

Technological Advancements in Maruti Suzuki Cars in India

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ABSTRACT: A Car is defined as a machine that is an assembly of power producing, power transmitting and power consuming parts whose combined function is to provide speed to wheels and provide safety and comfort to passenger(s) on 4 or 6 wheels. A car has an internal combustion engine or electric motor(s) that act as power house of vehicle and work to rotate and provide speed to set of 2 or 4 wheels. India being the largest hub for Automobiles is a great market for cars. Maruti Suzuki being the largest car manufacture in India, study is done on the developments in the technology embedded in Maruti cars. The following paper also contains the study about market trends in India and changes that have come in the past years.

KEYWORDS: Passenger car, Sedan, Hatchback, MPFI, ABS, ESP, CRDI.

I. INTRODUCTION

India is the second most populated country in the world with high economic growth [1]. Being a developing country, India has changed over time and with the increasing income and living standards India leverages large amount of resources. India is a perfect place for placing automobiles due to the increasing demand of good cars in market. India was the sixth largest motor vehicle/car manufacturer in the world in 2013. Indian auto manufacturers produced a record 23.4 million motor vehicles in 2014-15 (Apr-Mar), including 3.22 million passenger vehicles [2].

Domestic Motor Vehicle Sales (2014-15) [2]

- Passenger Vehicles: 2.60 million units
- Commercial Vehicles: 0.61 million
- Two-wheelers: 16.0 million
- Three-wheelers: 0.53 million

TOTAL: 19.75 million units

India is the largest producer of passenger cars. Passenger cars have 21% market share among Indian automobiles (Figure-1) [3]. Exports from India in this sector rose from US\$1.0 billion in 2003-04 to US\$1.8 billion in 2005-06. Automobile sector contributes 4.7% to India's GDP [4]. Maruti Suzuki is India's top passenger car manufacturing brand with 43.07% share among Indian cars (Figure-2) and 54% share among hatchback segment cars (Figure-3) [3]. Maruti Udyog Limited was established in February 1981 and in 1982, a license & Joint Venture Agreement (JVA) was signed between Maruti Udyog Ltd. and Suzuki of Japan and thus it became Maruti Suzuki. Maruti Suzuki started its journey in Indian market with 800 in 1983. Maruti Omni and Gypsy were launched later in 1984 and 1985. As of November 2012, it had a market share of 50% of the Indian passenger car markets. Maruti Suzuki's after sales services and fuel efficiency are unmatched and are key reasons for its top position in market.

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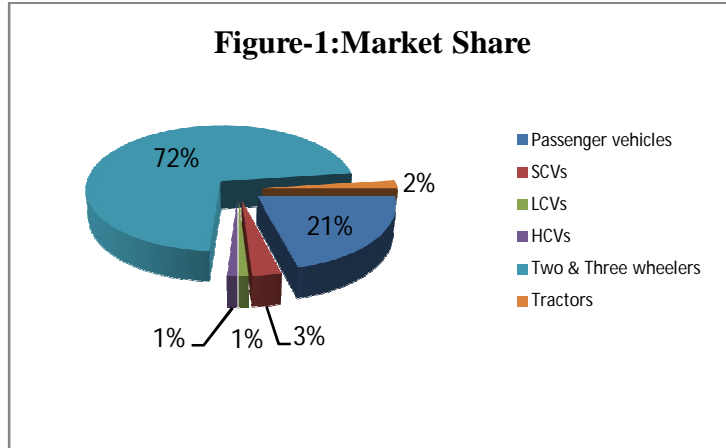


Figure -1 shows the market share of passenger cars and other segments in India. Two and Three wheelers segment is the largest contributing 72%. Passenger vehicles segment contributes 21% and is growing rapidly with increasing number of cars.

