Major Project

Improving profitability using Jigs & Fixtures in Auto industry

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Submitted in partial fulfillment of the requirement for award of Master of Business Administration (Executive)

May 2018

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Disclaimer

The views expressed in this project are personal and not of the organization and this project is done as a detailed study under the course from strategy perspective only.

Certificate

This is to certify that the project entitled “Improving profitability using Jigs & Fixtures in Auto industry” has been successfully completed by Ajay Kumar Madhok – 2K16/EMBA/504.

This is further certified that this project work is a record of bonafide work done by him under my guidance. The matter embodied in this report has not been submitted for award of any degree.

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Acknowledgement

I, Ajay Kumar Madhok, wish to extend my gratitude to Dr Jagmohan Taluja, Professor, Delhi School of Management (DSM), Delhi Technological University; for giving me all the guidance and valuable insights to take up this Semester Project.

I also take this opportunity to convey sincere thanks to all the faculty members for directing and advising during the course.

ABSTRACT

This research is an attempt to investigate the performance improvement measures such as productivity, responsiveness, cost saving & profitability when the moulded/ casted/ punched/ forged/ fabricated auto components are produced using dies in conjunction with various jigs & fixtures in production shop.

The sustainability in auto sector is dependent on how quickly a firm adapts to its ever changing business environment to redesign processes around the outcomes to satisfy the customer. Today`s metal forming industry is bound to look for optimization in every aspect of its activity. Lean production leads us to identify waste and reduce it as much as possible, whether it`s in the form of WIP, inefficient processes & information flow, or useless & redundant procedures that don`t generate value for the customer.

This research conducted, identifies a distinct classification of OEM (original equipment manufacturer) vs SME (small & medium sized enterprise) in auto sector, wherein large companies believe in capex investment in hi-tech modern CNC set-up to achieve zero defects quality with economies of scales. On the other hand, small job shop units bank upon skilled/semi-skilled labour, innovative production tools (such as Jigs, Fixtures & Gauges) and a mix of conventional as well as CNC machineries, in the absence of cheaper capital options at their disposal.

An in-depth case study on two automobile components namely; a sheet metal CRCA (cold rolled close annealed) drawn component, and a forged & machined alloy steel Ejector Pin has been thoroughly analyzed & interpreted here.

The Micro, Small & Medium Enterprises (MSME) comprising of 125 lacs units has been a significant contributor to the manufacturing sector by accounting for nearly 50% of the total industrial production. Tooling industry has been recognized as the backbone of the manufacturing sector & enhancement of the tooling facilities will give a fillip to the sector by providing quality moulds / dies, jigs, fixtures & gauges.

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OVERVIEW

The Design and Need for Jigs and Fixtures in Manufacturing

The numerous advantages that are associated with the use of jigs and fixtures in manufacturing to include: production increase, cost reduction, interchangeability and high accuracy of parts, reduction of the need for inspection and quality control expenses, reduction of accident as safety is improved, automation of machine tool to an appreciable extent, easy machining of complex and heavy components, as well as low variability in dimension which leads to consistent quality of manufactured products.

Introduction

The people's quest for manufactured goods has been growing rapidly over the years. Therefore, to meet up with the high demand, manufacturers have reacted by introducing innovative ways of manufacturing high quality products at a faster rate. The production processes has witnessed numerous changes and evolution with the introduction of numerous innovative manufacturing concepts which include Lean Production System, Cellular Manufacturing. These creative approaches have necessitated the need for a reliable and cheaper tools and work-holding devices.

As the efficient running of a manufacturing company which demands a prompt and simple work positioning strategy for correct operations depends largely on the interchangeability of machine components and work-pieces, to ensure un-complication of assembly, and unit cost reduction, as well as to become competitive, reduce the enormous manufacturing cost, and also increase their profitability, the industry has resorted to streamlining its supply chain in a bid to maintaining a very low amount of inventory. This has also led to the demand for a better and cost-effective work-holding device which will ensure better quality products, reduce lead time, and also increase throughput.

Also, although some machining operations are so straight-forward, like in turning where the job is secured tightly on the chuck while the turning operations are easily performed, some jobs in other operations may not be easily held on either the three or four jaw chucks, and may also require the tools to be guided by the means of a different device. This explains the need for production standard work-holding devices to increase the rate of manufacturing. Jig is the device which guides the tool, while fixture is a device that securely holds the job in position during machining operations.

Jigs and Fixtures

Jigs and fixtures are manufacturing tools that are employed to produce interchangeable and identical components. They are unique tool-guiding and work-holding devices designed specifically for machining and assembling large number of parts. The purposes of jigs and fixtures reduction of production cost, increase of production rate, high accuracy of products without any manufacturing defects, provision of interchangeability, easy machining of complex shaped parts, reduction of quality control costs, etc. Jigs and fixtures eliminate the need for a special set up for every work-piece thereby facilitating production and also ensuring that every work piece is manufactured within a predetermined tolerance. Jigs and fixtures "eliminate the necessity of a special set up for each individual part." Once a jig or fixture is appropriately set up, that any number of duplicate components can be readily produced without additional set up. The main advantages of Jigs and fixtures are "durability, setup reduction, improvement in productivity, reduced decision making in operation selected from the standard components. “The major difference between a jig and a fixture is that jigs guide the cutting tool to its precise position, as well as locating and supporting the work-piece during operations.

The essential features of jigs and fixtures include:

- Clamps position;
- Neatness of work-piece;
- Standardization;
- Idle time reduction;
- Set up time reduction;
- Hardened surfaces.

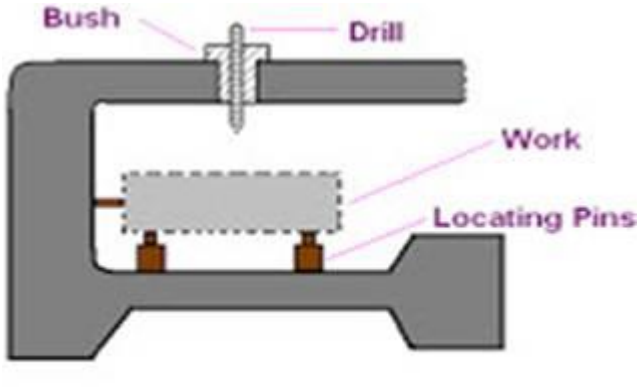
The application of jigs and fixtures in manufacturing operations lead to the production of faster, more accurate, and reliable products at a reduced cost.

Jig

A jig is a work-holding device that supports, holds, locates a work-piece and also guides the cutting tool for the desired machining operations. Its main objective is to ensure high degree of precision, interchangeability, and duplication in product manufacturing, it is also applied to manipulate the location and movement of

other tools. A device that does both functions (holding the work and guiding a tool) is called a jig. An example of a jig is when a key is duplicated, the original is used as a jig so the new key can have the same path as the old one.

A jig is a type of custom-made tool used for the location and motion of another tool. They observed that the primary purpose of a jig is to provide repeatability, accuracy, and interchangeability in the manufacturing of products. Although the most common jigs are the drilling and boring jigs, they are all identical except for the shape, type, and the position of the bushings for drilling or boring.



