Study on the requirements of Safety & Technology & the Environmental Impact in Automobile Sector of India

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Abstract—India is among the nations where automobile sector is witnessing a lot ups & downs due to certain factors- with the primary being- safety & environmental norms. Our country is still into the developmental phase where a lot of automobiles available are not yet available with extravagant features like autonomous self driving sensors, or electricity supply charging stations etc. But, due to various products available in the Indian market like SUVs or be it the sports sedans, buyers are now actually craving for more in their daily drives. They are now willing to spend an extra amount for their daily drives as every one of us wants 100% return on our invested drives. There was a time when cars available in India had a mere feature list like an air conditioning unit & seatbelts. But with the changing demand & increased awareness towards safety & technological updates, cars now are actually connected to us through various Smartphone applications & many more. The future is quite predictable in terms of safety, technology & emission norms advancement for the upcoming cars & a positive growth can be expected in this particular industry.

Keywords— technological updates, safety norms, & BS6 emission norms.

I. INTRODUCTION-

The Indian automobile industry is the world's 4th largest manufacturer of cars and the 7th largest manufacturer of commercial vehicles in 2018. India is also a prominent auto exporter and has strong export growth for the near future. The exports for the same grew by 14.50% during the FY 2019. The export activities are expected to grow by 3.05% during the FY 2020-2026.Moreover, the Indian automotive industry (including component manufacturing) is expected to reach INR 16.16-18.18 trillion (US$ 251.4-282.8 billion) by 2026. In FY 2019, two new brands were introduced in India- KIA & MG. Both these automakers have significantly contributed to increasing the sales of the passenger vehicle segment and gaining the attention of a large number of people. The industry has also attracted Foreign Direct Investment (FDI) worth US$ 23.89 billion during the period April 2000- December 2019 (according to DPIIT- Department for Promotion of Industry and Internal Trade).

Market Share-

In FY 2019, the passenger vehicle sales in India crossed 3.37 million, and is further expected to increase to 10 million unit's FY 2020. *(But due to coronavirus outbreak, achieving such a high target will now take some time) *. Even, the domestic automotive production increased at 6.96 % between FY 2013-2019 by 30.92 million vehicles manufactured in the country in FY 2019.The exports for the passenger vehicles grew by 14.50% during the FY 2019, while during April- December 2019, overall export increased by 3.9%.Overall, the domestic sales increased at 6.71% between FY 2013-2019 with 26.27 million vehicles getting sold in FY 2019.

Source- SIAM India
(http://www.siam.in/statistics.aspx?mpgid=8&pgidtrail=14)

Automobile Domestic Sales Trends

Category	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Passenger Vehicles	2,601,236	2,789,208	3,047,582	3,288,581	3,377,389	2,773,575
Commercial Vehicles	614,948	685,704	714,082	856,916	10,07,311	717,688
Three Wheelers	532,626	538,208	511,879	635,698	7,01,005	636,569
Two Wheelers	15,975,561	16,455,851	17,589,738	20,200,117	21,179,847	17,417,616
Quadricycle#		0	0	0	627	942
Grand Total	19,724,371	20,468,971	21,863,281	24,981,312	26,266,179	21,546,390

Safety & Technological Updates

Automobile Safety is the study of design, structure, features &equipment's that allow the designers to undergo through these aspects in order to minimise the risk of any uncertainty or any accident event. Vehicle safety these days is gaining a lot of attention among the car buyers because of increasing awareness campaigns by various automotive journalist of our country. In the past, most of the manufacturers were sticking to the formula of providing safety features only on the top-end versions of the car. People too, were happy with the purchase they made for their cars. At that point of time, most of them were ready to sacrifice safety equipped version for a lower model in order to incur less cost. But with the increasing accident rates in the past, buyers were now keen to opt for basic safety features even in the hatchbacks. That is the reason, why Ministry of Road Transport & Highway made it mandatory for manufacturers to include 4 safety features such as Airbags, ABS, Pre-tension Seatbelts & speed limit warning alarm from cars manufactured after 1st July 2017.

Various automotive companies took the step of introducing several technological features even for the passenger segment models. Features such as seat ventilation, navigation system with rear view camera compatibility, automatic headlights on/off function, parking sensors, etc were some that were solely introduced by Hyundai India in its model line-up. In Luxury segment, several manufacturers introduced various technological features like connected car technology, gestures control unit, remote control parking system, massaging seats and rear screen entertainment systems, etc and BMW was the 1st company to implement such features in its line-up.

