

Contents

[Technology](#), [Cars](#)



Contents No table of figures entries found. 3 1. Introduction 4 2. Automobile Industry — Indian Overview 4 3. Major Player - Across the Globe 5 4. Value chain 6 5. Business Processes 6 5. 1. Raw Material Procurement 6 5. 2. R&D: Design, Concept Building and Manufacturing of prototypes 6 5. 3. Manufacturing 7 5. 4. Quality Control and Inspection 7 5. 5. Testing 8 5. 6. Distribution and Sales 8 6. Modules 9 6. 1. Manufacturing 9 6. 1. 1. Stamping 9 6. 1. 2. Welding 9 6. 1. 3. Painting 9 6. 1. 4. Making the engine 10 6. 1. 5. Supplier 10 6. 1. 6. Interior Assembly 11 6. 1. 7. Mate 11 6. 2. Quality Control and Inspection 12 6. 2. 1. Body and Interior Report 12 6. 2. 2. Mechanical Report 12 6. 3. Testing 12 6. 3. 1. Full-wrap frontal collusion test 12 6. 3. 2. Offset frontal collusion test 12 6. 3. 3. Pedestrian head protection performance test 12 6. 3. 4. Rear passenger’s seat belt usability evaluation test 13 7. Sub Modules 13 7. 1. Painting 13 7. 1. 1. Primer 13 7. 1. 2. Surfacer 13 7. 1. 3. Top Coat 14 7. 1. 4. Clear Coat 14 7. 2. Body and Interior Report 14 7. 2. 1. Body 14 7. 2. 1. Paintwork 14 7. 2. 2. Window Glass & Front Screen 14 7. 2. 3. Lamp Glasses/Lens 15 7. 2. 4. Interior Trim 15 7. 3. Mechanical Report 15 7. 3. 1. Underside 15 7. 3. 2. Exhaust System 15 7. 3. 3. Wheel and Wheel Rims 15 7. 3. 4. Keys and Locks 15 8. Cross functional Processes 15 8. 1. 15 9. Future 15 Reference 17 Figures * No table of figures entries found. * * Introduction The automobile industry comprises of designing, developing, manufacturing, marketing and selling of motor vehicles. It can be classified as one of the world's most important economic sectors. The automotive industry is inherently interesting - it is massive, competitive, challenging and is expected to undergo major restructuring in the near future due to globalization and decreasing oil reserves. This

analysis focuses on the business processes followed in automobile industry, specifically, large-scale manufacturers of automobiles with global presence. The term automotive industry here does not include industries dedicated to automobiles after delivery to the customer, such as repair shops and motor fuel filling stations. The process of planning, manufacturing and distributing of cars is a lengthy and detailed phenomenon. It is a capital intensive market and requires thought, research, efforts and high investments to produce the world's most famous, unique and popular cars. Planning stage starts prior to 3 - 4 year and goals are set with consideration of evolving and dynamic customer's needs and requirements. Close attention is paid to changing lifestyles and preferences of consumers.

Automobile Industry – Indian Overview

The Automotive industry in India is still in its growth stage and is one of the largest and fastest growing industries in the world. This industry is expanding widely in India. It is able to manufacture over 17.5 million vehicles (including 2/4 wheelers) and exports about 2.33 million every year. India's passenger car and commercial vehicle manufacturing industry is ranked seventh in the world, with an annual production of more than 3.7 million units in 2010. According to recent reports, India is set to overtake Brazil to become the sixth largest passenger vehicle producer in the world, growing 16-18 per cent to sell around three million units during 2011-12. In 2009, India emerged as Asia's fourth largest exporter of passenger cars, behind Japan, South Korea, and Thailand. Chennai, also known as the "Detroit of India" is the automobile hub in India with the India operations of Ford, Hyundai, Renault and Nissan headquartered in the city and BMW having an assembly plant on the outskirts. It accounts for 60 per cent of the

country's automotive exports. Maruti Suzuki manufacturing plants are based in Gurgaon and Manesar in Haryana. The Chakan corridor near Pune, Maharashtra is another vehicular production hub for automobile companies like General Motors, Volkswagen, Skoda, Mahindra and Mahindra, Tata Motors, Mercedes Benz, Land Rover, Fiat and Force Motors having assembly plants in the area. Ahmedabad with the Tata Nano plant, Halol again with General Motors, Aurangabad with Audi, Skoda and Volkswagen, Kolkatta with Hindustan Motors, Noida with Honda and Bangalore with Toyota are some of the other automotive manufacturing regions around the country. Thus the sector growth is nationalized and not regional.

