

A Study of Manufacturing Processes, Assembly Processes and Supply Chain Dynamics in Indian Automotive Industry

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Abstract— Automotive industry plays very vital role in economy. In this review paper, how automobiles are being produced in the plant is described. Since, all components are not being manufactured and assembled in one place. So, Dynamics of Supply chain with challenges is very important to study to understand with more clarity. This study helps to understand automotive industry stakeholders and process flow of production of automobiles.

Keywords— Foundry, Casting, Cost Optimization

I. INTRODUCTION OF INDIAN AUTOMOTIVE INDUSTRY

Automotive industry is the most important for economy growth of country. It is giving 19 million people direct and indirect jobs. India is the fifth largest in motor vehicles production. India will become third largest automotive market in terms of production. There are major hubs like: Chennai(Tamil Nadu), Chakan(Maharashtra), Gurgaon(National Capital Region) and

Sanand (Gujarat).

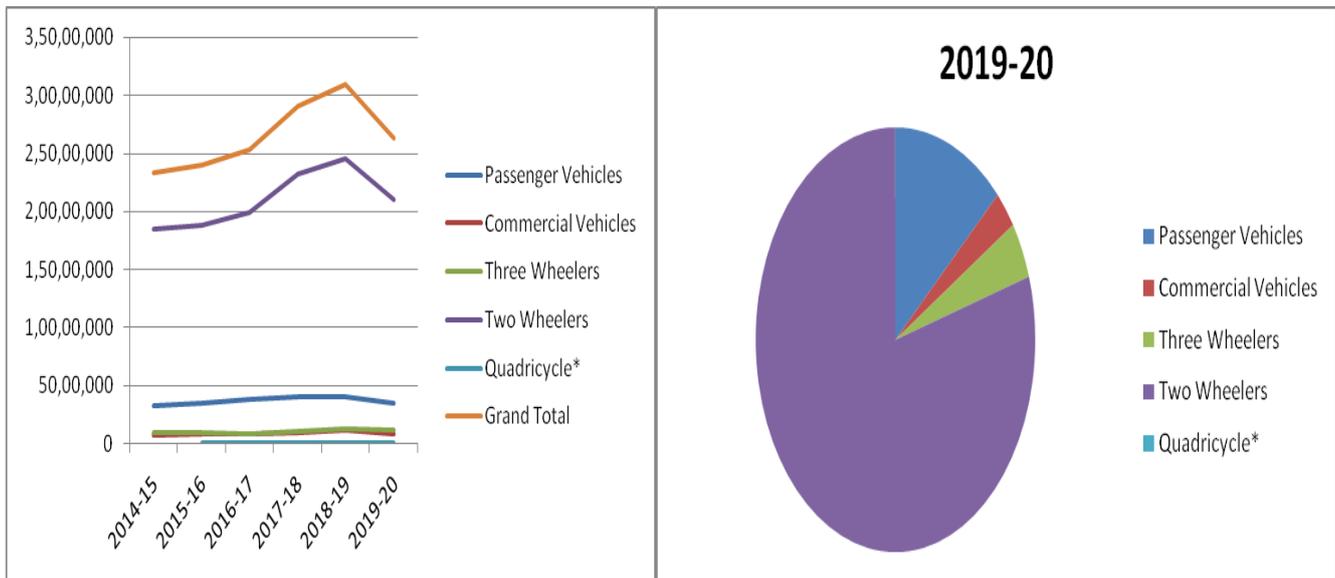


Fig1.SIAM's Automobile Production Trends year on year Fig2. SIAM's 2019-20 data of Production and Sale

We are seeing significant growth in automobile productions. Because of Covid-19 Pandemic, sales were low. Demand of two wheelers is growing year on year. Major portion of production and sales is of two wheelers. It is more than 75% of total production.