BS6 EMISSION NORMS –

A brief overview- **BS6 (Bharat Stage-6) norms, came into effect from 1st April 2020.** The BS6 norms were supposed to be introduced in April 2024 but the pollution levels in Delhi-NCR (North region) reached its peak limit thus attracting the government to skip the introduction of BS5 emission norms instead. Now, with the introduction of BS6 emission norms, carmakers have to upgrade their engine technology by introducing these major things-

1) Selective Catalyst Reduction (SCR)- Diesel cars with an engine capacity of more than 2.0 litres need Selective Catalytic Reduction (SCR), which is a clever emissions control system that injects ammonia-based urea, or what is called Diesel Exhaust Fluid (DEF), into the exhaust. The ammonia in the fluid triggers a chemical reaction that essentially converts NOx into harmless nitrogen & water. SCR technology can alone achieve NOx reductions of up to 90 percent and allows diesel engines to comfortably meet the norms. However, it needs regular replenishment, and hence all SCR-equipped cars have an onboard DEF tank that'll need to be topped up every 10,000 km. This can be done when a car goes for a routine service or at a fuel station. The problem with the same is that SCR systems are hugely expensive and add over 1 lakh to the cost of the car and that is the reason why many auto manufacturers go for Lean NOx Trap (LNT) technology.

2) Lean NOx Trap (LNT)- This particular technology mainstreams Indian car companies as it turns out to a cost-effective solution that's much cheaper than SCR. A canister placed downstream of the engine's exhaust manifold, traps NOx particles. When it fills up, a richer fuel mixture is injected into the engine, and it reacts with NOx, as it converts it to harmless nitrogen, and is then expelled from the LNT into the exhaust system. A general rule for this technology is that the limit for LNT is in cars with engines upto 1.5 litres and a bodyweight of under 1500 kg. Also, the technology is not as effective as SCR, and the emission levels can be close to the limits, leaving very little margin.

3) **Diesel Particulate Filter (DPF)-** Diesel Particulate Filter, another main piece of hardware in a modern diesel, is also located in the exhaust system, and usually before the SCR or after the LNT, doesn't like sulphur either. Excessive sulphur content can clog the filter, but it can be burned off by running the engine at high speeds or by active regeneration- a method that involves spraying neat, un-burnt diesel through the cylinders into the exhaust manifold to light off the DPF. A fact to note- the higher sulphur content in BS4 fuel means the DPF has to regenerated or cleaned more frequently.

4) Catalytic Converter- This particular technology is made for petrol/ gasoline-powered vehicles only. To meet the tougher norms, this particular engine needs a larger catalytic convertor and 2 most important thing to know-

-) It isn't hugely expensive or difficult to engineer.

-) This particular technology can even run on decades-old gasoline engines.

However, the problem with a bigger catalytic converter is increased exhaust backpressure, which has a direct impact on fuel efficiency and drivability. That is why the official fuel

consumption figures on some BS6 petrol models are lower when compared with BS4 counterparts. Also, the throttle responses in many BS6 vehicles are quite slow to react, resulting in slow power delivery.

Advantages of Introducing BS6 Norms in India-

1) With the introduction of BS6 emission norms, auto manufacturers are now using a system known as **OBD (On-Board Diagnostic).** This regulates and keeps a check on the engine for optimum combustion.

2) This system also monitors real-time emissions from the exhaust gauges of the vehicles. The introduction of BS6 norms was done to minimize the pollutants released from the vehicles. So, using various engine technologies, the emissions are now under control but, simultaneously, less mileage can be witnessed from several car models.

3) The norms have also lower down NVH levels (Noise-Vibration Harness), thus, resulting in smooth driving experiences.

4) A BS4 vehicle can easily run on BS6 fuel without losing any engine power or torque performance.

Difference Between BS4 & BS6 Engines Emission Limits- Source- AUTOCAR INDIA

EMISSION TARGETS

Engine type	Mass of exhaust gas	BS4 limit	BS6 limit	Percentage decrease
Petrol	CO (in mg/km)	1000	1000	Nil
	HC (in mg/km)	100	100	Nil
	NOx (in mg/km)	80	60	25%
	PM (in mg/km)	-	4.5 (for gasoline direct injection engines only)	
Diesel	CO (in mg/km)	500	500	Nil
	HC + NOx (in mg/km)	300	170	43%
	NOx (in mg/km)	250	80	68%
	PM (in mg/km)	25	4.5	82%

II. LITERATURE REVIEW-

1) Theme- **Safety Features & Standards-**

A buyer now prefers to switch to a new brand that is rich in safety & technology systems packages. Nowadays, even car companies too, think of providing numerous assistance features to their model line-up to beat the competition. Manufacturers are simultaneously reducing their emphasis on quality and are laying more focus on introducing various systems that are assisting the drivers. Even car buyers are now going for top variants and not looking at the overall build quality of the vehicle, (**Kotwal,2019**)