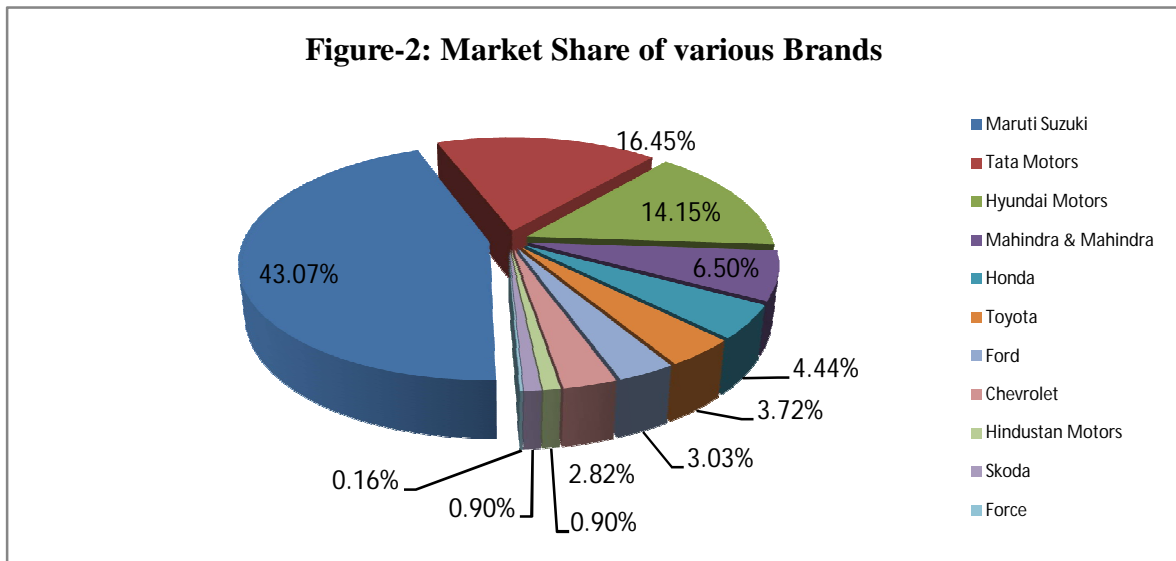


Figure-2 shows the market share of various Automobile brands in India. Maruti Suzuki is the most popular car brand in India. It is the market leader having 43.07% share followed by other brands like TATA Motors and Hyundai Motors with 16.45% and 14.15% shares.

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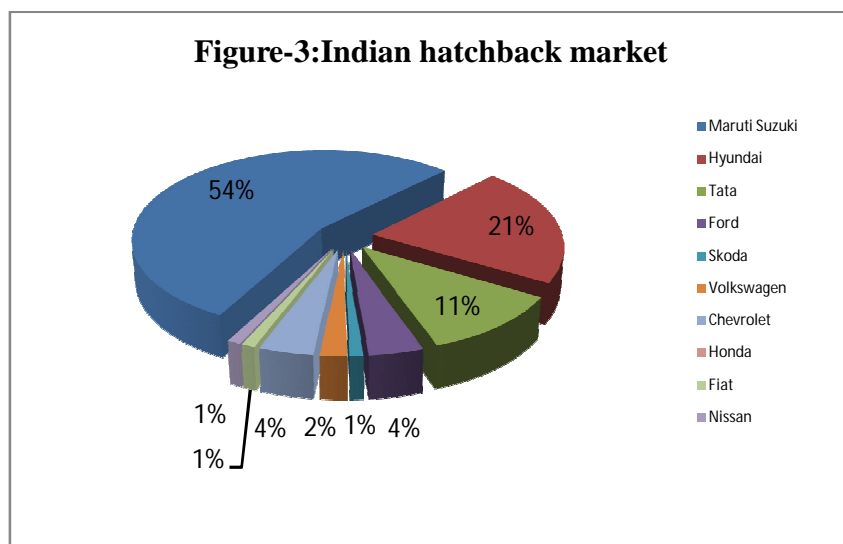


Figure-3 shows the share of different brands in the Hatchback car segment. India is a country of small cars or hatchbacks with Maruti Suzuki as the most popular brand having 54% shares in Indian Hatchback market followed by Hyundai with 21% share in market.