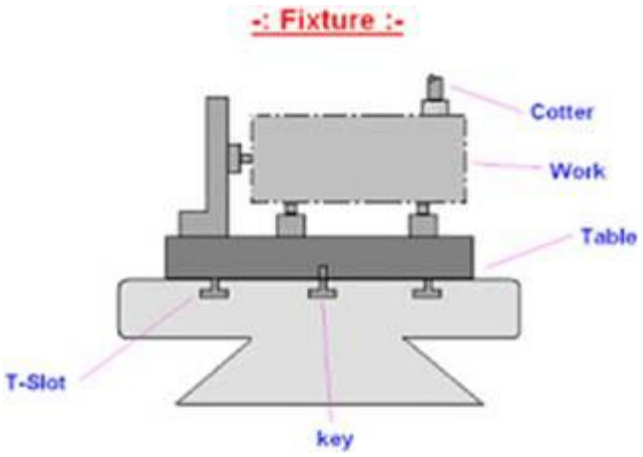
-: Jig :-

Jigs are imparted with tool guiding elements such as drill bushes, which regulate the tool to the right position in the work piece. These are rarely clamped on the machine table as it is essential to push the jig on the table to align the numerous bushes in the jig with the spindle of the machine. The different types of jigs are template jig, drilling jig, open type jig, etc.

Fixtures

Fixtures are rigid and sturdy mechanical devices which allow fast and precision machining with reliable quality, interchangeability, and lead time reduction. As a work-holding device, fixtures do not position, guide, and locate the cutting tool, as it is achieved by making necessary adjustments on the machine.

The "main purpose of a fixture is to locate and, in some cases, hold a work-piece during either a machining operation or some other industrial processes." What makes fixtures unique is that these are all manufactured to fit a particular shape or part.



Fixtures often fastened to the machine table, are made to hold the work piece firmly and in the desired position during machining operations. There are sometimes an arrangement in the fixture for adjusting the tool with respect to the work-piece/fixture, although the tool is not guided like in a jig.

While fixtures are always identified by the machine tool where they are applied, they have broader applications than jigs, and also manufactured for operations where the cutting tools cannot be easily maneuvered like the drilling or boring tools. The different types of fixtures are welding fixture, tapping fixture, milling fixture, boring and drilling fixture, milling fixture, turning fixture, etc.

Advantages of Jigs and Fixtures

The advantages of jigs and fixtures include but not limited to the following:

• Production increase;

• Low variability in dimension, thereby leading to consistent quality of manufactured products;

• Cost reduction;

• Ensures interchangeability and high accuracy of parts;

• Reduces the need for inspection and quality control expenses;

• Reduces accident, as safety is improved;

• Semi-skilled machine operators can easily use them thereby saving the cost of manpower;

• The machine tool can be automated to an appreciable extent;

• Complex and heavy components can be easily machined;

• Easy assembly operations save labour, and also lead to reduction of defective products;

• They eliminate the need for measuring, marking out, punching, positioning, alignments, and setting up for each work-piece thereby reducing the cycle and set up time;

• Increases technological capacities of machine tools;

• The application of more than one tool simultaneously on a work-piece can be achieved;

• Setting of higher values of some operating conditions like depth of cut, speed, and rate of feed can be attained because of the increased clamping capability of jigs and fixtures.

Elements of Jigs and Fixtures

The body, Clamping devices, Locating devices, and Tool guide/bushes are the major elements of jigs and fixtures.

- The Body

As the most outstanding element of jigs and fixtures, the body is constructed by welding of different slabs and metals usually mild steel or by casting of cast iron. After the fabrication, it is often heat-treated for stress reduction as its main objective is to accommodate and support the job.

The different types of jig bodies are as follows:

Channel body type – this is fabricated from the regular steel channel.

Box body type – usually made very light, the box type jig body is adopted where a work-piece needs drilling in various parts, hence the jig is fabricated to have a required amount of drill bush plates.

Plane body type – this is the most common type of jig body and is often applied when the work-piece requires drilling or boring, hence the provision of drill bushes on it.

Leaf body type – usually made from block of steel as it holds and supports heavy components.

Built-up body type – this is made from standard steel.

- Clamping Devices

Without sacrificing efficiency and effectiveness, the clamping devices must be very simple and easy to operate. Apart from holding the work-piece securely in place, the strong point of clamping devices is its ability to withhold the strain of the cutting tool during operations. The bench vice is a popular example of a clamping device. The need for clamping the work-piece on the jig or fixture is to apply pressure and press it against the locating components, thereby fastening it in the right position for the cutting tools. The familiar clamping devices include:

Clamping screws – they are used for not too rigid clamping.

Hook bolt clamp - a simple clamping device generally used where the normal clamping tip cannot fit in.

Latch clamp – this is a unique clamp which provides space for the loading and the unloading of a work-piece through its latch or lid.

Other clamping devices are the C-clamp, the Bridge clamp, and the Heel clamp,

- Locating Devices

Made with hardened steel and with different designs, the pin is the most popular device applied for the location of work-piece in jigs and fixtures. The pin's shank is press-fitted or driven into a jig or fixture. The locating width of the pin is made bigger than the shank to stop it from being pressed into the jig or fixture body because of the weight of the cutting tools or work-piece.

The pins are classified as follows:

Locating pins – the locating pins are used for the location of the work-piece when completed or reamed holes have been provided on the work-piece. The two types of locating pins are cylindrical and conical locating pins.

Jack pins – jack-pins also referred to as spring pins are used for the location of work-piece whose dimension will vary during operation. The pin is designed to rise under spring pressure or in the contrary the weight of the work-piece pushes it down. As the position of the work-piece is firmly fixed, the locking screw is used to fasten the pin in the desired position.

Support Locating/Rest pins – these pins which ensure reliable and secure location are made to be either curved or flat. Those with flat heads are often used to provide support and location to machine surface, as more contact area is accessible during location. Because of their stability, the head support locating pins are for supporting coarse or rough surfaces during machining.

- Jig Bushing or Tool Guide

Guiding parts like jig bushings and templates which must be wear resistant, interchangeable, and precise, are used to locate the cutting tool relative to the component being machined. Jig bushes are applied in drilling and boring, here for the drill to pass through, a bush fits into the hole of the jig.

Bushes are mainly made of reliable grade of tool steel in order to ensure hardening at a low temperature and also reduce the risk of fire cracking. Although, hardened steel bushes are preferred for guiding reamers, drills, and taps, the guiding tool bushings can also be made of cast iron.

The jig bushings are categorized into three: the linear wearing bushes, press-fit wearing bushes, and renewable wearing bushes.