II. AUTOMOBILE MANUFACTURING AND ASSEMBLY PROCESSES

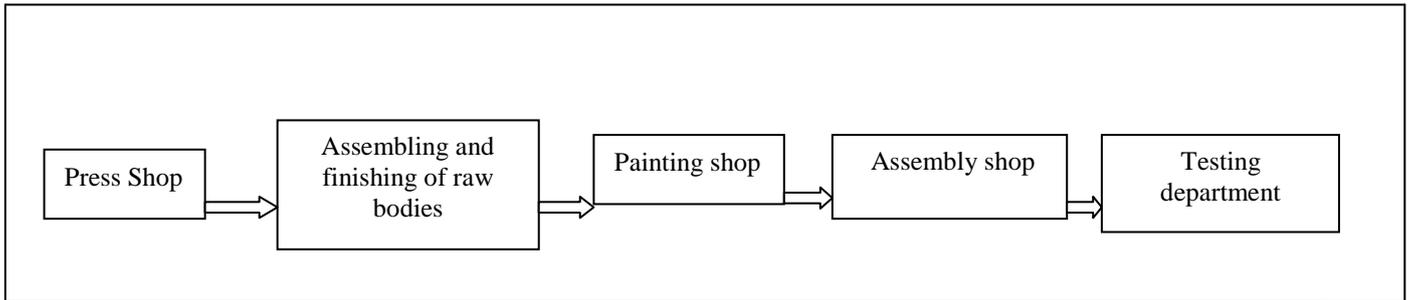


Fig.3 General Layout for a car assembly plant

1. Press shop

In Foundry Processes, cast iron and aluminium foundries uses sand or semi-permanent castings. Massive Steel Parts Printing is being done by forging, hot and cold extrusion. Body panels, doors, hoods, floor pans and other parts are stamped out of sheet metal.

Fully automated transfer presses cut out of blanks from the metal sheets. Dies are used in heavy stamping machines to shape the metal, trim excess, bend edges and pierce holes.

Various Stamping Process Operations

- i. Blanking: Cutting Piece of Sheet Metal into pieces.
- ii. Trimming: Cutting excess metal off the part
- iii. Stamping: Stretching the flat Blank into product shape.
- iv. Piercing: Punching necessary holes, slots in parts
- v. Flanging: Folding the edges of the part to make it functional, hides rough edges, provide surface for fastening.

Plastic Parts Printing is being done by injection printing, injection-compression, extrusion and relative processes for coating and joining parts.



Fig.4 Hydraulic Presses

2. Assembling and finishing of raw bodies

Assembling and Joining of Steel Parts is being done by resistance welding, laser welding with or without metal amount carried over, MIG/TIG welding or cold welding. There are around 2000 welds which are being done manually or robots.



Fig.5 Assembly of raw bodies

3. Painting shop

The car's body is moved to another unit where it is protected by corrosion. The body is submerged in chemical where it is rotated in 360 degrees to get coated from inside and outside.

The coating is of Nickel, Manganese and Zinc.

The car is emerged in an electrical charge solution where this coating sticks to the body like apparent magnet and prevents it from rusting. Paints are being done by automated robots as of now.

4. General assembly shop

Engines, gearboxes and chassis systems are produced while the car body is going through the other processes.

Engines are built up from cylinder head, camshaft, crank case and other subassemblies, then the built-up unit is with peripheral items like the exhaust manifold, fly wheel and injection pump.

Chasis systems, complete with braking, suspension and transmission subsystems are put together as well.

Once completed, the powertrain and chasis system are transferred to the vehicle assembly line for fitting.

Final assembly involves fitting out the finished car body with seats, wheels, engine, dashboard etc.

Some parts come from nearby supplier plants while other comes from a far.

As the wheels are mounted, the vehicle rolls into the testing area, either under its own power or on a belt.

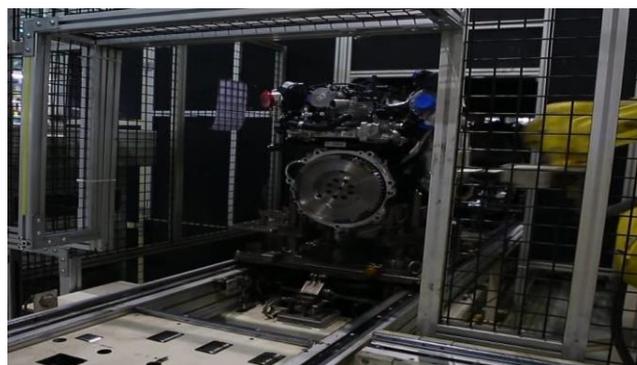


Fig.6 Assembly of engine parts

5. Testing and delivering area

Testing areas where the cars alignment tests for wheels and turning radius, headlight test, side-slip test, engine drum test, suspension test and the brake test.