- Abbreviations used: -
- i) Cyl= cylinder
 - ii) Dis.co.= discontinued models
 - iii) MPFI= multi point fuel injection
 - iv) ABS= antilock breaking system
 - v) EBD= electronic brake force distribution
 - vi) BA=brake assist
 - vii) ESP= electronic stability program
 - viii) CRDI= common rail direct injection
 - ix) SUV=sports utility vehicle

II. RELATED WORK

Home to millions of cars, much work has been done on the Auto industry. Lot of studies have been done by researchers in this field. Studies on the features, factors, growth, economy, markets and performance of Indian auto industries are done concluding about its future, threats and opportunities. Biswajit Nag[1] in his work studied about the global structure of Automobile industry and the growth in the selected countries of china, India, Indonesia and Thailand. Govind Shinde[3] studied the evolution of the Auto industry from 1983-2007 and data about market share of passenger vehicles, commercial vehicles, two wheelers and three wheelers can also be found in the work. He has also done study on Indian brands like Tata, Maruti and Hyundai. Badri narayan G[4] in his work talks about the economy and growth of auto industry. Study on organised, unorganised sectors and exports, imports is also done by him. No satisfactory study regarding the technical specifications and development of cars of any brand was found. This paper contains study about the technical advancements made in cars taking the Maruti Suzuki as the benchmark. Maruti Suzuki is the only brand that completely defines the behaviour, wants and trend of Indian market. Called as the Indian People's car brand Maruti sums up all the factors required to be studied in Indian industries.

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III. MARUTI SUZUKI CARS IN INDIA

Maruti Suzuki cars have moved a long way from 1983 to present. The following table shows the data about the Maruti cars that are launched from 1983-April 2015. The table also contains information about the models that are discontinued (dis.co.).

Model Name	Launch year	Vehicle type	Engine	Length /Width	Safety features	Other Features
800 (dis.co.)	1983-2013	5 door hatchback	Inline 3 cyl 796cc,37bhp	3335mm/14 40mm	Seat belts for front and rear passengers.	i)Top speed of 140km/h ii)4-speed manual transmission iii) Macpherson strut front and coil spring gas filled shock absorbers for rear. iv)Air Conditioning(optional)
Omni	1984	Mini van	Inline 3 cyl 796cc, 34.7ps	3370mm/ 1410mm	Seat belts for front and rear passengers	i)5-speed manual transmission ii)Macpherson strut and leaf spring front and rear suspension.
Gypsy	1985	Off roader	4 cyl 1298cc,80bhp	4010mm/ 1540mm	Seat belts	i) Five forward one reverse speed. ii)MPFI iii)Four wheel drive
1000 (dis.co.)	1990-2000	4 door sedan	4 cyl 970cc,46bhp	4075mm/ 1575mm	Seat belts	i)Maximum speed of 100km/h ii) Depreciated rack front and helical spring rear suspension. iii) Five speed manual transmission.
Zen (dis.co.)	1993-2006	5 door hatchback	4 cyl 45kW,60hp	3535mm/ 1495mm	Seat belts, child safety lock, central locking	i)5-speed manual transmission ii) Independent front Macpherson strut coil spring suspension. iii) Air conditioning. iv) Power steering.
Esteem (dis.co)	2000-2007	4 door sedan	Inline 4 cyl 63kW,85hp, 1298cc	4095mm/ 1575mm	Seat belts	i)5-speed manual transmission ii)Maximum speed of 164km/h iii) Air conditioning and power steering.
Swift 1 st gen (dis.co.)	2005-2011	5 door hatchback	4 cyl 1298cc,55kW	3695mm/ 1690mm	Seat belts, ABS(optional),central locking, child safety lock, Engine immobilizer	i)5-speed manual transmission ii)Air conditioning iii)Front cup holders
A-Star (dis.co.)	2008-2013	5 door hatchback	3 cyl	3500mm/ 1600mm	Rear seat belts, child safety lock, door ajar warning, engine immobilizer	i)5-speed manual transmission ii)air conditioning iii)power steering
Swift Dzire 1 st gen (dis.co.)	2008-2011	Sedan	4 cyl,1298cc, 73.9bhp	4160mm/ 1690mm	Seat belts, central locking, child safety lock, engine immobilizer	i) 5-speed manual transmission ii)MPFI iii)Macpherson strut front suspension Coil spring rear suspension. iv)Air conditioning ,power windows and power steering
Alto (dis.co)	2000-2016	5 door hatchback	Inline 3 cyl 35kW,4hp	3490mm/ 1476mm	Seat belts, central locking, child safety lock, engine immobilizer	i)5-speed manual transmission ii)MPFI iii)top speed of 130km/h iv)air conditioning
Wagon-R 1 st gen (dis.co.)	1999-2006	5 door hatchback	1061cc	3520mm/ 1690mm	Seat belts, child safety lock, engine immobilizer	i)5-speed manual transmission ii)MPFI iii)air conditioning
Wagon-R 2 nd gen (dis.co.)	2005-2013	5 door hatchback	Inline 4 cyl 47kW,63bhp	3520mm/ 1491mm	Seat belts, child safety lock, engine immobilizer	i)5-speed manual transmission ii)MPFI iii)air conditioning
Wagon-R 3 rd gen	2013	5 door hatchback	Inline 3 cyl 998cc,50kW	3599mm/ 1495mm	ABS, airbags, Seat belts, child safety lock, engine immobilizer	i)5-speed auto/manual transmission ii)MPFI iii)air conditioning iv)power steering and power windows