Selection of Materials

There are a wide range of materials from where jigs and fixtures could be made, to resist tear and wear, the materials are often tempered and hardened. Also, phosphor bronze and other non-ferrous metals, as well as composites, and nylons for wear reduction of the mating parts, and damage prevention to the manufacturing part is also used. Some of the materials are discussed below:

• Phosphor Bronze: phosphor bronze is used in the production of jigs and fixtures for processes that involve making of interchangeable nuts in clamping systems like vices, and also in operated feedings that require screws. As the manufacturing of screws is very expensive and also wastes a lot of time, the reduction of their tear and wear is often achieved by using replaceable bronze mating nuts made with phosphor bronze.

• Die Steels: the three variants of die steel - high chromium (12 %), high carbon (1.5 to 2.3%), and cold working steels are applied in the production of jigs and fixtures for the making of thread forming rolls, as well as cutting of press tools.

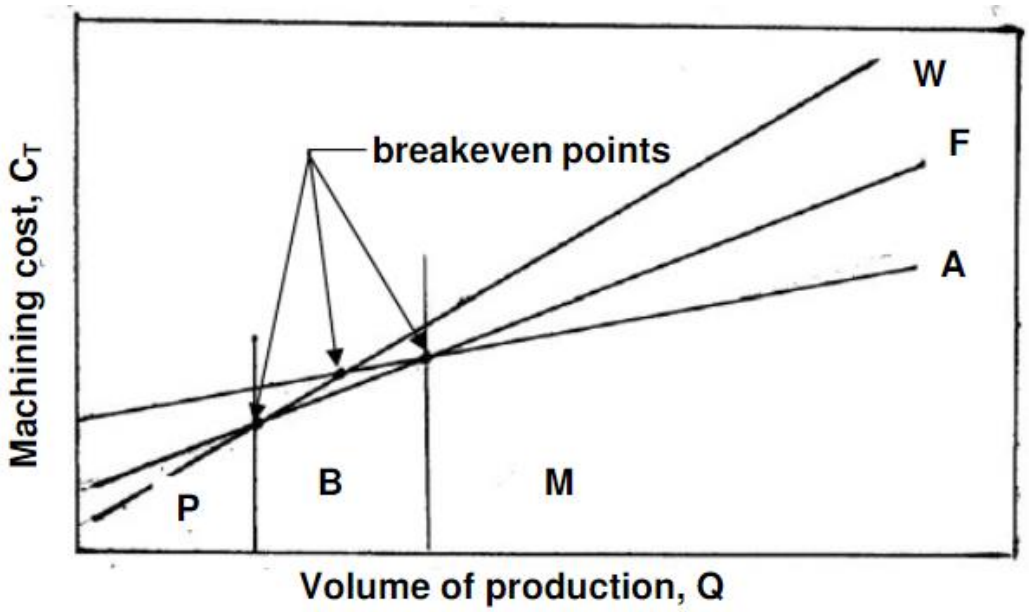
When alloyed with vanadium and molybdenum for it to retain toughness at very high temperature, die steels are applied in the fabrication of jigs and fixtures that are used in high temperature work processes which include extrusion, forging, and casting processes.

• High Speed Steels: high speed steels which contain more quantity of tungsten and less quantity of chromium and vanadium has high toughness, hardenability, hardness retention at high temperature, and good wear, tear and impact resistance. When tempered, they are applied in the production of jigs and fixtures for reaming, drilling, boring, and cutting operations.

• Carbon Steels: when tempered with oil, carbon steels are applied in the making of some jig and fixture parts which are exposed to tear and wear like the locators and jig bushes.

• Mild steels: mild steel which contain about 0.29% of carbon are very cheap and because of their easy availability are often the choicest material for the making of jigs of fixtures.

• Other materials for the making of jigs and fixtures include: Nylon and fiber, steel castings, stainless steel, cast iron, high tensile steels, case hardening steels, and spring steels.



W – without using jig & fixture
F – using jig and fixture
A – automatic (special purpose) machine
P – piece production
B – batch production
M – mass production

Role of Jigs and Fixtures on machining cost

Design of Jigs and Fixtures

The design of jigs and fixtures is dependent on numerous factors which are analyzed to achieve an optimum output. Jigs should be made of rigid light materials to facilitate easy handling, as it has to be rotated severally to enable holes to be drilled from different angles. It is recommended that four feet should be provided for jigs that are not bolted on the machine tool, to enable the jig to wobble if not well positioned on the table and thereby alert the operator. Drill jigs provide procedures for proper location of the work-piece with respect to the cutting tool, tightly clamp and rigidly support the work-piece during machining, and also guide the tool position and/or fasten the jig on the machine tool.

To achieve their expected objectives, jigs and fixtures consist of many elements:

Frame or body and base which has features for clamping;

The accuracy and availability of indexing systems or plates;

The extent of automation, capacity and type of the machine tool where jigs and fixtures will be employed;

Bushes and tool guiding frames for jigs;

The availability of locating devices in the machine for blank orientation, and suitable positioning;

Auxiliary elements;

The strength of the machine tool under consideration;

The precision level of the expected product;

Fastening parts;

The available safety mechanisms in the machine tool;

The study of the fluctuation level of the machine tool.

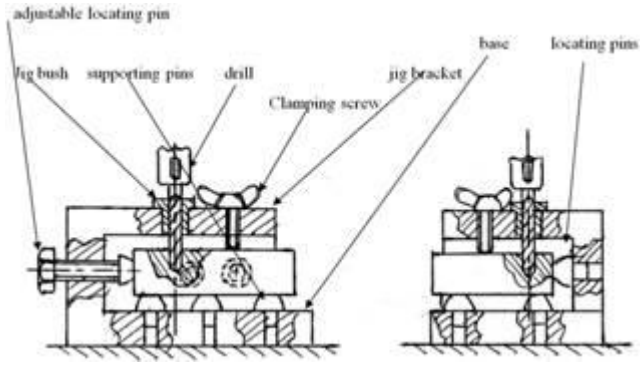
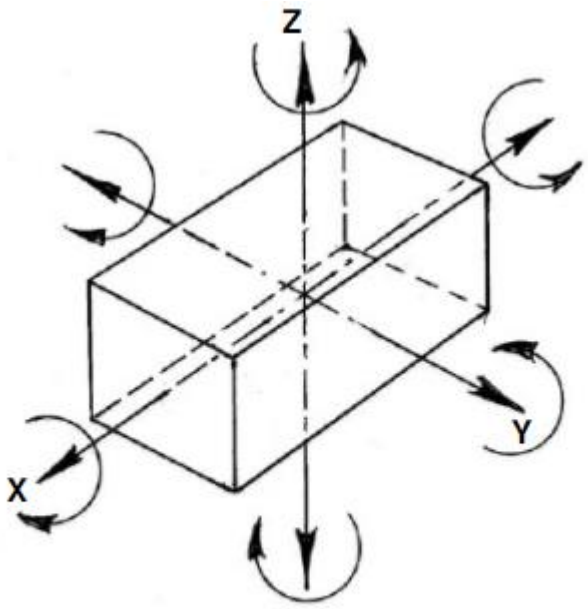


Figure 3. Major elements of jigs and fixtures.

The factors below are to be reflected upon during design, production, and assembly of jigs and fixtures due to the targeted increase in throughput, quality of products, interchangeability, and more accuracy.