The "Motor Vehicles Act", an initiative by the Ministry of Road Transport & Highways under the leadership of Mr. Nitin Gadkari states mandatory requirement of 4 basic safety features for all cars and they are- Airbags, ABS brakes, Pretension Seat Belt Limiters & Speed Limit Warning setup. Simultaneously, the government is planning to initiate in a plan in future as it talks about incurring double amount for insurance premium, if any driver does an accident and causes death to the other party, (**Rupani,2020**)

It was suggested that a safe car means a safe drive. In early 2004, a road safety test was conducted by Bosch Scientists on a Mercedes Benz S 500 series. There were 2 cars with the former having ABS brakes and latter without ABS brakes. The results were shocking as the non-ABS version of the car did not pass the safety test and that led to raising an awareness campaign on the need for safety systems. In earlier times, buyers got the versions that had a decent numberof features in the car. That campaign was highly spread across among car buyers and that moment led to introducing various safety standards in the cars. (**Kirplani,2014**)

There is a need for conducting safety tests for all the cars that are available in India. Another step or initiative taken by the Ministry of Heavy Industries & Public Enterprises that have made it compulsory for all car companies to conduct a safety crash test for all vehicles from 1st October 2017. With these practices being done, the government will now grant permission only to those automotive companies once their models pass these tests, (**Boora,2014**)

The world must teach their upcoming generations to be better drivers. Educating the younger generation will certainly bring a much-needed development in terms of road driving manners and they become the best drivers for tomorrow. Accordingly, educating them about driving habits will significantly lower accident rates, and more people are going to follow traffic rules and regulations. (**Marmar,2016**)

India is spending 4.6% of its GDP onto the healthcare sector. There is a need for the extension of private sector health insurance. Health insurance is needed in the middle and upper

classes. Health insurance companies should focus more on 1) improving the quality of product, 2) improving the efficient tariff model 3) to focus more on reaching out to each and every member of community. The growth of private sector health insurance will be primarily affected by the insurers clear push to this market **(Pillai, 2006).**

In the fiscal year 2005-06, the health insurance industry registered a sixteen percent growth. Innovative goods, improved marketing and efficient distribution have allowed emerging private firms to sign up faster than anticipated for Indian clients. The private players focus primarily on customer service. Public sector firms were already finding latest ways to meet the demands, and will compete in the near future with private players. Growth will be strong, and the industry will become highly competitive **(Sabera,2007).**

There can be a lot of reasons that can lead to non-suitability of health insurance plans among lower income group in India and proposed that there is a major variation in the payment of premium for health insurance due to multiple causes such as income volatility, disease occurrence in dwellings, providers quality and proximity in different locations **(Dror,2007).**

2) Theme- **Technological Features & Updates-**

Camera systems in today's time are making an impact in various cars. Today, automobile companies are making a point to install a rearview/ parking camera in their entire model line-up as it acts both as a safety feature and marks an entry of new technology. Various luxury brands like BMW, Lexus, Range Rover, Volvo, etc. now give 360-degree camera systems as standard equipment in their maximum model line-up. The need for this particular technology is necessary as it lets the driver to access various blind spots while driving & parking their cars. Also, a dash camera should be made mandatory across all vehicles as it helps to record events while driving. **(Bandrawala,2018)**

Even the popularity of touch screen systems is rising in cars these days. Various car companies (like Ford, Honda, Hyundai, Kia, etc.) are embedding high-resolution touch systems in their cars and these systems are quite better in terms of usability when compared with previous generations of Apple I-pad. All thanks to better software programming, manufacturers are now able to embed more functions like apple car play and android auto connectivity. Nowadays, companies are also enabling certain software for buyers like a vehicle diagnostic/check-up that allows the owner to run a program through a touch screen system. **(Bhatia,2018)**

The definition for a luxurious, technology laded vehicle has changed in the recent times. Both "technology and luxury factors" are indeed becoming a company's priority and now most of the manufacturers are offering class-leading gadgets such as gestures control, remote control parking system, heads up display, etc. Companies like "ROLLS ROYCE" & "Bentley" both offer state of the art- technology, high-quality materials like pure leather for seats and simultaneously offering various customization options to their respective buyers. **(Souza,2014)**

A new feature- "Connected-Drive" allow owners to connect with their respective cars. There are various connected car programs that are garnering buyers interest and some of the highlights for the same are- like tracking the vehicle, engine diagnostic test, remote air conditioning on/off system, remote engine start, etc, are some of the highlights of connected car package. These systems can even transform employment issues of India, as more of freelancers can be hired by automotive companies, who can further simply work on new technologies or upgrading the existing software for a better usability. **(Chaliha,2019)**