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						v)cup holders
Zen (dis.co.)	2006-2009	5 door hatchback	Inline 4 cyl 1061cc,47kW, 64hp	3495mm/1495mm	airbags, Seat belts, child safety lock, engine immobilizer	i)5-speed auto/manual transmission ii)MPFI iii)air conditioning iv)power steering and power windows v)cup holders vi)Macpherson strut with torsion type roll control
Zen Estilo (dis.co.)	2009-2014	5 door hatchback	Inline 4 cyl 1061cc, 64bhp	3600m/1475mm	Seat belts, child safety lock, engine immobilizer	i)Top speed of 160km/h ii) air conditioning and defogger iii)power steering and power windows
SX4 (dis.co.)	2007-2013	Sedan	Inline 4 cyl 1248cc, 88.73bhp	4500mm/1735mm	Rear Seat belts, Central locking, child safety lock, door ajar warning, seat belt warning, engine immobilizer	i)5-speed manual transmission ii)air conditioning iii)power steering and power windows iv)Direct injection system v)cup holders
Grand Vitara (dis.co.)	2007	SUV	Inline 4 cyl 2393cc, 163.5bhp		Dual airbags, ABS, EBD, BA, child safety locks, engine immobilizer, central locking	i)5-speed manual or automatic transmission ii)air conditioning with climate control iii)power steering and power windows iv)MPFI
Versa (dis.co.)	2001	Van	4 cyl 1298cc, 82bhp	365mm/1475mm	Seat belts, child safety lock, engine immobilizer, Central locking.	i)5-speed manual transmission ii) Top speed of 150km/h iii)electronic MPFI iv)Macpherson strut with torsion type roll control
Alto K10	2010-2014	5 door hatchback	K10, inline 3 cyl 998cc,67bhp	3620mm/1475mm	Seat belts, child safety lock, engine immobilizer, Central locking.	i)5-speed manual transmission ii)Macpherson strut with torsion type roll control iii)air conditioning iv)power steering and power windows v)MPFI
Ritz	2009	5 door hatchback	Inline 4 cyl 1197cc,83bhp	3775mm/1680mm	ABS, EBD, Seat belts, child safety lock, engine immobilizer, Central locking, seat belt warning	i)5-speed manual transmission ii)Macpherson strut with spring coil iii)air conditioning iv)power steering and power windows v)MPFI vi)rain sensing wipers
Kizashi	2009	4-door Sedan	Inline 4 cyl 2393cc,175bhp	4650mm/1820mm	8 airbags, seat belt warning, ABS, EBD, BA, ESP, Engine immobilizer, door ajar warning	i)6-speed Manual transmission ii)Automatic climate control and heater iii)keyless start iv)Cruise control v)Steering with leather and mounted controls
Eeco	2010	van	Inline 4 cyl 1196cc, 73bhp	3675mm/1475mm	Seat belts, Engine immobilizer	i)5-speed manual transmission ii)Air conditioning
New Swift	2011	5 door hatchback	Inline 4 cyl 1248cc, 74bhp	3850mm/1695mm	Seat belts, ABS Engine immobilizer, Central locking, seat belt warning, BA, door ajar warning, anti theft alarm	i)5-speed manual transmission ii)Top speed of 155km/h iii)CRDI with turbo charger iv)Air conditioning and power steering
Ertiga	2012	5-door minivan	Inline 4 cyl 1248cc,88bhp	4265mm/1695mm	Seat belts, ABS Engine immobilizer, Central locking, seat belt warning, BA, door ajar warning, anti theft alarm, crash sensor, speed sensing door lock	i)Top speed of 160km/h ii)CRDI with turbo charger iii)Air conditioning with power steering iv)5-speed manual transmission
Alto 800	2012	5 door hatchback	Inline 3 cyl 796cc,47bhp	3395mm/1490mm	Seatbelts, central locking, engine immobilizer, child safety lock	i)5-speed manual transmission ii)Air conditioning with power steering