Major Player - Across the Globe

- * The automobile manufacturing industry in spite of being a capital intensive sector practices perfectly competitive market conditions with more than 30 global players. Top 10 players include:
- * Toyota Motor Corporation, Japan
- * General Motors, USA
- * Volkswagen Group, Germany
- * Ford Motor Company, USA
- * Honda Motor Company, Japan
- * Nissan Motors, Japan
- * Peugeot Citroen, France
- * Hyundai South, Korea
- * Suzuki Motor Corporation, Japan
- * Fiat S. p. A, Italy

* Value chain

* Business Processes

Raw Material Procurement

Although the bulk of an automobile is virgin steel, petroleum-based products (plastics and vinyl) also form an increasingly large percentage of automotive components. The light-weight materials derived from petroleum have contributed in reducing weights of some models by as much as thirty percent. As the price of fossil fuels continues rising, preference for lighter and fuel efficient vehicles is also becoming pronounced. Raw materials may differ amongst manufacturer in the same industry and may vary from chrome alloyed steels to aluminium and

petroleum direct or by-products. Also the latest technologies use more natural fibres for their strength and durability compared to synthetic ones, and for their biodegradability. Other raw material products such as silicones binders and sealants are also used for automotive industry. Also polyurethanes are used as covers and also sealants and Ceramics for catalysts. R&D: Design, Concept Building and Manufacturing of prototypes

Introduction of a new model of automobile generally takes three to five years from inception to assembly. Ideas for new models are developed to the changing requirement of the public. With the help of computer-aided design equipment, designers develop basic concept drawings that help the automobile engineers to visualize the proposed vehicle's appearance. Based on this simulation, they are able to construct clay models that are then studied by the design and styling experts. Aerodynamic engineers also review the models, studying air-flow parameters and doing feasibility studies on crash tests. Only after all models have been reviewed and accepted, tool designers are required to build tools that would manufacture the component parts of the new model. Manufacturing * Manufacturing is at the heart of the automobile industry. This is where the production of the car actually takes place and the finished product is produced. This process consists of a large number of sub processes that are interlinked with one another such as pressing, welding, painting, assembly etc. All the processes are synchronised in such a manner so that none of them have to wait for an earlier process to finish. Some of the manufacturing processes are done manually whereas many of these have been automated. The processes followed by most of the automobile manufacturers are almost similar with

minor modifications to suite their business needs. Quality Control and Inspection All of the components that go into the automobile are produced at different sites. Thus the different component pieces that comprise the car are manufactured, tested, packaged, and shipped to the assembly plants. This requires ample amount of planning. To accomplish this, most automobile manufacturers require outside parts vendors to subject their component parts to rigorous testing and inspection audits similar to those used by their assembly plants to ensure their quality. This helps them in ensuring that the products arriving at their receiving docks are Statistical Process Control (SPC) approved and free from defects. Once the component parts of the automobile begin to be assembled at the automotive factory, production control specialists follow the progress of each embryonic automobile by means of its Vehicle Identification Number (VIN), assigned at the start of the production line. In many of the more advanced assembly plants, a radio frequency transponder is attached to the chassis and floor pan. This unit carries the VIN information and monitors its progress along the assembly process. Knowing what operations the vehicle has been through, which is the subjected next process, and when it should arrive at the next assembly station gives the production management personnel the ability to electronically control the manufacturing sequence. Throughout the assembly process quality audit stations keep track of vital information concerning the integrity of various functional components of the vehicle. This process comes from a change in quality control ideology over the years. Formerly, quality control was seen as a final inspection process that was performed in order to discover the defects only after the vehicle was built. However now quality is