• Guiding of tools for slim cutting tools like drills;
• Type of operations;
• Inspection requirements;
• Provision of reliable, rigid, and robust reinforcement to the blank;

• Production of jigs and fixtures with minimum number of parts;
• Fast and accurate location of the jig or fixture blank;
• Rapid mounting and un-mounting of the work-piece from the jig or fixture;
• Set up time reduction;
• Standard and quality parts must be used;
• Reduction of lead time;
• Easy disposal of chips;
• Enhanced flexibility.



Possible degrees of freedom of a solid body.

The design of jigs and fixtures must be fool-proof so that the tools, bushes, and components cannot be inserted except in the correct way. Apart from ensuring that locating points are made adjustable when the component is a rough casting and may be out of alignment, the clamps should be located in the best position in order to resist the cutting tool pressure when at work. A proper design must also incorporate tolerances at the design stage for jig and fixtures components that are standardized.

AUTOMOTIVE SECTOR OVERVIEW

In the present economic scenario of globalized competitiveness, the companies thrive on their products technological edge and the abilities to upgrade with advanced features quickly before the rivals produce a substitute. The engineering industries, especially the Automotive sector, has been banking on their new products launch to retain/increase the business market share. The major sub-assemblies of any automobile/ vehicle constitute plastic, sheet metal & die-casted components. These components can only be produced in mass production with superior & consistent quality with the help of fully automatic Dies & Moulds in conjunction with Jigs, Fixtures & Gauges.

Automobile companies in India like Toyota, Volkswagen, Mercedes, Tata Motors, Suzuki Maruti, General Motors, Skoda, Mahindra, Hyundai and many more are selling their vehicles to the Indian customers. The present automobile Indian as well as multinational companies from all over the world like USA, Europe, Japan, Korea with their manufacturing plants pan-India are competing to capture the majority of Indian market share. With time, the completely knocked down (CKD) imported cars business in India converted to SKD imported cars and subsequently to imported assemblies and sub-assemblies. Now the present scenario witnessed the totally made-in-India cars from auto MNCs with almost all indigenous parts and assemblies.

The Indian customer is very cost conscious and demands value for money for the products offered & services rendered. The auto sector over a period of time in past witnessed dramatic segmentation and positioning of the products from these Indian and foreign auto companies, to become cost competitive for different income class of Indian customers. Almost all automobile companies increased their investments in India into manufacturing capacities, to cater to growing vehicles demand in all variants, be it luxury or economical models. The buying power of Indian customer has been drastically increasing post liberalization and he has become more quality conscious and demanding.

Indian government initiatives to impose a condition of minimum local sourcing for MNC`s project in India, gave a jump start to Indian tooling industry. Automobile companies have been launching new vehicle variants as well as cosmetic changes in the existing cars variants quite often. This results in frequent requirements of dies & moulds to produce car components in large volumes and varieties. Depending upon car launch frequencies in India, the tooling industry has been under tremendous pressure since last two decades. The OEMs as well as SMEs have been operating at their full capacities to meet the deadlines of products trials and approvals.

It has become imperative to produce various tooling on job work basis in a Tool-room, for example:

- Die-casting dies for ferrous / non-ferrous components.
- Plastic moulds for plastic components.

- Forging dies for solid ferrous / non-ferrous components.
- Press tools for Sheet metal components.
- Forming tools for large-sized components manufacturing.
- Jigs, Fixtures & Gauges for repetitive clamping, locating & inspection purpose.

An Industry of Small Businesses

The tool and die industry represents a tiny portion of Indian manufacturing. Nonetheless, it has an instrumental role in manufacturing. While mass production is made possible by tooling, the principal tools themselves cannot be mass produced. Tool making, and especially mould and die making, is one of the few activities connected with modern large-scale industry in which there has not been a general substitution of machinery for basic skills. These tools are custom-made, one-at-a-time by skilled artisans who patiently and precisely machine, finish, and construct the complicated devices. Only one die, or set of dies, is needed for the manufacture of many thousands, and sometimes millions, of automobile fenders or hoods of a given design.... The one-of-a-kind characteristic of the tooling industry accounts for enormous differences in management and capitalization strategies, and the skills, machinery, and technology amenable to tooling making and mass production. The tool and die industry is primarily made up of small businesses using skilled employees with many years of experience. Nine out of ten tool and die industry firms employ fewer than 50 workers. These firms are generally privately owned and often family operated.

Tool and die making contracted more than overall manufacturing because of the nature of that business. Tool and die makers rely on a continuous flow of new orders for tools, dies and moulds to make new products. As long as their larger manufacturing customers are updating vehicles, appliances, or other products, there is a steady need for tools and dies. But when their customers retrench, tool and die production is affected disproportionately. As tool and die experts noted, contrasting tooling with other kinds of manufacturing, "if…the 'build' volume of an existing car model dropped by 20%, the parts manufacturer would experience a 20% drop in business. But when a project is cancelled or delayed, the tool and die makers would see their business drop precipitously – maybe dropping to zero, if

things got really bad." Although tool and die firms are small in number and total employment, they play a central role in manufacturing innovation: any durable-goods manufacturer seeking to introduce a new product is likely to require customized tools, dies, and moulds to make metal, plastic, and ceramic components. While most tool and die production is used to make consumer durable goods, the industry also plays an important role in manufacturing of such military equipment as jet aircraft, missiles, tanks, and electronics.

To manufacture Jigs & Fixtures, any Toolroom requires a few Basic machineries such as Centre Lathe, Shaper, drilling machine, Milling machine, Hacksaw, Surface/ Tool & Cutter/ Cylindrical Grinding machines, EDM, CNC wire-cut, VMC along-with a quality control equipment's for inspection. Though heat-treatment set-up and a minimum set of production machines like Power Press, Injection moulding etc. are required for dies-components trials, but mostly these activities are outsourced.

The evolution of IT & its integration into manufacturing is further restructuring the production processes. CNC and Robotics have led the way to rapid prototyping and quick-change set-ups. An upfront investment in production toolings such as jigs & fixtures give the flexibility to be quickly & easily used for any product design, with batch size irrelevant.