Another feature "Track & Tell" system, is capable of running an entire engine diagnostic test and can give owners information about the real problems the car faces at any point of time. The system is even capable of detecting drivers' attention and can even sense drowsiness when the driver is on the move. The company is also a partner with Hyundai Motor Limited and more companies are now partnering with the "Track & Tell" company as well. **(Souza G. 2020)**

There is a favorable future for shopping cars online. With the emerging technology, numerous carmakers are now shifting towards selling cars through online mediums. Technologies like Augmented Reality technology will let the buyer experience the whole car right at his/her place. The best part- most of the companies are enabling this technology for their buyers. **(Reed 2019)**

3. Theme- **Emission Norms- BS6 Standards-**

In 2016, several car companies had to face a ban on the sale of diesel-powered vehicles that were above 2000cc in capacity. This was all done due to increasing pollution levels then and the move was considered to be a serious step to curb pollution. This ban was meant for the entire Delhi-NCR region and it almost lasted for 6 months. Many manufacturers had then

gathered huge inventory owing to the ban and they had to offer huge discounts/benefits to clear out the existing stock. In November 2016, the Ministry of Road Transport & Highway laid the new rules for the registration process of diesel cars that now allowed diesel-powered vehicles to ply on road with a registration period of 10 years **(Aulbur,2016)**

Air pollution in the country will now significantly decrease by a huge margin, but, at the same time, diesel-powered models will see a higher price because of the technology involved in upgrading the engine. The cost of upgrading a diesel engine is quite high when compared to upgrading a petrol-powered engine car. Similarly, the acceleration responses will improve due to BS6 norms. So more the use of better technology, better will be the driving experience of that vehicle.**(Sorabjee,2020)**

The "Continental" company's technology is into the generation of more torque by consuming low voltage. The system is known as "48 High-Power Technology," and the other name for the same stands out to be- 'Mild Hybrid System'. Now the manufactures will be able to provide it in their upcoming cars thus bringing more of mild hybrid engines and significantly depending less on gasoline engines. **(Bansal 2019)**

III. RESEARCH METHODOLOGY-

Objective of the study:

1) To identify the various segments and price range of vehicles available in the Indian market.
2) To know what safety & technological features are available for various/different cars available in India.
3) To understand why safety norms are getting mandatory for cars of India.
4) To study the introduction of BS6 emission norms and the reasons for the implementation of the same.
5) To know the difference between BS4 and BS6 engine emission limits.

Research Design:

This data has been collected by using secondary data sources like magazines & journals, car brochures, data from government websites like (SIAM, IEBF), car specification sheets, and automobile websites. This data set has been acquired through external sources.

Research Methodology-

This data has been collected through **secondary sources**. All of this data is available to explore on various websites and links which I am going to mention in the references page.

Segments of Cars Available India-

1.) Hatchbacks (Micro, length<3.2 m)
2.) Hatchbacks (Mini, 3.2<l<3.6 m)
3.) Compact sedans (up to 4 m length)
4.) Compact hatchbacks (up-to 4.1 m length)
5.) Mid-size sedans (up to 4.4 m length)
6.) Premium sedans (up to 4.5 m length)
7.) Semi luxury sedans (up to 4.7 m length)
8.) Premium luxury sedans (up to 4.9 m length)
9.) Luxury sedans (up to 5 m length)
10.) Ultra-luxury sedans (more than 5 m length)
11.) SUV (Sports Utility Vehicles) (up to 4 m length)
12.) SUV (Sports Utility Vehicles) (up to 4.4 m length)
13.) SUV (Sports Utility Vehicles) (up to 4.5 m length)
14.) SUV (Sports Utility Vehicles) (up to 4.7 m length)
15.) SUV (Sports Utility Vehicles) (more than 5 m length)
16.) MPV (Multi-Purpose Vehicles)
17.) Sports cars
18.) Hypercars.