seen as a process built right into the design of the vehicle as well as the assembly process. This enables assembly operators to stop the conveyor if a defect is detected in the initial phases. Corrections can then be made. Also supplies are checked to determine whether the entire batch of a particular component is defected. Vehicle recalls are costly and thus manufacturers take all precautionary steps possible to ensure the integrity of their product before it is shipped to the customer. Once the vehicle is assembled a validation process is conducted towards the end of the assembly line to verify quality audits from the various inspection points throughout the assembly process. This final audit tests for proper fitting of panels; dynamics; squeaks and rattles; functioning electrical components; and engine, chassis, and wheel alignment. In many assembly plants vehicles are periodically pulled from the audit line and given full functional tests. All efforts are thus put forth to ensure that quality and reliability of the assembled product. Testing Safety of the cars is an extremely important aspect and thus Testing is given due importance. Various tests are conducted on the cars to ensure that the final car manufactured is robust. Thus a different department is responsible for the operation of the compulsory vehicle inspection programme. To ensure that the cars live up to the consumers' standards and one-up competitors, car makers test their cars in all types of environments. While much testing can be done on closed tracks, real-world car testing needs to take place in real-world conditions

Distribution and Sales A car dealership or vehicle local distribution sells the manufactured cars at the retail store often called as showroom, based on a dealership contract with an automaker or its sales subsidiary. It employs

automobile salespeople to do the sales. It may also provide maintenance services for cars, thus employing automobile mechanics, stock and sell spare automobile parts, and process warranty claims. With the emergence of Web, a new channel has been established. Auto manufacturers are setting up virtual showrooms and exclusive dealers are using the Web services to offer information and new services. Independent dealers use Web aggressively to improve their market position. It also helps its customers by providing abundance of information and store locator facilities to access the closest car dealer.

Modules Manufacturing The production of the car usually follows a standard sequential process used by most of the automobile manufacturers. Each manufacturer may slightly modify these basic processes as per his business requirements.

- * **Stamping** This process is also known as pressing by some manufacturers. Steel sheets the most important raw material used for making car bodies is sent from the steel making companies to the factories in big rolls. The steel sheet is cut according to the size of the part. It is then bent and cut in a stamping machine to make parts such as car doors, roofs, and hoods. The parts that have been stamped parts are then inspected and transported to the welding process.
- * **Welding** The stamped parts are heated and melted using electricity to be joined together at specific points to form the cars. The finished body is inspected and then transported to the painting process.
- * **Painting** The cars are painted with 3-4 coats. Each car is painted a different colour at the painting process according to the customer's order, consumer preferences etc. Painting involves various sub-processes such as Pre-cleaning, Surface coating multiple times primer, a surfacer, and a top coat and then with a clear coat for a beautiful shine. This gives the car

a beautiful colour and prevents rust. * Making the engine This is an important process in car manufacturing. The engine is a vital component of the car and thus needs to be manufactured with care. An engine is made up of more than 500 parts. Parts are made by casting and forging. These parts are then used to assemble the engine and suspension. The various sub processes used in making the engine are: Casting, Forging, Machining and Installation. * Supplier A car is made up of a large number of parts; each car approximately has 30000 to 32000 parts in it. Some of these parts are made in the car manufacturer's factory whereas others are purchased from other suppliers who may be located across the world. These parts are then shipped from various suppliers to the manufacturers. Different manufacturers use different ways of efficiently procuring the parts from the various suppliers. Toyota the world leader in "Lean Manufacturing" uses a "kanban system" to make sure the necessary number of parts are delivered at the same speed that cars are made to promote "Just in Time" system. Each box that holds parts has a paper attached to it called kanban. On each kanban is written the type and the number of parts that are needed. These are of two kinds: * Parts Retrieval Kanban * Production Instruction Kanban This helps to order the number of parts that were actually needed and thus saved the storing costs. * Interior Assembly The painted shell, the engine and other parts then proceed through the interior assembly area where workers assemble all of the instrumentation and wiring systems, dash panels, interior lights, seats, door and trim panels, headliners, radios, speakers, all glass except the automobile windshield, steering column and wheel, body weather strips, vinyl tops, brake and gas pedals, carpeting, and front and rear bumper