Majorly, Indian tooling producers are privately run businesses (Job-Shops). My study investigated two OEMs/ Tier-1 M/s ASK Automotive Pvt Limited & M/s Endurance Technologies Limited as follows:

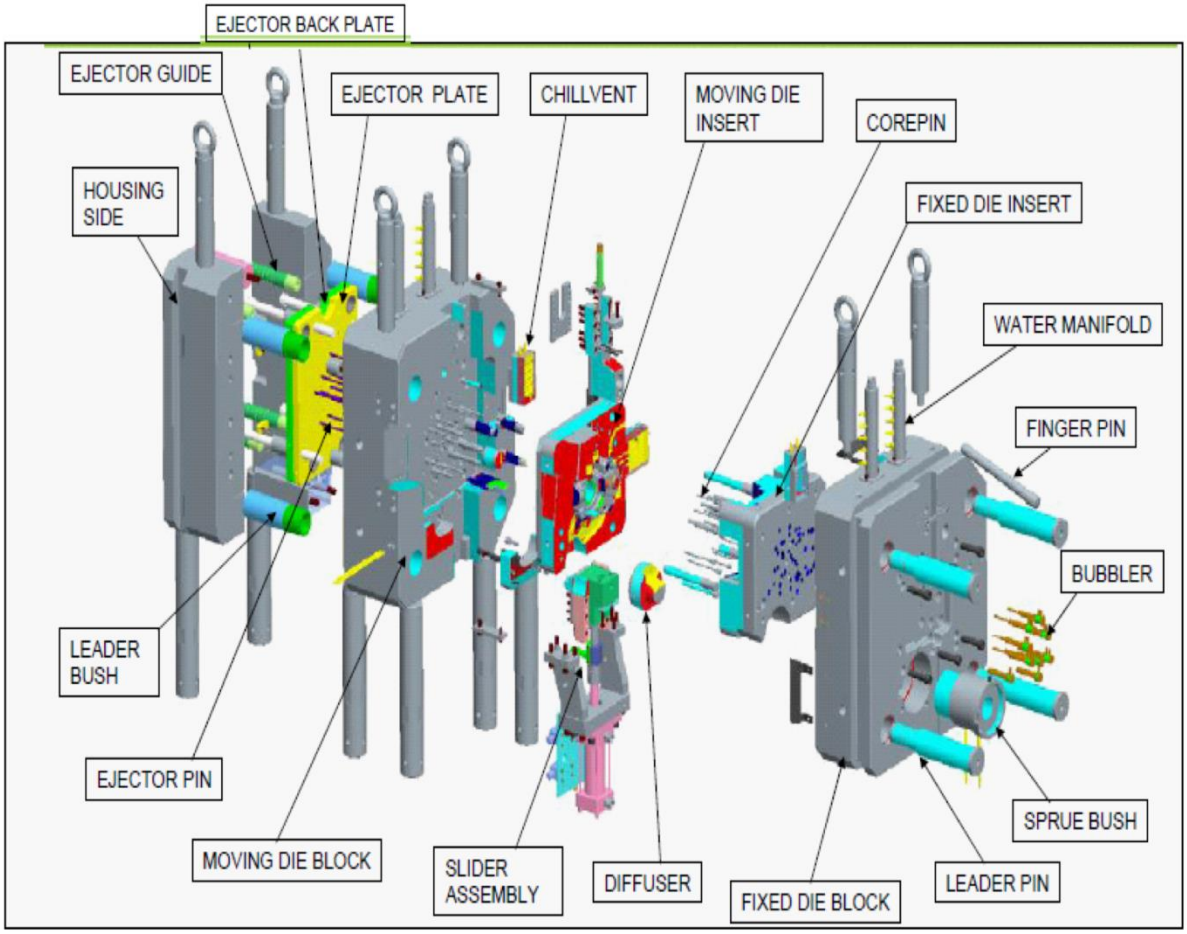
1) M/s Endurance Technologies Limited

Endurance was established in the year 1985 as M/s Anurag Engineering Co Pvt Ltd to manufacture Aluminum Die casted products at Aurangabad, Maharashtra. Endurance group is a global force in Casting, Suspension, Transmission and Braking products for two-wheelers, three-wheelers & four-wheelers with an annual sale of Rs 5281 Cr for the FY 2016-17 from domestic as well as overseas operations. More than 5000 employees work in 18 plants in India & 8 in Europe.

Their clients include Honda, Bajaj, Hero, Royal Enfield, India Yamaha, Mahindra, Maruti Suzuki and many more.

This study was carried out at their IMT Manesar, HR plant where main area of operations is Casting, Painting & Machining which are supported by well-equipped Toolroom facilities.

DIE MANUFACTURING DETAILS



DIE CASTING MOULD SPECIFICATIONS

2) M/s ASK Automotive Pvt Limited

ASK Automotive Pvt Ltd was established in the year 1989 under the leadership of Mr K S Rathi, to manufacture Aluminium Die casted products at Gurgaon, HR. ASK group has total 12 plants at 4 different locations in India. The last FY 2016-17 turnover was recorded as Rs 1400 Cr with products ranging from Castings, Brake linings, Brake pad, Brake shoes, Brake assembly for two-wheelers, three-wheelers, four-wheelers & commercial vehicles; Clutch Plates & shoes and

Control Cables for two-wheelers & three-wheelers. They have total 100 numbers of High pressure die casting(HPDC) machines capacity ranging from 80T to 900T.

The company has been accredited with various quality & documentation certificates as QS, ISO, TS & OHAS. Their clients include Honda, Bajaj, Hero, TVS, Mahindra, Endurance, Stanley, Sunbeam, ASTI, Maruti Suzuki and many more.

This study was carried out at their IMT Manesar, HR plant where main area of operations are Casting, Painting & Machining which are supported by well-equipped Toolroom facilities.

Presently, the toolings performance measures are being studied through two main components:

1) Sheet metal components
2) Forged Ejector pin

CASE STUDY

A. Sheet metal component

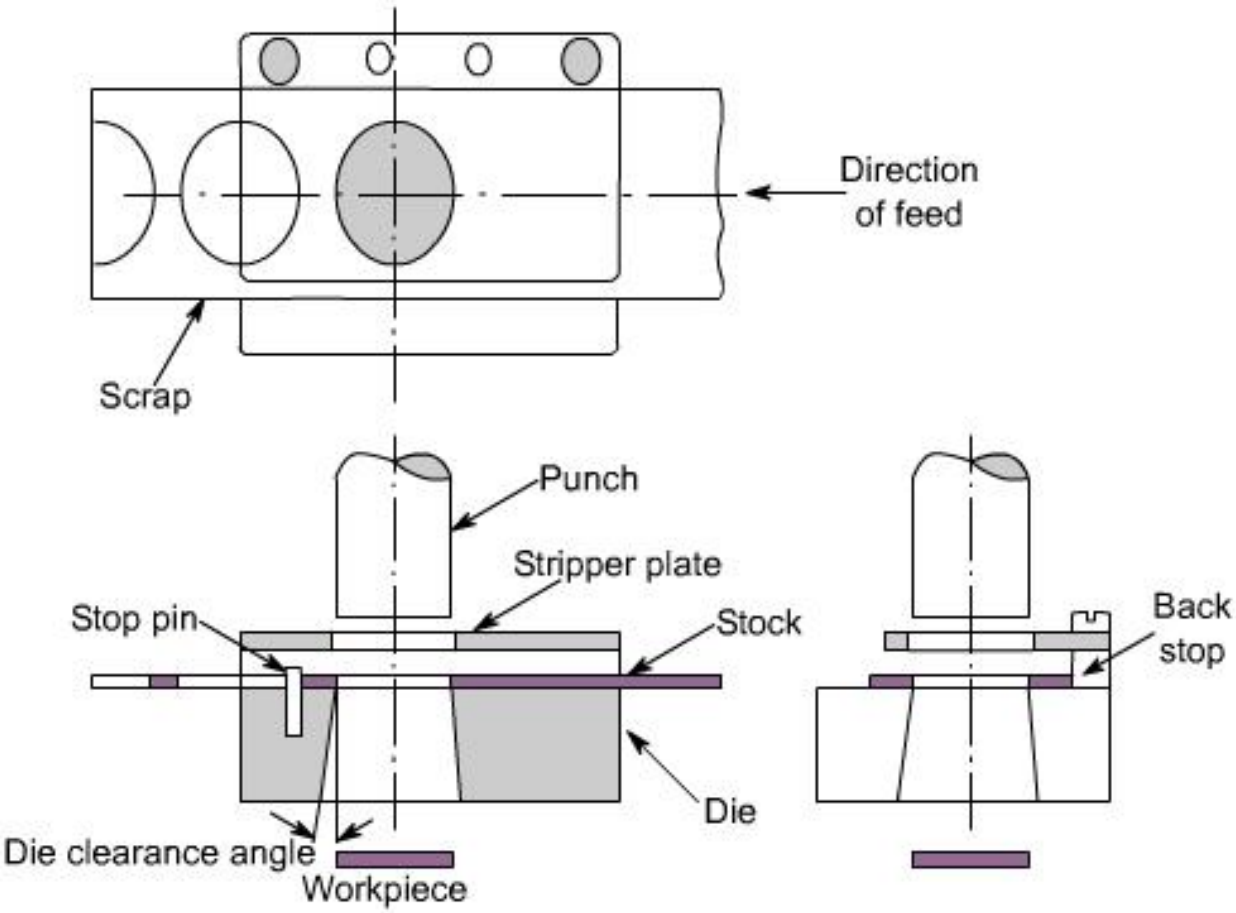
1. Component Die Cost = Rs 11,00,000
2. Washer Die-Fixture cost = Rs 2,00,000
3. Main Component Production schedule= 13L pieces in 2 years
4. Production rate for main component= 6 pieces per minute x 60 minx8 hours x 80% efficiency x 25 days x 12 months x 2 years = 13,82,400 i.e. 13L pieces (assume a few defective)
5. Production rate for By-product= 6*2 pieces per minute x 60 minx8 hours x 80% efficiency x 25 days x 12 months x 2 years = 27,64,800 i.e. 27L pieces (assume a few defective)

6. Component specification:

    - Nett part weight= 3.14x25x25x 1x 7.8 / 1000000 = 0.015kg
    - Blank sheet weight(RM)= 52x52x1x7.8/1000000 = 0.021kg
    - Waste= 0.021-0.015= 0.006kg i.e. 28.5%
    - Overall wastage= 0.006x 13L = 7800kg
    - Value wise waste = 7800 x Rs 50/kg = Rs 3,90,000

7. By-product specification:

    - Nett part weight= 3.14x5x5x 1x 7.8 / 1000000 = 0.0006kg
    - Blank sheet weight(RM)= NA
    - Waste= NA
    - Overall sheet utilization= 0.0006x 27L = 1653kg i.e. 21% waste sheet utilization
    - Value wise utilization = 1653 x Rs 50/kg = Rs 82,650



8. Emortization scenario ‘A’:

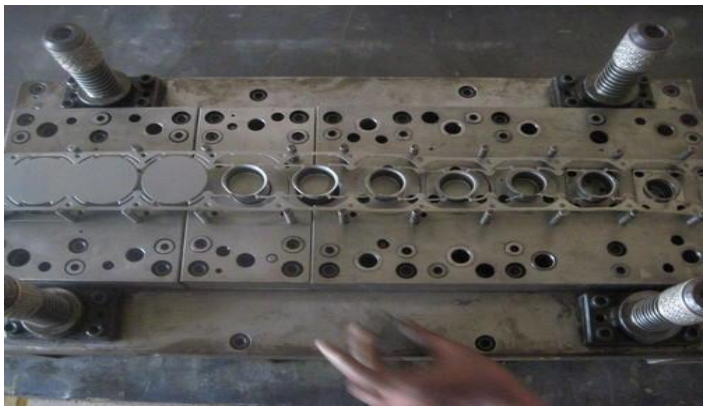
   - Fixed Cost (FC) Die = Rs 11,00,000
   - FC/piece = 11,00,000/13,00,000 = Rs 0.85
   - Selling Price/piece = Rs 2.50
   - Cost Price breakup = FC+RM+Ovehead(35% RM)+profit= 0.85+1.05+ 0.37+ 0.23= Rs 2.50

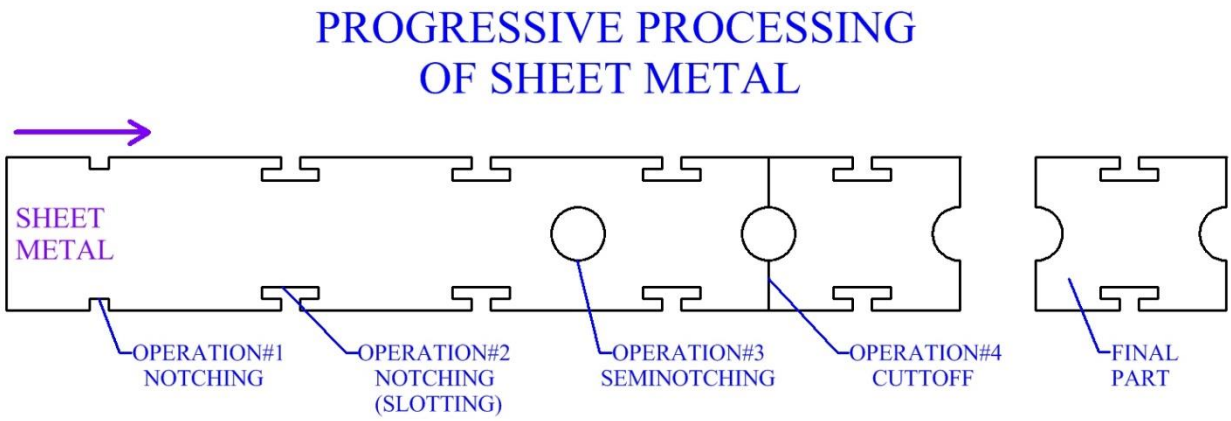
     (Profit margin @10%)

9. Emortization scenario ‘B’:

- Fixed Cost (Die-Fixture) = Rs 2,00,000
- FC/piece = 2,00,000/27,00,000 = Rs 0.07
- Selling Price/piece = Rs 0.50 (Open Market)
- Cost Price breakup = FC+RM+OH+profit= 0.07+0.00+ 0.07+ 0.36= Rs 0.50

  (Profit margin @250%)





Interpretation:

- *Scenario 1- Main Component production only*

  Scrap 7800Kg x Rs 22/Kg = Rs 1,71,600 recovery

- *Scenario 2- By Product production also*

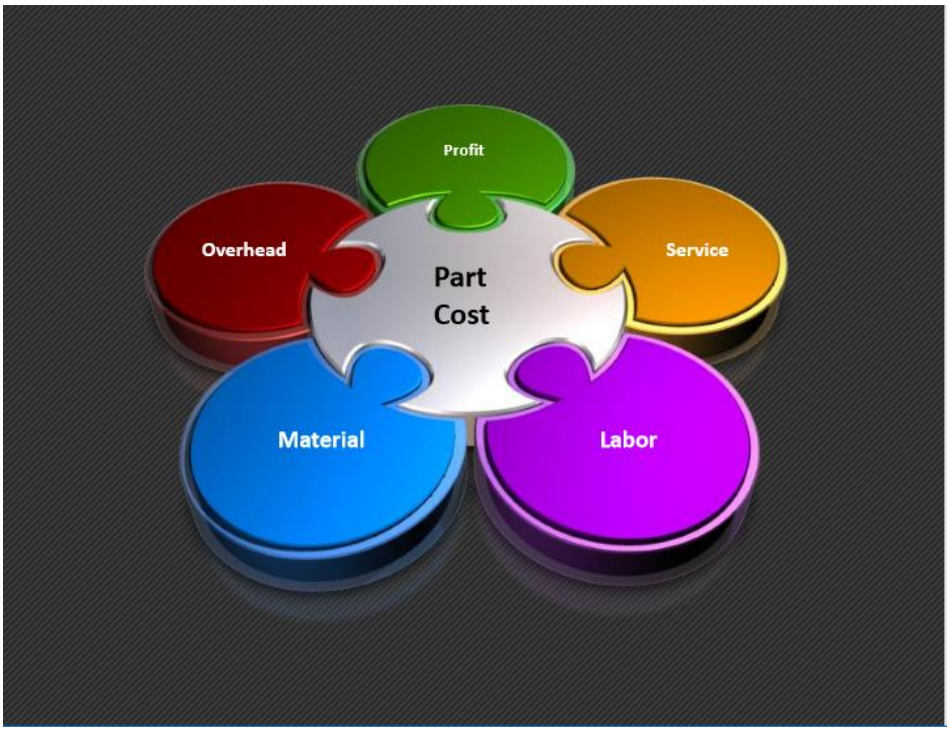
  Scrap 7800-1653= 6147kg x Rs 22/ Kg= Rs 135234 recovery with additional profit margin of Rs 972000 (Rs 0.36x27L).

  - Assumptions that OEMs don`t use scrap sheet cage. Moreover, SMEs Capex insignificant & labour/OH cost 40% lower comparatively.

B. Forged Ejector pin

1. Component round blank weight = 3.14 x 11 x 11 x105 x 7.8 x 1000000= 0.311Kg
2. Finished ejector pin weight= (3.14 x 10x10 x 10 x 7.8 1000000) + (3.14 x 8 x 8 x 92 x 7.8 x 1000000) = 0.024 + 0.144 = 0.168 Kg
3. Wastage while processing on Lathe = 0.311-0.168= 0.143 Kg i.e. 46%.
4. Weight of blank, while processing parts on turning= 0.311kg
5. Weight of blank, while processing parts on forging using Fixture= 3.14 x 8 x 8 x (95+16) x 7.8 x 1000000 =0.174kg

6. Component Production schedule= 1L pieces in 1 year
7. Scenario 1:
    - Production rate for turning of components on one Lathe= 11 pieces per hourx8 hours x 80% efficiency x 25 days x 12 months = 21,120 pieces.
    - Number of lathes to achieve annual target= 100000/21120= 5 nos (assume one shift only per day)
    - Wastage/Scrap = 0.143Kg x 21120 = 3020Kg
    - Value wise wastage = 3020kg x RM @ Rs 80 less scrap sale @ Rs 18/Kg = 2,41,600 – 54360 = Rs 1,87,240.
8. Scenario 2:
    - Production rate for forging of components using Fixture= 100 pieces per hourx8 hours x 80% efficiency x 25 days x 6.25 months = 1,00,000 pieces.
    - Number of fixture used on forging to achieve target= 1 nos (assume one shift only per day)
    - Wastage/Scrap = (0.174 - 0.168) x 100000 = 600Kg
    - Value wise wastage = 600 kg x RM @ Rs 80 = Rs 48,000.



Interpretation:

- *Scenario 1- Turned Component production*

  Five lathes engaged with five operators & took one year causing nett wastage of Rs 1,87,240 to achieve target production.

- *Scenario 2- By Fixture-Forging combo*

  Single fixture with one operator completed target within half a year. Since Lathe machine cost & Forging fixture cost are almost same, productivity & profitability is undoubtedly better.

Research Objectives

The following are the main objectives of the present research work:

- To get an insight & correlate the OEM vs SME approach towards achieving their firm`s overall growth objectives.
- To study their approach towards productivity & profitability improvement.
- To examine the level of responsiveness & need of cost saving.

Research Methodology

This research is carried out to clarify thoughts and gather opinions about the research problem on the respondent's population, or to provide insights on how to do more exploratory or may be conclusive research. The target sample units consist of technically qualified managers, executives & entrepreneurs who are decision makers. The results of this exploratory study could generate hypotheses for further study.

Almost negligible secondary research relevant data is available on the subject matter on the internet. The Judgement & Convenience Sampling Non-Probability technique is used here. The study is empirical in nature & it is based on the data personally collected with the help of a structured questionnaire. All attempts are made to extract the correct information through informal discussions with the executives & entrepreneurs. The research objective has called for more indirect method of questioning under qualitative projective techniques to deeply probe the minds of respondents.

A sample of 16 tiny job-shop units is selected from Industrial areas in Delhi-NCR region with an objective to have a special focus on the entrepreneur`s performance of their respective establishments. The research budget and time constraint have limited the research to such numbers.

A thorough case studies of M/s Endurance & M/s ASK , across all their functional areas, are conducted by in-depth interviews and a structured questionnaire.

Questionnaire Measures

M/s Endurance &M/s ASK study

- Gauging respondent`s satisfaction & dissatisfaction towards outsourced auto components.
- Industry competitive benchmarking.

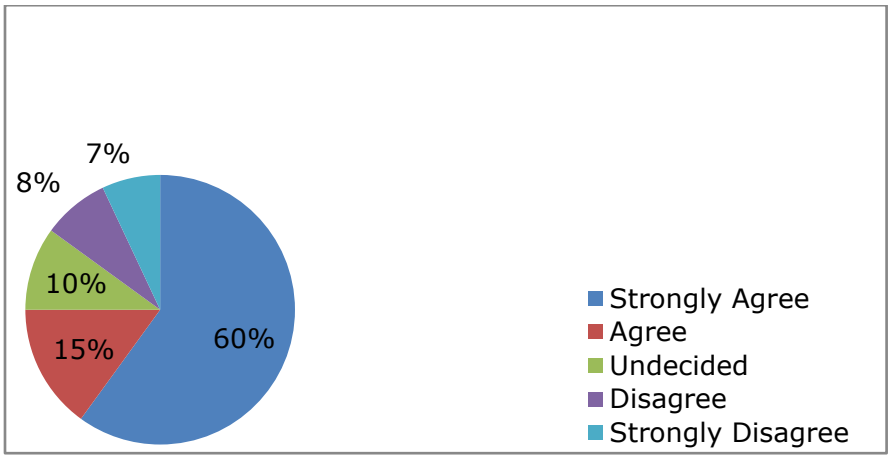
Small Job Shop study

- Most critical threats.
- Most important changes, they need to make.
- Best opportunities, if they make these changes.