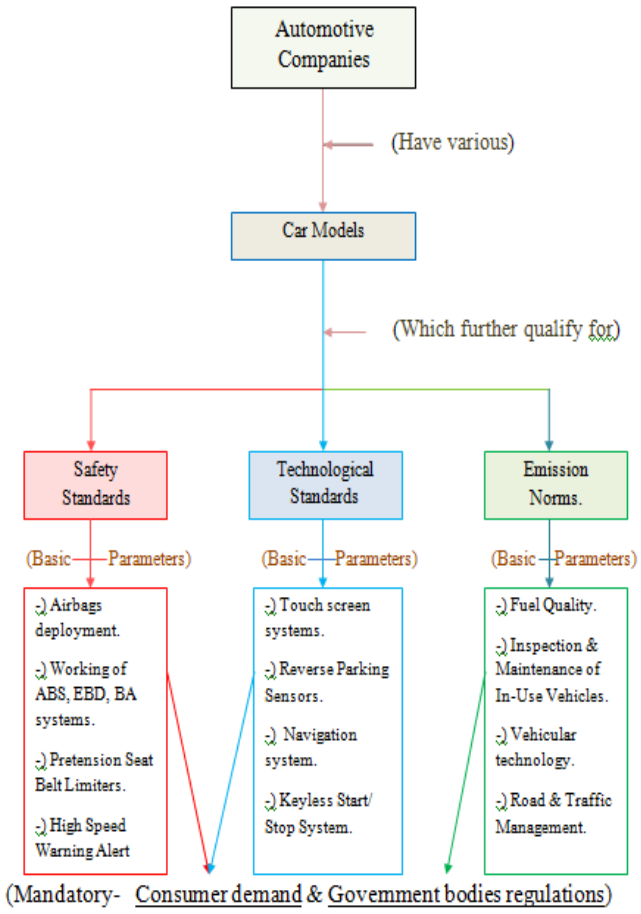
IV. MODEL FRAMEWORK OF THE STUDY-

The following framework talks about various safety & technological features that were **invented** due to the rise in the **demand of customers.** There was a time when a car buyer was simply happy buying a very economical car, had a stereo system, full wheel covers, and loud exterior body paint. Neither the companies were concerned about safety features nor did the customer see any of these during the purchase. But a few years ago, there was a consumer shift in the car buying process. From that moment, customers are now exploring certain new features like rearview camera, airbags, ABS brakes, parking sensors, and remote entry/exit. Even government regulations made it compulsory for automotive manufacturers to embed 4 basic safety features in the car and they were- Airbags, ABS, Seat Belt Pretensions, & Speed Limit Warning System that too for a car manufactured after 1st July 2017. But before that, customers were paying attention to

such details, and that the reason why customers are now willing to pay a premium for safety features in cars because they now value their own & their family life.

Similarly, **with the updated government regulations**, manufacturers were given a deadline to liquidate BS4 compliant engines by 31st March 2020. The reason for the same was of the rising air pollution in the territory. SIAM with the help of the Ministry of Road Transport & Highway, was now directed to introduce BS6 Emission Standards, which made engines cleaner, more economical and it gave a mild boost in the power delivery as well. The government was strict enough among manufacturers to clear all unsold BS4 inventory before 1st April 2020. These particular Emission Standards are now applicable across India and with the introduction of such norms; our environment is going to benefit a lot. Fuel quality level & Vehicular technology will significantly improve in the future and people are now going to maintain their cars properly by getting it serviced from company workshops only.

Model Framework Of The Study-



V. ANALYSIS & INTERPRETATION-

The year 1942, when the 1st car company, Hindustan Motors (HM), debuted in India by launching their 1st car- "Ambassador" was considered to be a boon in the Indian car industry. The car was all sparse and just had a 6-passenger seating layout, a mechanical powered steering, mechanical rolling windows, and metal bumpers. At that time, the car had a robust build quality and was quite popular among various politicians of our country. From the Prime Minister of our country to the top bureaucrats, the car certainly won all hearts and it was considered to be a gem among various people.

But in 1944, Premier (another automotive brand) came out with their first car- "Padmini". The car gave competition to Ambassador and both these cars ruled the industry for the next 40 years. This car was meant for middle and high-income group people and that car too, certainly won the heart of many buyers. With an added transistor, people at that time, went crazy for it and some of them even tried to get an aftermarket stereo system for Ambassador. These were 2 cars that were a class apart in their segment. A person who owned one of these had another status symbol and was quite considerate among various people.

Hindustan Motors again in the year 1984 came out with a more up-market model named- "Contessa". Its theme was based on a more up-scale car for the Indian market. This too gained popularity among the buyers because of its engine that produced 48 BHP and had been a powerful car of that time. This car was also famous among the villains of our movies and was certainly the king of all cars at that time. It was considered to be a luxury car because of its design language and its production lasted till 2002.

But, in the year 1983, these two companies had to face competition from another brand- Maruti Suzuki. It was called "Maruti 800" and was the first car launched by a Japanese and Indian conglomerate. This was the 1st car for India that featured a factory fitted air conditioning unit. The car was sold till 2014 and till that time, it found around 26 crore homes. It was so special that even today some of their owners have kept this vehicle in pristine condition. There were some enthusiasts who at a later stage modified this vehicle by adding aftermarket accessories as well. It's strength-Simple, reliable, and a cheap vehicle, this surely won the hearts of all Indians.