fascias. Next, robots equipped with suction cups remove the windshield from a shipping container, apply a bead of urethane sealer to the perimeter of the glass, and then place it into the body windshield frame. Robots also pick seats and trim panels and transport them to the vehicle for the ease and efficiency of the assembly operator. After passing through this section the shell is given a water test to ensure the proper fit of door panels, glass, and weather stripping. It is now ready to mate with the chassis. * Mate This is the stage at which the car is finally assembled to form the final product. As the chassis passes the body conveyor the shell is robotically lifted from its conveyor fixtures and placed onto the car frame. Assembly workers, some at ground level and some in work pits beneath the conveyor, bolt the car body to the frame. Once the mating takes place the automobile proceeds down the line to receive final trim components, battery, tires, anti-freeze, and gasoline. After this the vehicle is ready to be started and inspected before it is finally rolled out of the manufacturing unit. * Quality Control and Inspection Once the car has been finally assembled and is ready to move out of the manufacturing unit it goes through a thorough quality check and inspection * Body and Interior Report Rigorous quality control checks are don't to inspect the body and interior of the car and a detailed report is prepared. It comprises of various sub processes such as Body, Paintwork, Window glass, Interior Trim inspection etc. * Mechanical Report Various mechanical parts such as exhaust systems, wheels and wheel rims, keys and locks etc are inspected and reports are prepared Testing * Full-wrap frontal collusion test Also commonly known as the crash test dummies are placed in both the driver's and front passenger's seats and the vehicle is made to

collide with a concrete barrier at a rate of 55 km/h. Both the dummies used and the vehicle are then checked for injuries or for any damage or deformation. * Offset frontal collision test Similar to a full-wrap frontal collision test the vehicle is made to collide head-on on the driver's side (at an offset of 40%) with an aluminium honeycomb at a rate of 64km/h *

Pedestrian head protection performance test Cars moving at a particular speed are made to collide against simulated pedestrian or other car bonnets.

* Rear passenger's seat belt usability evaluation test As wearing seat belts by rear passengers have been made mandatory in some countries various factors such as accessibility, comfort-ability, insert-ability etc. of the rear seat belt is tested. * Sub Modules * Painting * Primer To apply primer a mixture of resin and binder along with some pigments is fed in a tank.

Through an overhead container the vehicle is then lowered into the tank [Figure]. An electric current is also applied to make the vehicle rust proof. *

Surfacer Depending upon the manufacturer either a robot or a person evenly sprays on a gray paint to help the topcoat keep its colour and to make the car surface smooth * Top Coat Varying with different manufacturers either a

robot, human beings or various vents automatically spray the final colour from different angles to provide a final even finish. * Clear Coat Finally the paint is applied for a beautiful finish, so the body shines like a mirror. The final output of these various sub-processes in painting is a beautifully

finished smooth car. Body and Interior Report * Body The final vehicle is inspected for any minor dents on the surface, missing or faulty trims or badges is noted and finally reported if any. * Paintwork The paintwork is

inspected to assure that the car is scratch free and the paint has been done

evenly. * Window Glass & Front Screen These are inspected for quality of glass used and to check whether they are fit appropriately in the drivers sight line or not. * Lamp Glasses/Lens All lens and lamps are inspected to assure the vision is appropriate as per the specified standards. * Interior Trim The finishing of the interiors including the inside lights are checked properly. Mechanical Report * Underside Inspection of the underside is done to assure that all the mechanical parts are intact and there is no distortion in the chassis. * Exhaust System These are inspected to assure that they are free from leakage. * Wheel and Wheel Rims All wheel and wheel rims are inspected to check their alignment etc. * Keys and Locks All keys, locks and remotes are inspected to assure the safety of the car. Cross functional Processes * Purchase process Management The manufacturing of a car requires thousands of parts to be assembled together. Some of these parts such as engine are made in-house by the manufacturers where as many other parts such as screws, car seats etc are purchased from the suppliers. Maintaining good relationship with the raw material and intermediate parts suppliers is important for all manufacturers. Procuring inventory based on just in time approach to reduce inventory carrying cost is a common practice followed in the industry. Manufacturing Processes Management Manufacturing process is at the core of the automobile industry. The different technologies used in these process right from pressing, to welding, to painting etc help to differentiate the final product and add value for the customer. Each manufacturer has its own operational efficiency in performing these processes. The different manufacturing processes help to give a competitive advantage to these companies over others. E. g. Japanese

manufacturer Toyota has excellent operation efficiency in all these processes and its differentiation is its cost advantage due to “ Lean Manufacturing”

Human Resource Management HR is the most valuable asset for any industry. In spite of increasing automation in this industry, HR skills is needed right from the designing phase, across the manufacturing and testing, till the marketing and sales of the automobiles. Thus managing and retaining HR has become very vital. Various employee engagement programs have been undertaken by most of the manufacturers. Since these organisations operate globally, taking care of the cultural diversity is an important aspect of human resource management.