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Stingray	2013	5 door hatchback	Inline 3 cyl 998cc,67.7bhp	3636mm/ 1475mm	Seat belts, central locking, engine immobilizer, child safety lock, speed sensing door lock	i)5-speed manual transmission ii)Macpherson strut with spring coil iii)Air conditioning with power steering
Celerio	2014	5 door hatchback	Inline 3 cyl 998cc,67bhp	3600mm/16 00mm	Seat belts, central locking, engine immobilizer, child safety lock, speed sensing door lock	i)5-speed manual transmission ii)Macpherson strut with spring coil iii)Air conditioning with power steering
Ciaz	2014	4-door sedan	Inline 4 cyl 1373cc,91bhp	4490mm/17 30mm	ABS, EBD, 2 airbags, engine immobilizer, seat belt warning, central locking, child safety lock	i)5-speed manual transmission ii)Macpherson strut with spring coil iii)Air conditioning with climate control iv)parking sensors and power steering v)leather upholstery vi)GPS and steering mounted controls
S-Cross	2015	5-door Compact SUV	Inline 4 cyl 1598cc,118bhp	4300mm/ 1765mm	ABS, EBD, 2 airbags, engine immobilizer, seat belt warning, central locking, child safety lock	i)6-speed manual transmission ii)DDIS engine iii)Air conditioning with climate control iv)keyless entry v)cruise control vi)parking sensors
Baleno	2015	5 door hatchback	Inline 4 cyl 1248cc,74bhp	3995mm/ 1745mm	2 airbags, ABS, EBD, BA, engine immobilizer, central locking child safety lock, seat belt warning	i)5-speed manual transmission ii)Air conditioning with climate control iii)keyless entry iv)parking sensors
Brezza	2016	Compact SUV	Inline 4 cyl 1248cc,89bhp	3995mm/17 90mm	2 airbags, ABS, EBD, BA, engine immobilizer, central locking child safety lock, seat belt warning	i)5-speed manual transmission ii)keyless entry iii)cruise control iv)parking sensors and turbocharged v)Day time running LED lights

IV. TECHNOLOGICAL ADVANCEMENTS

Indian cars have moved a long way and have adapted themselves to the modern day technology and design. ‘Maruti Suzuki’ the biggest car brand in India is a benchmark to study the behaviour of customers. Some of the technological developments are as follows-

Development in Engines-

Maruti Suzuki cars have been always known for their outstanding mileage and performance. Maruti 800 was the first car of the brand to be launched in the country with 800cc petrol engine. The company also offered diesel variants for other models. Gypsy was the first car to use MPFI. Later cars with K series and CRDI technology were also launched and are till date in market (Table-1). Cars use Direct Injection and turbochargers for enhanced performance.

