120M.T. production capacity concentrating upon production of Truck and Bus Tyres, Tubes and Flaps. Subsequently the production capacity was increased to 149 M.T. during the year 1999-2000. The Unit also simultaneously established Radial Tyre Plant which started production since November, 2000 with production capacity about 5 M.T. per day to produce only passenger car tyres. Presently, our installed capacity is 272.5 M.T. and plant is running with full capacity in both the cases.

The indigenous sale is built up through OEM, DGS&D and replacement market. TELCO, Ashok Leyland, Mahindra & Mahindra & TAFE, are the regular OEM

customers. The company has seventy two distribution points spread all over India for direct sales to the replacement market. The export is made to various Countries like, U.S.A., U.K., Canada, Brazil, Sweden, Singapore, Ireland, Norway, Spain, Germany, Bahrain, Algeria, Nigeria, Peru, Philippines, Malaysia, Bangladesh, Nepal & Vietnam.

The prevailing market situation has compelled the Company to concentrate on TPM norms which have helped immensely in cutting down all the hidden losses thereby drastically reducing the cost of production. This has helped to withstand the tough competition and company is constantly striving to sustain the present status.

3. Overview

Kesoram was founded in 1919 under the name of Kesoram Cotton Mills Ltd (see Exhibit 1). From its humble beginnings as a cotton textile mill in Calcutta, Kesoram expanded into the production of rayon. Its first rayon plant was built in 1959, with a production capacity of 4,635 metric tons of rayon yarn per year. The spirit of entrepreneurship did not end there. Kesoram soon entered the tyres and cement industries. A change of name was needed to reflect the company's increasing portfolio of businesses. So in 1986, it changed its name to Kesoram Industries Limited. Since then, Kesoram's operations have grown from strength to strength. Its reputation is recognised today by its listings on four global stock exchanges – National Stock Exchange of India, Bombay Stock Exchange, Calcutta Stock Exchange Association, and the Societe de la Bourse de Luxembourg.

To provide unmatched accessibility, Birla Tyres has more than 170 sales depots regionally. With more than 491 sales engineers and 8,831 dealers at major locations, you will always find a Birla Tyre representative to meet your needs. (See Exhibit- 4) for the market position of Birla Tyres.

4. Production Capacity

Birla tyres prides itself on delivering innovation and operational excellence. The state-of-the art factory at Laksar-Haridwar, Uttaranchal, a production capacity of over 44 lakh truck tyres per year. Today, with the integrated plant at Balasore, Odisham, Birla tyre has a combined capacity of 298,669 metric tonnes. With plans to expanded into the production of passenger car tyres, Birla tyres is poised to become one of the most comprehensive tyre manufacturers in this region. (See Exhibit 5) for the production capacity of Birla tyres.

5. Corporate

Birla Tyres was first established in 1991, as part of Kesoram Industries Limited. It then collaborated with world-class tyre manufacturer Pirelli, in the production and development of its tyres. Since then, Birla Tyres has built a solid reputation for quality and is now recognised as one of the best tyre manufacturers around.

6. Growth & Success Point

The First Plant for manufacturing of rayon yarn was established at Tribeni, District Hooghly, West Bengal and the same was commissioned in December, 1959 and the second plant was commissioned in the year 1962 enabling it to manufacture 4,635 metric tons per annum (mtpa) of rayon yarn. This Unit has 6,500 metric tons per annum (mtpa) capacity as on 31.3.2008. The plant for manufacturing of transparent paper was also set up at the same location at Tribeni, District Hooghly, West Bengal, in June, 1961. It has the annual capacity to manufacture 3,600 metric tons per annum (mtpa) of transparent paper.

Birla Tyre has been established with an overall market share of about 16% of the total tyres sold in the Country. Out of total sales made, 50% sale is in replacement market, 30% sale in export market and rest 20% in OE Market. Birla Tyre has been awarded the "Best Company of the year" many a times in its life span from the state of Orissa. It has been awarded "The Tyre Company of the Year" from ATMA. It has received the Chief Minister Award, "Golden Peacock Shield" twice in the year 2001 and 2006. CII, Odisha Chapter also awarded trophy and shield in different occasions. For quality performance also Birla Tyre has been awarded innumerable prizes from different circle. For the highest export from the State it has received trophy twice in its life span (see Exhibit-6).

7. Product Mix of Kesoram Industries Limited

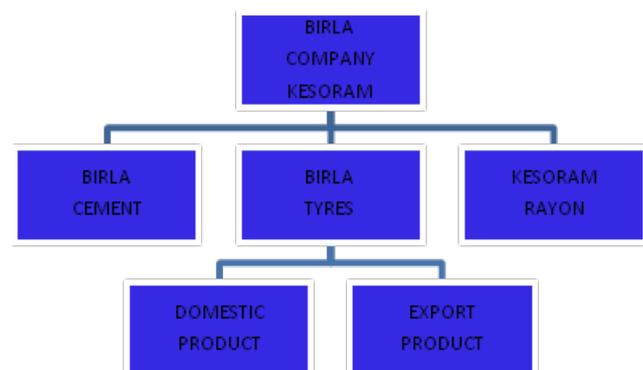


Figure 1. Product Mix of Birla Company

7.1. Product Mix of Birla Tyres

From motorcycles to farm tractors, millions of people rely on Birla Tyres for their everyday needs. Figure 1 shows the product mix of Kesoram corporation limited. The company produces tyres for domestic market as well as international market (export). The details are presented in Table 1 (product mix of domestic market) and in Table 2 (product mix of export market) respectively. With over 170 sales in India, one can always find a dealer to serve to his/her needs. Lets have an access to Birla tyre's international network that stretches across 17 countries worldwide.