In the year 1991, when the Finance Minister of our country announced the introduction of LPG policy, that movement led to the introduction of various foreign brands and private players in our country. Various auto companies entered the Indian market and to name a few, they were- TATA, Hyundai, Honda, Toyota, etc. These companies then had their plants set-up in various parts of the country and **within a few years, various cars were launched like TATA Indica, Hyundai Santro, etc.** Honda was still in the setup stage and so they launched their 1st car –Honda City as a CBU (Completely Built-Up) product. These cars were now gaining interest among several buyers and soon they found their places among various owners. They also marked the introduction of basic safety features such as airbags and ABS brakes (all reserved for the top versions).

Then, people were only concerned about the brand they got for daily use. Fuel consumption & mileage were the top priorities/concerns for every buyer. Most people found their new cars consuming more fuel thus getting low average from their daily drives. Many people at that time considered going for basic versions and went on installing aftermarket accessories. Few people got their hands on the fully-loaded versions that had these basic safety assistance systems.

In the year 2003, a revolution was witnessed by all the players in the auto industry. Skoda Auto commenced its operations for the Indian market and the first car they launched was- "Octavia". That was the time when many people got what we use to say now- "Value for money". That car came with standard Airbags, ABS with EBD system even on its lowest version. At an attractive price of INR 11 lakhs (on-road price), the car found many enthusiast and was quite famous among the elite class of that time.

Around 2004, Indian automotive journalists started creating awareness on the need for such high-end cars for India. Many companies then launched such high-end models like Octavia, Chevrolet SRV, Opel Optima, Toyota Corolla, Ford Mondeo, etc with the Ford Mondeo considered to be the worst of the lot. These high-end cars featured the introduction of various technological updates such as Auto headlights with on/off feature, speed-sensing door lock tech, etc. This shook the industry as the demand for these was very high for the 1st time. These cars created a storm in the market with numerous orders for Toyota & Skoda.

In the year 2010, SIAM (Society of Indian Automobile Manufacturing) introduced certain regulations for all automakers operating in India. This includes the introduction of BS4 Emission norms in India. The move was quite certain as more gasoline and diesel-powered engines were cleaner, more fuel-efficient and they had a better driving character as well. At that time, certain automotive journalists also highlighted the need of introducing standard safety assistance systems for all the cars. Various car manufacturers now started giving these features right from the middle versions but still, the base variants were not given any of these features.

In 2014, Global NCAP (New Car Assessment Programs) took some of the base variants of several cars and conducted a full-frontal crash test. The results were shocking as 90% of the cars achieved a 0-star rating in the adult protection category. Many auto companies were not able to accept the fact and that movement led manufacturers to introduce safety features for the base variants of the car. Even people now realized the need for safety features after analyzing these points and there was again a surge in the demand for cars that had various safety features. Still, some auto companies were not active in incorporating these systems, and were simply going with the traditional thinking of selling the cars.

In 2016, SIAM in association with the Ministry of Road Transport & Highways laid the plan, for making it compulsory for manufacturers to incorporate safety features even on the lowest grade of the vehicle. This rule applied to the cars that were going to be launched after 1st July 2017. Honda was the 1st company as the company had then incorporated this rule with 90% of its portfolio. The government then at a later stage made it mandatory for automotive companies to phase out the models that fail the NCAP test or re-modify the vehicle to pass the same. A deadline was given by the same department and that was 1st October 2019. That rule led manufacturers to re-modify their cars for the crash test with many of these companies simply phasing out those models that performed worst during the test. This was another darkest hour in the history of the automobile sector as many manufacturers at that time, had to incur losses because of low demand and the changing perspective of the buyer from buying a feature-loaded car to buying a safe and durable car. With that TATA motors launched their sub-4 meter SUV, "Nexon" and it was the 1st Made-In India car that featured a 5-star rating in adult protection category. It was tested according to Global NCAP standards and procedures in 2018.

Another initiative was seen in 2019, when "The Ministry of Road Transport & Highway" **introduced the first-ever-"Bharat New Vehicle Safety Assessment Program**

(BNVSAP) under the Motor Vehicles Act of 2019. It can outperform numerous safety tests just like Global NCAP bodies. All the new cars that are made after 1st October 2019 have to undergo these tests to get approval from SIAM before the official launch. The BNVSAP is designed according to the standards that Global NCAP bodies follow. As per the new test crash standards, vehicles have to undergo full frontal impact at a speed of 48 km/h, side impact with a mobile deformable barrier at 50km/h, and an off-set fixed frontal impact with a deformable barrier at 56km/h.