Year	Car Model(s)	Technology/Feature
1983	800	First 800cc petrol engine
1985	Gypsy	First 4 cylinder car and with MPFI
1999	Wagon-R, Alto	K6A engine
2009	Wagon-R,Alto, Celerio	K10B engines
2011	Swift, Ertiga	CRDI

Table -1

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Development in Safety-

In the past years safety was not a matter of importance for selection of cars. Old generation cars had seat belts only as a safety feature. Later new technologies were introduced. Airbags, ABS, BA, EBD, ESP came into existence after 2005. Present cars have more safety features like central locking, airbags, ABS, engine immobilizers etc. and are moreover standardized, improving safety of automobiles (Table-2).

Year	Car Model(s)	Technology/Feature
1983	800	Three point Seat belts
1993	Zen	Central locking and child safety locks
2005	Swift 1 st gen	Engine immobilizer and ABS
2006	Zen Estilo	Airbags
2009	Kizashi	8 airbags, ABS, BA, ESP, EBD

Table-2

Development in Comfort –

The definition for the need of a car has changed over the years, now the customer wants every other good feature to be embedded into the car. 800 was the first Maruti car to give optional air conditioning. Later power steering and power windows were added in to the cars for more comfort experience. The suspensions play a vital role in comfort; previous models had leaf springs suspensions that were uncomfortable and stiff. The traditional leaf springs were then changed with McPherson struts with hydraulic shock absorbers for more comfort and easy handling. Some cars have independent suspension. Some cars were given the features of steering mounted controls, leather interiors, climate control and cruise control, rain sensors, auto headlights etc. As the time changed so does the features. The present day cars have standard features of air conditioning, power windows, power steering, parking sensors and cup holders.

Year	Car Model(s)	Technology/Feature
1983	800	Air conditioning
1993	Zen	Power steering
2000	Esteem	Power windows
2009	Kizashi	Climate control and cruise control

Table-3

V. SWOT ANALYSIS

Strength-

- Good brand image
- Best service and sales network in country
- Low maintenance cost of cars
- Highly fuel economic cars
- Market is well acknowledged about products
- Additional Premium range of products under Nexa
- Products with high resale value
- High frequency of new product launches

Weakness –

- New in luxury segment cars
- Image of small car manufacturer
- High import tariffs on imported models

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Opportunity-

- Luxury segment cars(Hatchback, sedan and SUV)
- Products made for the international market
- More safer and premium products
- Micro cars and electric cars

Threats-

- Other Indian and global brands
- Growing competition in hatchback and sedan segments
- High taxes on import and export

VI. CONCLUSION

India is a rapidly growing economy with growing number of customers that can afford car. Maruti Suzuki is a market leader among the hatchbacks. In recent years various brands have launched their product ranges giving direct competition to Maruti Suzuki. New products bring new technologies and features in given price ranges making it difficult to compete. Maruti Suzuki has adapted marvellous changes in their products according to market demand and trends. New products with more features, rigid and safe design and safety features have come up giving strong competition to other brands. Maruti cars are now safer with airbags, ABS, ESP, BA, EBD etc also they have become more premium and good looking offering more comfort and safety on rigid Indian roads. New engine and power technologies have made engines more refined and powerful making ride more peppy and enjoyable. Now more engine types with different fuel options are available to suit customer's needs. Maruti Suzuki is successful in sustaining their brand image and is more rapid in new and good product launches. Maruti has grown incredibly from 1983 to present and will continue to grow the same.

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