Table 1. Product Mix of Domestic Market

Domestic							
Truck And Bus Bias	Radical	Light Truck Bias	Passenger Car Bias		Motor Cycle Bias	Farm Bias	OTR And Mining Bias
XPL	VICTUS D321	XPL	BT 339	BLAIZER	ROAD MAX BT R-41	SHAAN	GRADER MAX
XET DLX, SUPER BT, ZINA	VICTUS D311	SAMSON	BT 444	DAZZLER	ROAD MAX BT F-21	SHAAN+	KALAPATTHAR
SAMSON, ZETA+DLX ROADMILER, BT339+	VICTUS D331	ROADMILLER	BT 446	DELTA	ROAD MAX BT F-81	SUPER	LOADERMAX
BT 112 PLATINUM	VICTUS A511	BT 111	THUNDER	DERBY	ROAD MAX BT R-42	-	ULTRAGRIP
BT 112 PLUS, BT 334, BT 336, TIRIB DLX, BT339*	VICTUS S311	BT 112	-	MILANO	ROAD MAX BT R-81	-	ULTRA TRAC
BT 339 PLATINUM	-	BT 339	-	STEELEX	ROAD MAX BT R-82	-	-
ZYNO DLX, ULTRA PLUS, BT ULTRA, BT 112 GOLD, TARZAN DLX	-	BT 369	-	STELLAR	-	-	-
BT 111, BT112, RAFTAR, TISON DLX, BT 339, BT 339N,	-	BT 333	-	VECTOR	-	-	-
ZING, BT-MAX, BT334*,RUSTAM	-	CHAKRA	-	-	-	-	-

Table 2. Product Mix of Export Market

Export							
Truck And Bus Bias	Radical	Light Truck Bias	Passenger Car Bias		Motor Cycle Bias	Farm Bias	OTR and Mining Bias
XPL	VICTUS D321	XPL	BT 300	DAZZLER	ROAD MAX BT R-41	SHAAN	GRADER MAX
BtT112P	VICTUS D311	SAMSON	BT 444	DELTA	ROAD MAX BT F-21	SHAAN+	KALAPATTHAR
BISONP, BT333	VICTUS D331	ROADMILER	BT 669	DERBY	ROAD MAX BT F-81	SUPER	LOADERMAX
BT 112	VICTUS A511	BT 111	SAFAR	MILANO	ROAD MAX BT R-42	ARJUN	ULTRAGRIP
BT 223, BT 334	VICTUS S311	BT 112	RUSTOM	-	ROAD MAX BT R-81	BT555	ULTRA TRAC
BT 222	-	BT222	-	-	ROAD MAX BT R-82	BT666	-
BT 336, BT111 RUSTOM, BT369, BT880	-	BT 339	-	-	-	-	-
SAMSON, SUGAR, KING	-	BT 333	-	-	-	-	-
BT339	-	BT300 EXTRA	-	-	-	-	-

Table 3. Domestic Products (Bias)

Attribute / Tyres	XPL+	XPL-LG	BT 112 PLUS	BT-ZETA +	BT Roadmiler	BT 112	BT ULTRA	BT TISON DLX	BT ULTRA MILER	BT KALAPATHAR	BT 112 PLATINUM
Market	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic
Category	Trucks & bus	Trucks & bus	Truck & bus	Trucks & bus	Trucks & bus	Trucks & bus	Trucks & bus				
Application	High load	High load	High mileage	High mileage	Load & mileage	Mining	High mileage				
Pattern type	Lug	Lug	Lug	Lug	Rib	Rib	Rib	Lug	Rib	Lug	Lug
Tube type	Tube	Tube	Tube	Tube	Tube	Tube	Tube	Tube	Tube	Tube	Tube
Rim size	7.5"	7.5"	7.5"	7.5"	7.5",6.5"	6.5",7"	7.5"	7.5"	7.5"	6.5", 7.5"	7.5"
Tyre size	10-20	10-20	10-20	10-20	8.25-20	9-20	10-20	10-20	10-20	10-20	10-20
Ply rating	18	18	16	16	16	16,18	16	16	16	16,18	16
After Sales Service	2	2	2	2	2	2	2	2	2	2	2

8.1. XPL+

8. Domestic Market Bias Tyres of Trucks & Bus

- Extra thick casing and reinforced bead area to withstand toughest road conditions and heavy load carrying capacity

- With additional warranty of crown concussion and LRD upto 50% wear

8.2. XPL-LG

- Extra thick casing and reinforced bead area to withstand toughest road conditions and heavy load carrying capacity
- High NSD for better mileage

8.3. BT 112 Plus

- Specially designed cross Lug tyre with extra tread depth for higher mileage
- Special tread rubber compound and reinforce clinch area for better torque resistant
- Premium casing for additional retreads

8.4. BT Zeta +

- Specially designed cross Lug tyre with extra tread depth for higher mileage
- Special tread rubber compound and reinforce clinch area for better torque resistant
- Premium casing for additional retreads

8.5. BT Roadmiler

- Extra tread depth for high mileage
- Specially designed sinusoidal pattern for uniform wear, anti- rib sinking and excellent steering control
- Additional advantage for power steering application
- Very attractive and effective buttress design for cooler running
- Premium casing for additional retreads

8.6. BT Ultra

- Extra tread depth for high mileage
- Extra strong casing for wide range of load applications

8.7. BT 112

- Deep tread depth provides excellent traction and longer life
- Special tread rubber compound designed against chipping & chunking
- Reinforced nylon casing offers durability & multiple retreads

8.8. BT Tison DLX

- Proven cross lug design with reinforced casing ensures low cost per km

8.9. BT Ultra Miler

- Extra Tread Depth & Wide Central Rib for higher mileage
- Sinusoidal Grooves & Specially Designed SIPES for better steering and fit for new generation vehicles
- Optimized Mass at shoulder for cooler running
- Extra Under Tread & Durable Casing for multiple retreads

8.10. BT Kalapatthar

- Specially designed tread pattern and Reinforced casing for resistance to lug chipping, lug tearing, Cut resistance
- Strong shoulder block for excellent capacity and dry traction

8.11. BT 112 Platinum

- Specially designed high tread depth pattern for premium mileage & excellent traction on metallated and uninstalled roads
- Heavy duty casing for multiple retreads