With the introduction of such an advanced safety program by the government, from now on, all automotive companies will now focus more on quality as feature quantity comes out to be a secondary option. The other reason stands out to be the development costs as now, companies will seriously analyze the safety clause of the vehicle at the time of its development stage. The cars manufactured after October 2019, will now feature an added layer of protection for its occupants, as now, many people feel a bit safe while driving such cars.

The technological revolution came by Hyundai India when they started launching feature-rich models in their portfolio. Their cars were the 1st in the segments that featured rear parking camera and parking sensors as standard equipment. The Hyundai Creta, was the 1st urban SUV that captured the interests of most sedan buyers, all because of an excellent ride quality and feature-loaded models. This was the time when competitors were facing strong competition from Hyundai and that led many companies to re-launch their cars with new safety and technological features. Honda City (a popular mid-size sedan) again won the hearts of the buyer and simply de-throne the famous Hyundai Verna after 5 years.

New technologies were introduced by the carmakers with MG & Kia being the 1st ones, to enter the market with connected car technology. Their technologies allowed owners to gain access to the car remotely (i.e without using the actual key fob of the car). The connected car tech feature also allowed them to run a pre-diagnostic engine checkup with the touch of a button. Kia also marked the introduction of the Blind Spot Assist feature (1st in urban SUV segment) and that particular version became the hot-selling model in no time.

In 2017, when vehicular emission became a serious problem for rising pollution, SIAM again got into the action by ordering **automobile companies to switch towards BS6 Emission Norms**. The body also made it mandatory for car manufacturers to incorporate BS6 Emission Norms technology and that the BS4 version of the cars will not be registered after 31st March 2019. Mercedes Benz was the 1st luxury car brand to incorporate this norm with the introduction of their flagship model- "Mercedes S class". The car featured numerous software updates and new emission control systems like Selective Catalyst Reserve (SCR), Ad Blue Tank/ Urea Tank and Diesel Particulate Filter (DPF). Similarly, around mid-2019, many luxury car brands shifted to the new emissions technology and passenger car maker Maruti Suzuki (from passenger segment) became the 1st brand to convert its 80% of the range to the new technology in November 2019. The company also sold about 7.75 lakh units of BS6 models till March 2020.

With the introduction of BS6 emission Norms, government and all car companies are now keeping a check on 4 basic parameters and these are as follows-
-) Fuel Quality,
-) Inspection & Maintenance of In-Use Vehicles.
-) Vehicular technology.
-) Road & Traffic Management.

-) **Fuel Quality**- Most oil companies post January 2020 started re-calibrating their fuel machines to start the sale BS6 fuel only. Indian Oil was the 1st company to re-calibrate all of its fuel stations from 1st March 2020. BS6 norms are quite sophisticated in working and this is why, the fuel quality level needs to be at par with the engine technology.

-) **Inspection & Maintenance**- Now, all BS6 engines need a high level of maintenance checks to maintain the power flow and bandwidth of the vehicle. Many owners now even prefer to visit the official service station to maintain the engine of their car.

-) **Vehicular Technology-** Various cars are now getting mild hybrid systems as standard feature as this allows the car to automatically cut down ignition on idle park. This technology is designed to increase fuel efficiency and give a mild boost to the performance of the vehicle.

-) **Road & Traffic Management**- The traffic system of India is also increasing with more number of cars plying on the road. The level of infrastructure is still on the developing stage and this indicates constant that manufacturers still have to adapt to various technologies that are not going to be useful in India.

This is how Emission Norms are playing a vital role as far as car development is meant. The cars are now getting more connected to us, they are getting better quality engines and they are also advancing in various safety norms as well.

Various manufacturers have now shifted their cars technology to BS6 as per SIAM's instruction and almost 90% of vehicles in India, were BS6 applicable cars till February 2020. With the introduction of BS6 norms, the buyers will now have to shell out more money for their new cars. It is because these vehicles will cost automakers more and it is an additional cost for the buyer itself. Similarly, BS6 fuel too is quite expensive because of its refined nature. Also, many oil companies are now getting BS6 fuel as it now complies with the latest emission standards. The result is that buyers will now be paying more for power-train and fuel and in return experience smooth driving styles and more pleasurable rides. With BS6 norms emitting less smoke, the environment is going to get cleaner than before and various toxics and other harmful gases will no longer affect the present and future human life.

In an all, there is a new road that all manufacturers are going to explore and incorporate several new updates in the cars. Buyer's perception is significantly shifting and they are now more focusing on all aspects related to safety, technology, and smooth driving experiences. The automotive companies are still working hard to provide the best to their customers for the future, with the same time keeping a check on the government regulations and certain protocols, to comply with them. We all know that the future is always uncertain with various undulations, be it government policies or buyers choice. But ultimately, car companies are making themselves capable of tackling such issues and simultaneously generating demand from the customer end.