Fig.7 Testing and delivering area

III. SUPPLY CHAIN DYNAMICS

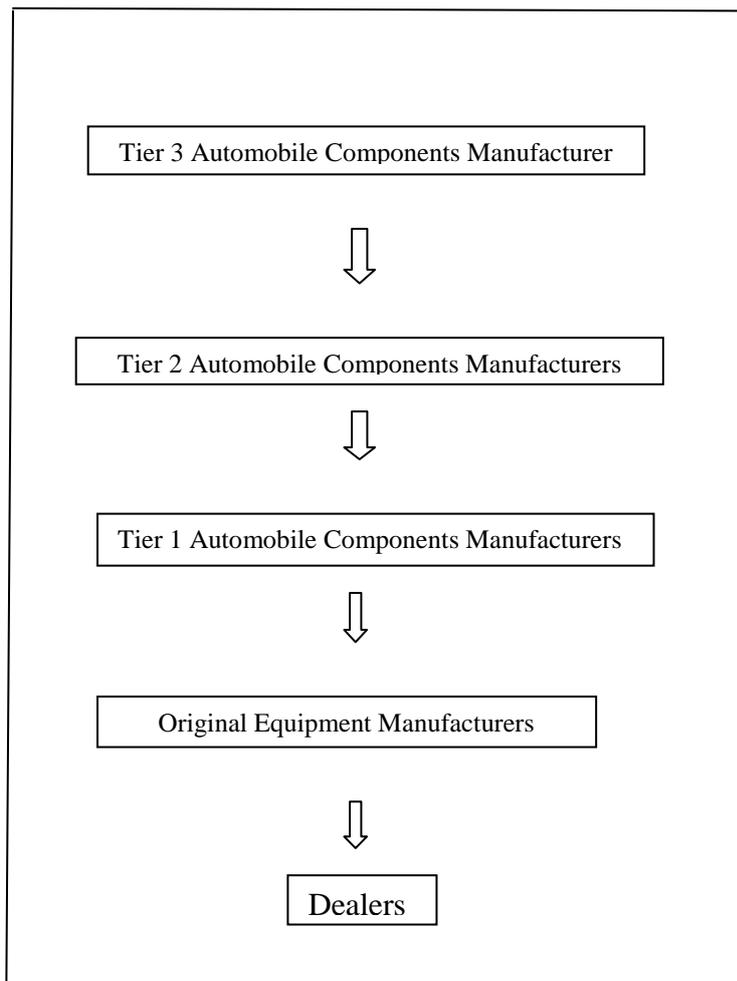


Fig.8 Stages of Supply chain in automotive industry

The supply chain includes Tier 3, Tier 2 and Tier 1 automobile components manufacturer, Original Equipment Manufacturer and suppliers and Major competition is between Original Equipment Manufacturers. Tier 3 and Tier 2 are local business owners who don't spend research and development like OEMs. Some big automobile components manufacturers like Bosch also play a very important role in Tier 1 suppliers.

OEMs follow Just in Time Model and don't hold more inventories for reduction of inventory cost. So it is very critical to replace defected parts because it takes more time. So, they keep reliable suppliers who don't delay in supplying on time. They also focus on reducing lead time and variability of lead time for reducing supply chain costs.

Technological changes and uneven customer demand is a major challenge. So, it is very important to get reviews and feedbacks from dealers for making decisions, quality and service. Collaboration between dealers, OEMs and suppliers is very important for changing consumer demands.

OEMs also share the forecast with their suppliers for synchronizing the supply chain. It helps suppliers to make work plan. So, they can fulfil demands of parts from OEMs.

IV. CONCLUSION

A growth of automotive industry is necessary to grow economy of a country. However, automotive industry has lots of stakeholders like OEMs, suppliers, dealers and government. Supply chain is very critical in this industry because of lack of coordination between them. So, these all stakeholders have to focus on improving supply chain and business environment for the growth of industry.

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IOSR Journal of Engineering (IOSRJEN) www.iosrjen.org ISSN (e): 2250-3021, ISSN (p): 2278-8719 PP 47-53