Table 4. Choosing the Right Tyres

ATTRIBUTES TO BE HIGHLIGHTED	TBB	TBR	LCV	SCV	ADV	FARM	OTR	2 WHL	3 WHL	PASS BIAS
Mileage	YES	YES	YES	YES	NA	NA	NA	YES	YES	YES
CPKM	YES	YES	YES	NA	NA	NA	NA	NA	NA	NA
Hours run	NA	NA	NA	NA	YES	YES	YES	NA	NA	NA
Load carrying capacity	YES	NA	NA	NA	YES	YES	YES	NA	YES	NA
Casing value	YES	YES	YES	YES	NA	YES	NA	NA	NA	NA
Retreadability	YES	YES	YES	YES	NA	YES	YES	NA	NA	NA
After sales service	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Value for money	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Aesthetics	YES	YES	NA	YES	NA	NA	NA	YES	YES	YES
Riding comfort/handling	NA	YES	NA	YES	NA	NA	NA	YES	YES	YES
Durability	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
State of the art technology	YES	YES	YES	YES	NA	NA	YES	YES	YES	YES

9. Conjoint Analysis

From the Table 4 it is observed that there are so many attributes of tyres to choose the right tyre of vehicles.

Using conjoint analysis the objective is to determine from the potential customers' point of view, how important each significant attribute is to them. Then the value of utility each combination of the levels can be derived by the customers which helps to understand the feasible

offerings from the marketer’s point of view so, that the company can design that type product for satisfying customers’ demand. By choosing 5 samples of the potential distributors of Bhubaneswar area data has been

collected for the appropriate product design of Birla tyre. Since the sum of the utility is zero, from the Table 5 it can be observed that all the part utilities of each level have been derived.

Table 5. Utilities Table for Conjoint Analysis

Distributor	Attribute	Levels	Part Utility	Range of Utility (Max-Min)
1	Application	High Load	-.591	10.431-(-9.84)=20.271
		High Mileage	-9.840	
		High Load & High Mileage	10.431	
	After Sales Service (years)	3	-.824	2.891-(-2.067)=4.958
		4	-2.067	
		5	2.891	
	Rim Size (“)	6.5	-.166	0.691-(-0.331)=1.022
		7	.691	
		7.5	-.331	
8		-0.194		
2	Application	High Load	-1.250	1.5-(-1.25)=2.75
		High Mileage	-.250	
		High Load & High Mileage	1.5	
	After Sales Service (years)	3	3.000	3-(-3.667)=6.667
		4	-3.667	
		5	0.667	
	Rim Size (“)	6.5	2.278	2.389-(-2.389)=0
		7	-2.278	
		7.5	-2.389	
8		2.389		
3	Application	High Load	.026	11.948-(-11.974)=23.922
		High Mileage	-11.974	
		High Load & High Mileage	11.948	
	After Sales Service (years)	3	-3.807	3.947-(-3.807)=7.754
		4	-.140	
		5	3.947	
	Rim Size (“)	6.5	-.643	0.943-(-0.873)=1.816
		7	.943	
		7.5	.573	
8		-0.873		
4	Application	High Load	.167	7-(-7.167)=14.167
		High Mileage	-7.167	
		High Load & High Mileage	7	
	After Sales Service (years)	3	2.583	2.583-(-1.5)=4.083
		4	-1.500	
		5	-1.083	
	Rim Size (“)	6.5	2.167	2.167-(-1.056)=3.223
		7	-.278	
		7.5	-.833	
8		-1.056		
5	Application	High Load	2.123	5.701-(-7.824)=13.525
		High Mileage	-7.824	
		High Load & High Mileage	5.701	
	After Sales Service (years)	3	-.723	2.946-(-2.223)=5.169
		4	-2.223	
		5	2.946	
	Rim Size (“)	6.5	2.963	2.963-(-2.346)=5.309
		7	-1.605	
		7.5	-2.346	
8		0.988		

9.1. Data Interpretation

From the Table 5 it is concluded that “Application” of the tyre is the most important attribute for the four potential customers (1, 3, 4, 5) out of five customers. There are two indicators for this:

- The range of utility value is highest (20.271, 23.922, 14.167, 13.525) for the “Application” of the tyre.
- The highest individual utility value of this attribute is at its any one of the three levels (10.431, 11.948, 7, 5.701).

So, “Application” is the most important attribute at given level of attributes. Then “After sales Service” is the second most significant attribute at the range of (4.958,

7.754, 4.083, 5.169) and the last attribute in relative importance is the “Rim size” where the utility range is (1.022, 1.816, 3.223, 5.309).

9.2. Combination Utility

The most potential customer is 3 since the range of the utility value is highest (23.922). From part utility of customer 3 it is observed that the combination of “Application” *High load & High mileage*, “After sales service” *5 years* and “Rim size” *7 inch* is the best because it has the highest utility value (11.948+3.947+0.943=16.838). The next best combination is “Application” *High load & High mileage*, “After sales service” *5 years* and “Rim size” *7.5 inch* because it has the

utility value ($11.948+3.947+0.573=16.468$). The worst combination is "Application" *High mileage*, "After sales service" *3 years* and "Rim size" *6.5 inch* since the utility value is ($-11.974-3.807-0.643=-16.424$). By using this technique the utility of any combination can be obtained for Birla tyre.

9.3. Individual Attributes

The difference in utility with the change of one level in one attribute can also be checked. For the "Application" of *High load to High mileage* there is decrease in utility value of 12 units but for the "Application" of *High mileage to High load & High mileage* there is increase in utility value of 23.922 units.

Similarly for the "After sales service" of *3 to 4 years* there is increase in utility value of 3.667 units but for the "After sales service" of *4 to 5 years* there is again increase in utility value of 4.087 units.

For the "Rim size" of *6.5" to 7"* there is increase in utility value of 1.586 units but for the "Rim size" of *7" to 7.5"* there is decrease in utility value of 0.37 units and "Rim size" of *7.5" to 8"* there is again decrease in utility value of 1.446 units.