VI. FUTURE SCOPE OF STUDY-

-) With maturing powertrain in vehicles, automotive companies are now able to provide more engine options to the buyer. He/she now will be able to select from different engine options like going for gasoline & hybrid-powered engine or simply opting for an electric vehicle etc.

-) The **use of lightweight materials** like aluminum or carbon fibre has significantly improved the vehicle's driving style and emitting less pollution due to lower body weight. These materials are quite strong if using in a cars body structure and provide extra agility to the overall structure of the car.

-) With an increasing demand for connected car technology, the buyers' perception of their car is changing. Now owners feel more connected to their daily rides and India still needs to upgrade to various levels of automation as level 1 is still the most basic form of connected car technology when compared with other nations like the United Kingdom or the USA where level 3 or 4 automation is in action
.

-) Fuel engine options will be cleaner, thanks to BS6 emission norms. This particular technology makes the engine run more smoothly and efficiently without compromising on power and emitting less fuel/pollution while driving. With mild-hybrid engine options, owners will witness high mileages from their cars.

-) Improvements **in India's infrastructure** like more highways, better road conditions, traffic management techniques, etc will significantly improve the level of driving in the future. If people will follow their lanes, fewer accidents will occur and the economy will not suffer any losses in the infrastructure development.

VII. CONCLUSION-

According to the data collected from various secondary sources, it can be said that there has been a significant rise in the demand for various safety and technological features. Several years ago, there was a time when a person got his/her car, not based on safety features it had, but the kind of fuel efficiency it gave. Earlier people were not aware of the need for any **safety features** be it, dual airbags or 4-channel ABS brakes, etc. Every buyer then simply got a car that had the best mileage and was spacious enough to carry his/her family as there were very few people who took the topmost versions of the cars that had some safety features.

In mid-2014, road accidents in India reached its peak by recording over 1.8 lakhs accidents with claiming over 56,000 lives. That is when various automotive journalists started creating awareness on the need for various safety features for cars. That is the time when SIAMs-Board of Directors drafted a plan where it made it compulsory for car companies to provide a driver-side airbag and ABS brakes to every vehicle model sold in India. Various manufacturers like Honda, Hyundai, Toyota, Maruti Suzuki, etc were quite quick to respond to that call and had then introduced such features.

In 2017, SIAM drafted more rigid rules that allowed cars to comply with the newly introduced- BVNSAP standards. These standards made automakers undergo major redevelopment for the models that failed during the Global NCAP safety test. Also, all automotive companies were asked to embed dual airbags, ABS, Pretension Seat-belts, and reverse parking sensors as standard features from cars sold after 1st July 2019.

In 2017, the Ministry of Road Transport and Highways along with SIAM members drafted a policy to re-jig the current emission norms **with more stringent BS6 emission standards**. The committee gave a deadline to sell all BS4 manufactured vehicles before 1st April 2020 with 31st March being the last date for registration. To make the environment free from pollution and harmful pollutants, the government was keen on introducing those norms. From now, every car manufacturer has to take care of 4 things while incorporating the BS6 technology. They are-

-) Fuel Quality,
-)Vehicle Technology
-) Inspection & Maintenance of In-Use Vehicles
-) Road & Traffic Management.

Various car companies are also increasing their customer base by providing extravagant **technology embedded features** in their various models. In 2015, Renault was the 1st carmaker in India to incorporate a touch-screen system in their smallest hatchback- "Kwid". From there on, almost every automobile giant started giving touch systems in their various model lineup. Hyundai had always been the trend-setter in terms of providing various technology-laden models to its customers. Hyundai was the 1st automotive company in India to provide a factory fitted rearview camera in its sedan- "Verna", in 2011 and at that time, it was a 1st in segment feature. Most people were quite attracted by the features Verna had and the car took the top spot by removing the segment king- Honda City within no time.

Honda managed to gain the top spot when they launched the 4th Generation City with numerous safety and technological features. Recently, MG & Kia were the 1st automotive brands in India that came out with industry-first connected car technology. They instantly won the hearts of the Indian buyer as those systems were capable of performing remote engine start without actually using the key fob.

So, in the end, I would like to conclude by saying that the car industry is still in the growing phase because of the demand of customers who need something extravagant in their daily drives. From buying a car with no/sparse equipment list to buying a fully loaded version of a car, sure, the mindset of all of us has changed during these years. Nowadays people do look at-

-) The features that the cars have,
-) The kind of safety equipment present in it,
-) How reliable is the engine quality for daily use.
& so, these all are some of the aspect's buyers keep in their mind before booking their new rides.

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