Finance and Asset Management Automobile industries financial strategy is based on the maintenance of sound financials that allow long-term, stable growth, with an emphasis on capital efficiency. As most of these organisations are targeting the emerging economies, there is a need for efficient asset acquisition and management. Another financial aspect is to procure inbound logistics at the best possible prices.

IT Management Advancements in Information Technology have revolutionised the product development of cars. The impact of IT on product development process has been multipronged as follows:

- * The reduction in product development lead-time,
- * The digitization of design documents using Computer Aided Design(CAD) technology.
- * The computer simulation capability both of the design of parts as well as the assemblability.
- * The efficiency in maintaining the communication and flow of information between different departments and geographies.
- * Providing a centralised view by integration of various manufacturing and other processes.

Sales & Marketing Management As there is immense competition

in the automobile industry, most of the major players believe in embracing a marketing strategy that is evolving rapidly in order to carefully chart most of their major moves well in advance to hold on to their market share and penetrate further. Each manufacturer is trying to position itself positively in the minds of its customers thus building a strong image. Various marketing and sales initiatives taken by the companies help to achieve this goal.

Various mediums such as TV, radio, newspaper internet etc, are being used to outreach, most of the competitors. Various companies are buying advertising on Internet search engines in hopes that their message pops up at the top of the list of sponsored links when people look for auto-related information online. External relationship Management Various activities are done by the automobile manufacturers to improve their public relations. Some companies have hired additional lobbyists and public relations specialists in their branches in different geographies across the globe to communicate better with the local consumers. Building customer loyalty is an important factor that is catered by these public relation activities. The primary aim of these objectives is to build a positive image in the minds of the end customer.

Cross functional link between the different processes The various processes mentioned above do not work in isolation to one other. They are closely linked with and work in tandem. The procurement, finance and manufacturing department work closely. The manufacturing department keeps a track of the inventory and lets the procurement department know when raw material or intermediate parts are required. The procurement department then contact finance department for issue of finance. This whole process is done in most of the efficient manner in order to reduce the

inventory carrying costs and also avoid stock-outs of raw material. IT department is closely linked with all the other departments as it helps to provide a centralised view of all the data in the system right from marketing, to finance, to operations etc. The human resource department keeps a track of the manpower required in the various manufacturing processes and makes sure that right people are present at the right place and right time. These cross functional links between the various departments helps to work in a very efficient manner and to speed up manufacturing time of cars. In future though internal combustion vehicles will continue to be widely prevalent in the market but slowly development of electric automobiles will increase and they will have a wider spread. Various factors such as depletion of oil reserves, air pollution due to tailpipe pollutants, emission of greenhouse gases due to combustion in vehicles, carbon dioxide emissions due to combustion of fuel etc have degraded the environment to a great extent. In the push for more fuel-efficient, lower-emissions vehicles, with the ultimate goal being a move to zero-emissions vehicles. Thus with greater awareness about the environment and a need to preserve the scarce oil reserves electric cars are the future of tomorrow. In response to these trends, automakers have developed electric models, including the Chrysler TEVan, Ford Ranger EV pickup truck, GM EV1 and S10 EV pickup, Honda EV Plus hatchback, Nissan lithium-battery Altra EV Miniwagon and Toyota RAV4 EV. Further innovations and technological inventions are being done in this field. This electric car has no engine, exhaust system, transmission, muffler, radiator, or spark plugs. Instead high performance cells are used to power the motors which are capable of generating more than 100 kilowatts of

power. And, unlike the lead-acid batteries of the past and present, future batteries will be environmentally safe and recyclable. The high growth of automobile usage, both in developed and developing economies and the increasing resistance to road building have made the highway systems both congested and obsolete. But new electronic vehicle technologies that permit cars to navigate around the congestion and even drive themselves may soon become possible. Turning over the operation of our automobiles to computers would mean they would gather information from the roadway about congestion and find the fastest route to their instructed destination, thus making better use of limited highway space. The advent of the electric car will come because of a rare convergence of circumstance and ability. Growing intolerance for pollution combined with extraordinary technological advancements will change the global transportation paradigm that will carry us into the twenty-first century. Thus, considering the fact that electric cars will dominate the market automakers like Toyota, General Motors, Honda are coming up with their electric versions of cars to make place for themselves in this new market. * * * * * Reference