10. Leadership, Performance & Response

The company has been always looking to the quality aspect. In order to achieve this, it has been concentrated and focuses on the truck tyres segment. To standardize and maintain the quality company is following ISO standard for different activity. It has also adopted TPM, Total Productive Maintenance, being the formula/concept for zero breaks down, Zero maintenance and zero accident. Implementing all these theories in daily life has culminated in a decrease in the loss and wastage ratio and increased the productivity level. This could certainly promote the quality parameters and emphasizes the leadership.

Total revenues of the Company during the year under review increased by about 8% to Rs. 6005 crore. Both major business, Tyres and Cement, recorded revenue growth. Operating margins, however, came under considerable pressure owing to spiraling input costs. These, in turn, impacted financing costs, which too showed a steep increase during the year.

The year under review was pervaded by several challenges making it perhaps the Tyre Business's most difficult year since inspection. Revenues grew by 9% to Rs. 3922 Crore. However, inordinate pressure on margins forced the Business's EBIDTA to decline significantly. Consequently, negative EBIDTA stood at Rs. 428 crore during the year under review as compared to negative EBIDTA of Rs. 15 crore in previous year.

The company's supply chain has been very effective because it has promised to its customer that right thing in right time and in right place has to be delivered. This has been recorded as vision statement. All employees are motivated by the vision statement and vowed to achieve goal. Moreover due to induction of SAP the process becomes more easy and transparent to achieve the goal.

11. Outlook & Outcomes

Despite concerns of a slowing economy in the near term and the consequent impact on the automotive sector, the overall outlook for the tyre industry is positive. Infrastructure investments in roads, growing income of the country's middle class, increasing mechanization of agriculture and the continued ready availability of loan finance for vehicles will act as an impetus to tyre sales. According to Basant Kumar Birla, Chairman Birla Tyres', *"much has changed over the last year economy continues its last sluggish journey greatly influenced by European concerns. At home we see rising inflation, a depreciating currency and rising cost of inputs coupled with purchasers' resistant price increases. Such times require us to revisit our strategy, which has brought us great benefits over more than ninety years. Changes have been undertaken to respond to today's needs and I am happy that indications are positive. The tyre business is under a new senior management team and is beginning to show signs of recovering from the difficulties faced for almost two years now. Success in the years ahead will be determined by the readiness to anticipate and be proactive to the fast changing business and regulatory environment while remaining fully committed to our corporate and social responsibility. This will ensure a beneficial experience for all our stakeholders: shareholders, customers, employees, bankers, dealers and suppliers."*

Our customers are very much complacent with the product of Birla Tyres. This resulted in dealers/sub-dealers to use our product, priority. Dealer commission, sub dealer commission is paid in time. Company also hold the dealer/sub-dealer meet once in a year and recognized the best dealer's achievement. The company is very much keen in providing free services to that customer whose tyre failed within guarantee period. There are system to allow the customer benefit whose tyre failed, depending upon the percentage of failure and expiry of tyre life.

12. Industrial Structure and Developments

The Indian Tyre Industry is dominated by five major Indian manufacturers Apollo Tyres, Birla Tyres, CEAT Tyres, JK Tyres and MRF who together account for more than 85% of the industry turnover. The major market segments of business are replacement, institutional (Organizational Equipment Manufactures "OEM" and State Transport Undertakings) and exports. In terms of product, the market is split into two broad segments Commercial Vehicle Tyres (trucks & buses, light commercial vehicles, agriculture and specialty vehicles) and Personal Vehicle Tyres (car, SUV, motor cycle, scooter and moped).

Commercial vehicle tyres continue to constitute the largest segment of the Indian market. A few years back, these tyres constituted more than 80% of the market. Over the last few years, however, the Indian passenger vehicle industry (cars as well as two wheelers) has grown at a pace that outstrips growth of commercial vehicle sales, driven by greater disposable incomes, the rising aspirations of a burgeoning middle class, and the presence of almost every international vehicle manufacturer in India. Growing passenger vehicle sales in the country has meant the proportion of commercial vehicle tyres in the

total tyre industry has dropped to a little more than 60% today.

A key trend in the Indian market is the shift away from the old technology cross ply tyres to radials. While radialisation is greater than 95% in passenger vehicle today, in commercial vehicle tyres it is still below 25%. This is, however, picking up and India should soon catch up with the world on this parameter. Growing preference for radials by fleets on account of their better performance, increasing fitment of radials by OEMs and massive investments in increasing capacities for truck and bus radials by industry players seems to be driving this change. Radicalization in the truck and bus segment is forecast to cross 40% in the next few years.

The automotive market has a direct correlation with the growth of the Indian economy. The deceleration in the Indian economy has had a negative impact on the automotive industry as a whole. Declining growth of economic activity slows the demand for commercial vehicles something that is evident in India today. Consequently, the overall domestic truck and bus tyre market also saw stagnation in 2011-12 as compared to the previous year, which had seen a growth of over 20%. Sales of passenger vehicles suffered a mid year slump resulting in lower off take of tyres by OEMs. Nonetheless, towards the end of the financial year 2011-12, indications were that sales were beginning to look up once again.

On the cost front, volatility in raw material prices, especially of natural rubber, has been a major factor impacting the fortunes of the Indian Tyre Industry in the previous year. Volatile raw material prices continue to pose the biggest risk for the tyre business.

13. Forecasting Techniques in Birla Tyres

13.1. Time Series Analysis

From this historical data it is easy to predict for future by using least square method of straight line and parabolic method and the interpretations are derived through the comparative study. By applying curve fitting of straight line of sales with respect to time the value of $R^2 = 0.955$ it shows that 95% of the variation in sales in Birla Tyres can be explained by the time factors or independent variable. From the ANOVA testing the significance of F is 0.000. This indicates that the model is statically significant at a confidence level of 95%. So the trend line $y = 4050.428 + 616.017x$, where y is sales and x is the time factor and it shows these two variables are statistically significant for the trend model as P-values are less than 0.05.

By applying curve fitting method of parabolic curve of sales with respect to time the value of $R^2 = 0.968$ which shows that 97% of the variation in sales of tyres can be explained by the time factor or independent variable. From the ANOVA testing the significance of F is 0.000. This indicates that the Parabolic model is also statistically significant at a confidence level of 95%. So the trend line of parabolic curve is $y = 4261.177 + 616.017x - 31.612x^2$, where y is sales of tyres and x is the time factor and it shows these two variables are statistically significant for the trend model as P-values are less than 0.05. So it is

appreciable to forecast sales both by using straight line and parabolic curve method of curve fitting.

By applying curve fitting of straight line of gross profit with respect to time the value of $R^2 = 0.137$ which shows that 14% only of the variation in gross profit in Birla Tyres can be explained by the time factors or independent variable. From the ANOVA testing the significance of F is 0.327. This indicates that the model is statically insignificant at a confidence level of 95%. So the trend line is $y = 230.877 - 47.779x$, where y is gross profit and x is the time factor and it shows these two variables are statistically insignificant for the trend model as P-values are greater than 0.05. So it is not appreciable to forecast the gross profit by using straight line method of curve fitting.

By applying curve fitting method of parabolic curve of sales with respect to time the value of $R^2 = 0.65$ which shows that 65% of the variation in gross profit of tyres can be explained by the time factor or independent variable. From the ANOVA testing the significance of F is 0.043. This indicates that the Parabolic model is also statistically significant at a confidence level of 95%. So the trend line of parabolic curve is $y = 503.055 - 47.779x - 40.827x^2$, where y is gross profit of tyres and x is the time factor and it shows these two variables are statistically significant for the trend model as P-values are less than 0.05. So it is appreciable to forecast the gross profit by using parabolic curve method of curve fitting.

By applying curve fitting of straight line of net worth with respect to time the value of $R^2 = 0.201$ which shows that 20% only of the variation in net worth in Birla Tyres can be explained by the time factors or independent variable. From the ANOVA testing the significance of F is 0.226. This indicates that the model is statically insignificant at a confidence level of 95%. So the trend line is $y = 889.488 + 69.320x$, where y is net worth and x is the time factor and it shows these two variables are statistically insignificant for the trend model as P-values are greater than 0.05. So it is not appreciable to forecast the net worth by using straight line method of curve fitting.

By applying curve fitting method of parabolic curve of net worth with respect to time the value of $R^2 = 0.806$ which shows that 81% of the variation in net worth of tyres can be explained by the time factor or independent variable. From the ANOVA testing the significance of F is 0.007. This indicates that the Parabolic model is also statistically significant at a confidence level of 95%. So the trend line of parabolic curve is $y = 1252.964 + 69.320x - 53.021x^2$, where y is net worth of tyres and x is the time factor and it shows these two variables are statistically significant for the trend model as P-values are less than 0.05. So it is appreciable to forecast the net worth by using parabolic curve method of curve fitting.

By applying curve fitting of straight line of EPS with respect to time the value of $R^2 = 0.35$ which shows that 35% only of the variation in EPS in Birla Tyres can be explained by the time factors or independent variable. From the ANOVA testing the significance of F is 0.093. This indicates that the model is statically insignificant at a

confidence level Of 95%. So the trend line is $y = 10.326 - 13.937x$, where y is EPS and x is the time factor and it shows these two variables are statistically insignificant for the trend model as P-values are greater than 0.05. So it is not appreciable to forecast the EPS by using straight line method of curve fitting.

By applying curve fitting method of parabolic curve of EPS with respect to time the value of $R^2 = 0.791$ which shows that 79% of the variation in EPS of tyres can be explained by the time factor or independent variable. From the ANOVA testing the significance of F is 0.009. This indicates that the Parabolic model is also statistically significant at a confidence level of 95%. So the trend line

of parabolic curve is $y = 56.365 - 13.937x - 6.906x^2$, where y is EPS of tyres and x is the time factor and it shows these two variables are statistically significant for the trend model as P-values are less than 0.05. So it is appreciable to forecast the EPS by using parabolic curve method of curve fitting.

From Figure 2 and Figure 3 data related to sales and gross profit and net worth and EPS respectively are compared with respect to the years which are given in Table 6. Following data Table 5 are collected for the study from the year ending 2005 to year ending 2013 from the balance sheet of Birla Tyres Company.

Table 6. Financial Data of Birla Tyres with respect to Year

Year	Sales (Crore)	Gross Profit (Crore)	Net Worth (Crore)	EPS (Crore)
2005	1709.09	98.12	377.15	7.33
2006	1877.82	132.50	416.05	9.99
2007	2516.48	400.08	654.43	58.08
2008	3440.32	641.80	981.92	83.80
2009	4292.07	520.97	1330.10	82.80
2010	5020.63	648.29	1540.24	51.88
2011	5750.72	120.24	1300.25	-45.95
2012	6004.86	-412.85	915.01	-83.02
2013	5841.86	-71.26	580.24	-71.98

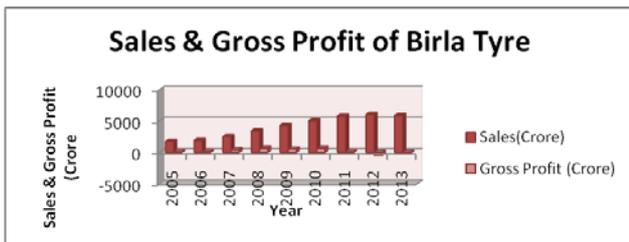


Figure 2. Sales and Gross Profit of Birla Tyre with respect to the Year

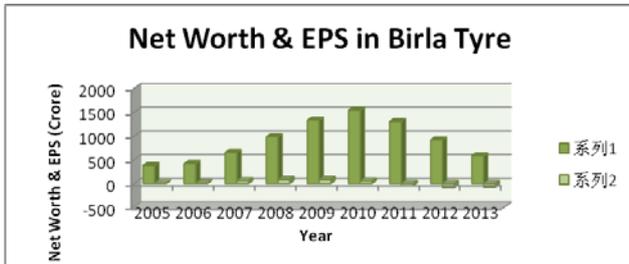


Figure 3. Net Worth and EPS of Birla Tyre with respect to the Year

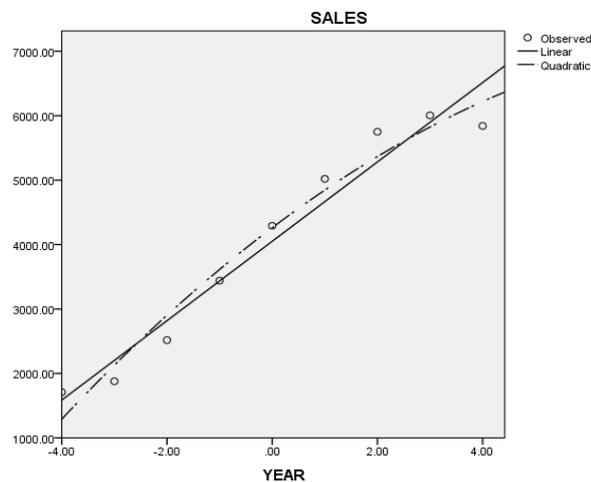


Figure 4. Curve Fitting of Sales with Year

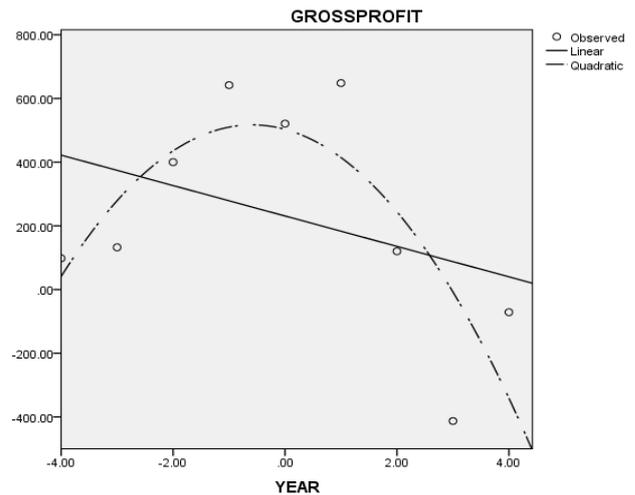


Figure 5. Curve Fitting of Gross Profit with Year

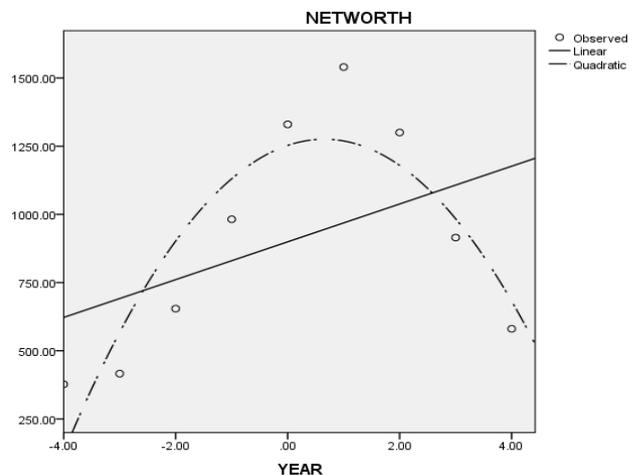


Figure 6. Curve Fitting of Net Worth with Year

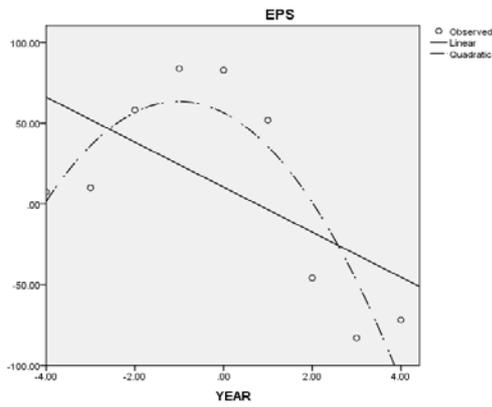


Figure 7. Curve Fitting of EPS with Year

From Figure 4 it is observed that curve fitting of sales with respect to the year using both linear trend line and parabolic curve techniques are fitting well as original data are approaching to the trend lines but from Figure 5 it is observed that curve fitting of gross profit by parabolic curve is fitting well as original data are approaching towards the parabolic curve rather than straight line. Figure 6 and Figure 7 show the curve fitting of net worth and EPS by parabolic curve respectively are fitting well as original data are approaching towards the parabolic curve rather than straight line.

Figure 8, Figure 9, Figure 10 and Figure 11 represent the forecasting values of sales, gross profit, net worth and EPS for the next 10 years using straight line and parabolic curve methods of least square.

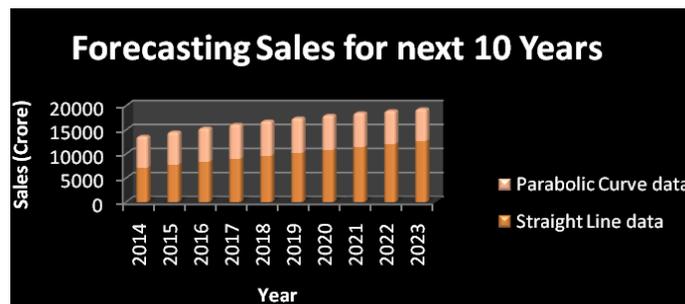


Figure 8. Forecasting of Sales by Straight Line and Parabolic Curve Method

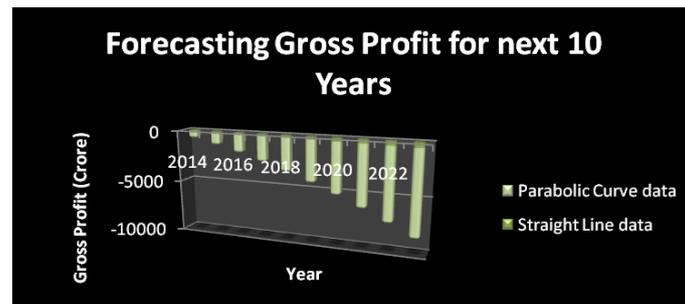


Figure 9. Forecasting of Gross Profit by Straight Line and Parabolic Curve Method

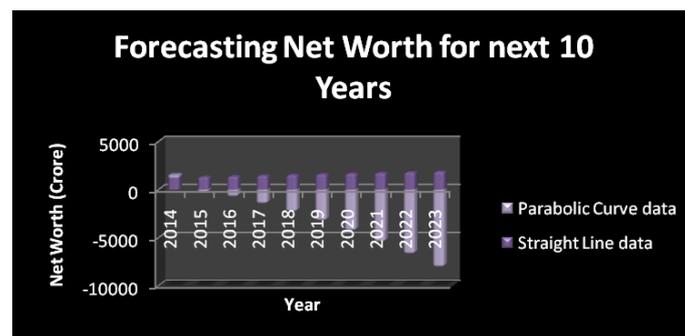


Figure 10. Forecasting of Net Worth by Straight Line and Parabolic Curve Method

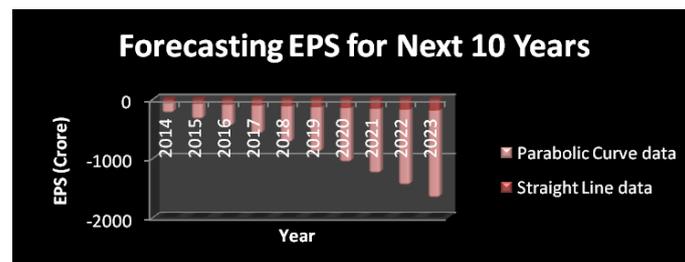


Figure 11. Forecasting of EPS by Straight Line and Parabolic Curve Method

Box 1. SWOT Analysis of Birla Tyres

Strength	Weakness
<p>Birla Tyres, Balasore, due to its location advantage and new technology it has gained cost benefit.</p> <p>Due to having its own captive power plant, it is producing power at a very low cost. It's infrastructure in plant set up is also very conducive to lower the production cost.</p> <p>It is situated on N.H.5, the new golden quadrilateral connecting channel and Kolkata. This leads the transportation of incoming and outgoing transportation very easy and cost competitive.</p> <p>Increased competition from global majors like Michelin, Bridgestone and Continental who are putting up or expanding capacities could emerge as a challenge for domestic manufacturers.</p>	<p>All Indian giant tyre companies like MRF, Apollo, JK, Ceat have set up their major units nearer to the raw material sources.</p> <p>For this their input cost is lower than Birla Tyres.</p> <p>Both the units of Birla Tyres are located far away from the raw material sources.</p> <p>Again all giants companies that are very old have set up more than 40 year have very experienced management and key personnel which Birla Tyre is lacking.</p> <p>The industry's large installed capacities in commercial vehicle cross ply tyres at a time of advancing radicalization could be another concern.</p>
Opportunities	Threats
<p>Although growth might have temporarily slowed, the trend rate of India's economic growth remains intact at a healthy level. This, coupled with increased investments in infrastructure should result in a rapidly expanding automotive market in India, and provide numerous growth opportunities for the tyre business. For all tyres companies in India, there is ample opportunity to grab the market. Presently Demand exceeds supply.</p> <p>The figures published in ATMA Bulletin/Magazine shows that there is good demand for export of tyres.</p> <p>Demand is coming from every sphere like East Asia, South Asia, Middle East, African Countries, European Countries and American Countries.</p> <p>Also due to rupee depreciation this has become more lucrative. Within the Country also globalization helps easy entry to various Multinational Companies for which big automobile giants have opened new manufacturing units in India and produced different varieties vehicles. This also increased the demand of tyres three fold.</p>	<p>Still there are various threat coming and impinging upon Birla Tyres. Most giants have now collaborated with International tyre companies like Michelin, Bridge Stone, Goodyear, Continental, Pirelli and with their partnership, have hired their technology. This helps them to modernize their plant and upgrade their technology.</p> <p>Birla Tyres yet has not chalked out plan for collaboration.</p> <p>Moreover, a low cost China tyre which is being dumped inside the country has become a matter of great concern.</p> <p>In this way about 10% to 15% demand is being filled up by these tyres.</p> <p>In the near term, however, there is some concern whether the automotive segment would grow as aggressively as in the past owing to a slowing economy.</p>

14. SWOT Analysis

For every new project or new programme implementation Birla Tyres is evaluating its strength weakness or weak point, opportunity & threat which are explained in Box 1.

15. Conclusion

World is facing a global recession for which demand is falling internationally. America, Europe and some Countries are on the brink of Bankruptcy. Country like Greece, Turkey are declared debt country and EUC had bailed out to save them. India is also facing the same problem. Our growth has come down drastically. Chief Economic Advisor had predicted a growth for 2013-14 within 5%. Industries have started feeling the pinch of the slow down. Automobile sector have started reducing their production quota. This will have automatic impact in tyre industries. All tyres manufacturing companies are also gradually heading for their production cut.

The Indian tyre market for truck and bus radials is set to grow at a tremendous rate owing to the infrastructure development in India. In a bid to enter and win the Indian radial tyre market segment, Birla Tyre is set to increase the production of truck and bus radials by a whopping 85 tonnes per day in the manufacturing plant at Haridwar in a move that would require an investment of INR 350 Crores. The tyre manufacturing plant in Balasore is slated to receive an investment of INR 450 Crores to increase the output of passenger car radials by a figure of 80 tonnes a day.

Tyre companies both Indian and foreign, are all headed to capture the Indian tyre market with many international brands such as Continental, Bridgestone, Goodyear and Michelin setting up shop on the Indian soil. For Birla Tyres, the competition is stiff, with all the major global

players as well as Indian tyre majors such as MRF and Apollo Tyres vying for the top spot and the largest market share.

Basant Kumar Birla, Chairman, Birla Tyres', reflected on Birla Tyre's achievements as he considered the challenges and opportunities that he discussed. His goal was to move beyond the supply chain and specific efforts to a more comprehensive supply chain strategy and new product designing strategy for regaining the financial stability through proper utilization of forecasting techniques of financial drives in the company. He believed that Birla Tyre could and should retain its position in the industry as a sustainability leader, but what was the best path to reach that goal? His mind wandered back to some of the key questions:

- How should Birla Tyre prioritize sustainability relative to other goals (e.g. providing the right thing at right time and minimizing cost)?
- How should Birla Tyre reconcile different sustainability expectations and priorities around the world with the understanding that TPM, Japanese formula based upon zero accident, zero break done and zero down time with the best product designing of highest utility value so that the optimum production can be achieved with minimum cost which impact the global brand? (See Box-2) for the model of Birla Tyre.

16. Future Plan

Birla Tyres is now very much watchful and cautiously stepping in the right direction. Negotiation is under process with Pirelli, the giant Italian Company for partnership business. It is also thrusting its full effort to positioning in marketing and instilling the market share by focusing on new business for sustaining in long run in the globe.

Box-2. Model of Birla Tyres

BIRLA TYRES

Vision

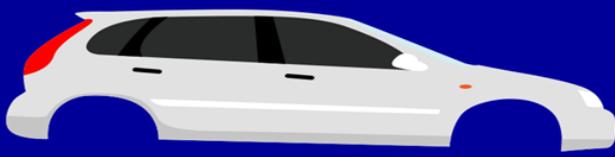
The company has committed to serve its customer by providing the right thing at right time with minimum cost. It has fixed for each function to achieve the goal. It has implemented TPM, the Japanese formula based upon zero accident, zero break down and zero down time, so that optimum production can be achieved with minimum cost.

Under TPM, the company has selected different programme under its goal mission and ultimate customer satisfaction by on time delivery. This has been formalized by selecting different activity through Kaizen principle and evaluated those to achieve the goal mission.

Mission & Principles

"we continue to operate in certain sectors where our customers trust our strategic vision. Cement and tyres, the two significant business of Kesoram have seen a mixed year. To meet the challenges of these dynamic markets and to continue on our journey of success, we have necessary foresight, strategy and preparedness."

- The company's supply chain has been



very effective

because it has promised to its customer that right thing in right time and in right place has to be delivered.

- Adopting Total Productive Maintenance (TPM) activities for strengthening the quality of product and personnel increasing efficiency and controlling cost.
- Implementing the Japanese formula based upon zero accident, zero break down and zero down time, so that optimum production can be achieved with minimum cost.
- Adopting Kaizen principle and evaluating those to achieve the goal mission.

Guidelines

Social & Economical	Environmental
<ul style="list-style-type: none"> • The social and economic position of the inhabitants of the district has been drastically changed. • Various jobs, direct and indirect were allotted in priority. • Many people have been employed in the service. • Local people have established the partnership transport business after a tie up with giant transporters doing business at national and international level. 	<ul style="list-style-type: none"> • Minimize release of harmful byproducts into the air. • Maximize energy use efficiency and use ecologically sustainable renewable sources when feasible. • Minimize in the loss and wastage ratio and maximize the productivity level. • Maximize recycling and ensure proper handling and disposal of solid waste. • Minimizing the use of chemical pest management that impact human, animal and environmental health.

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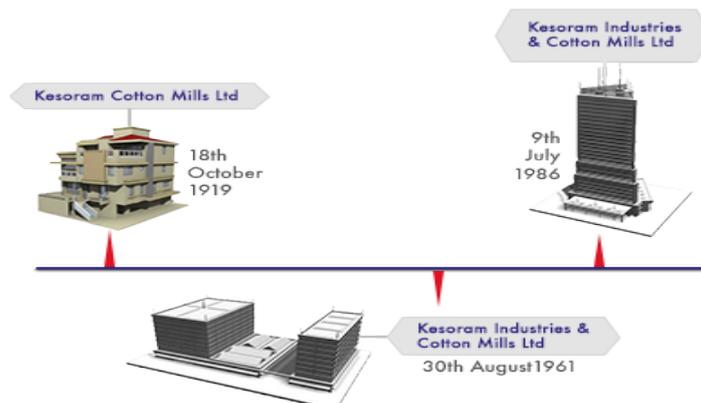


Exhibit 1. History of Kesoram Industries Ltd



Exhibit 2. Kesoram Industries Ltd



Exhibit 3. CEO Basant Kumar Birla

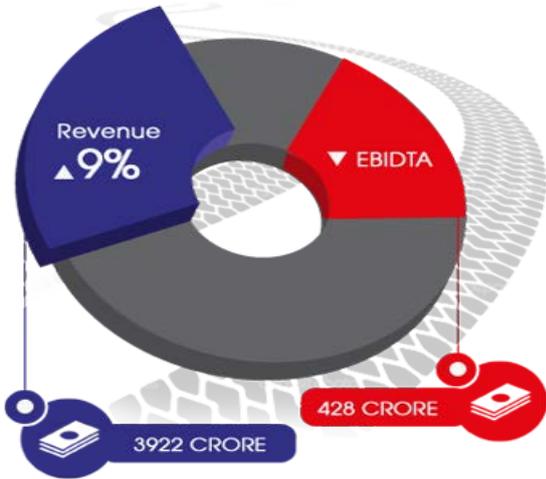


Exhibit 4. Market Position of Birla Tyre



Exhibit 5. Production Capacity of Birla Tyre



Exhibit 6. Accreditation of Birla Tyre



Exhibit 7. Product Mix of Domestic Bias Tyres of Trucks & Bus