Results, Discussions & Findings

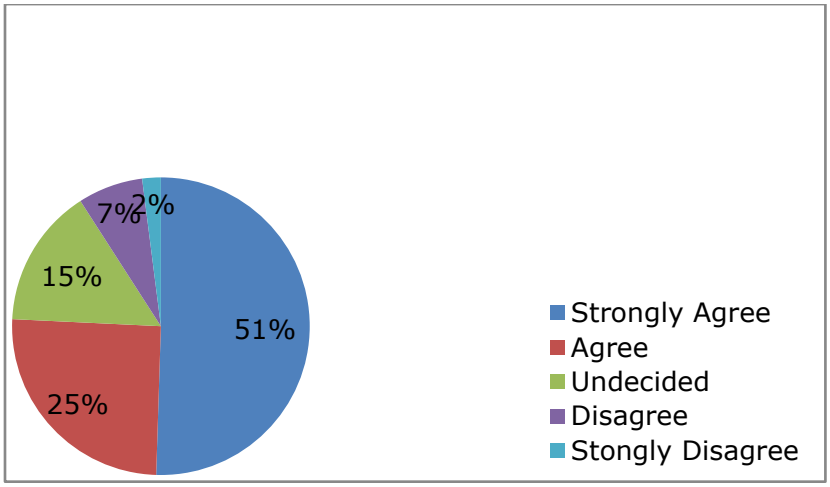
OEM case:

A) You believe in outsourcing non-core components.



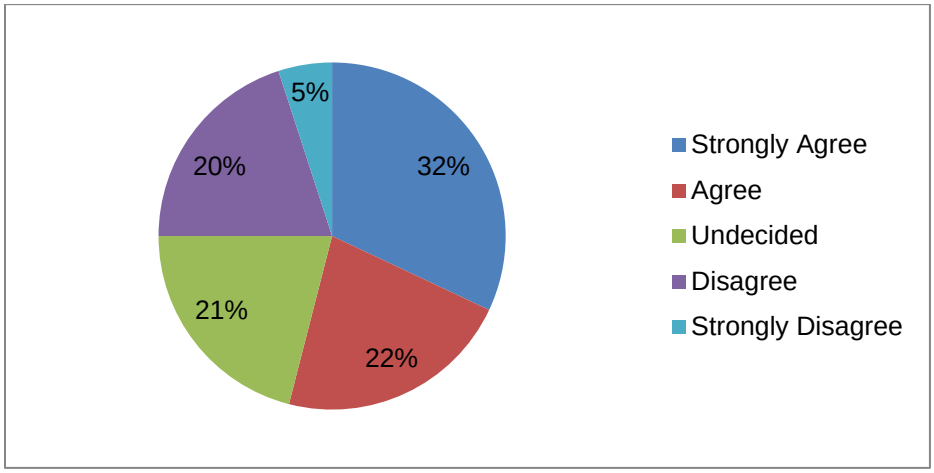
Interpretation: Majority executives agree.

B) Your firm`s Q/C deptt is satisfied with the vendor incoming parts quality.



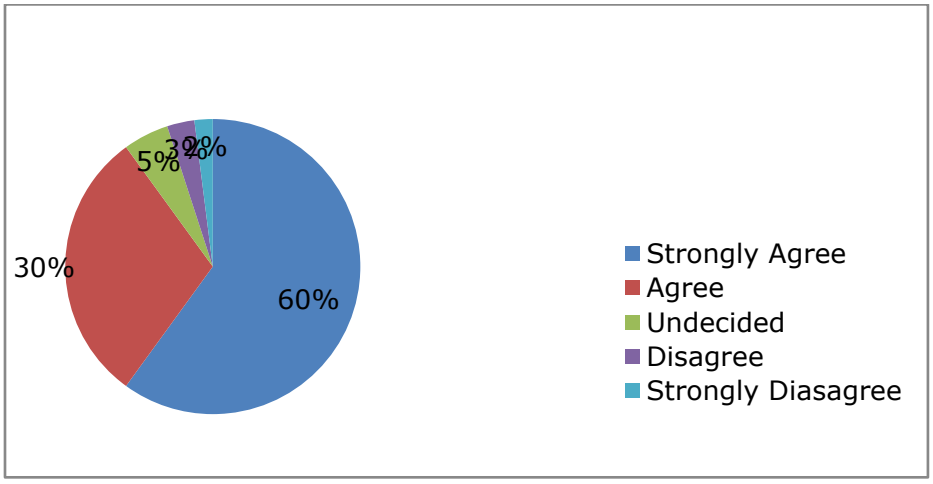
Interpretation: Majority agree.

C) You`re very much clear about the firm`s business objectives.



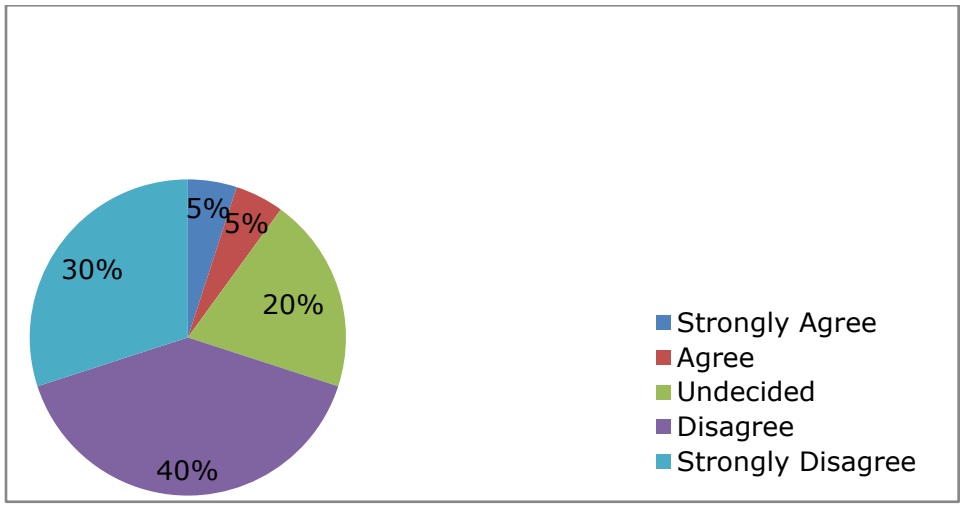
Interpretation: Vision is clear to majority.

D) You believe that outsourcing the sub-assembly in parts or, full is good decision to achieve the organization goal.



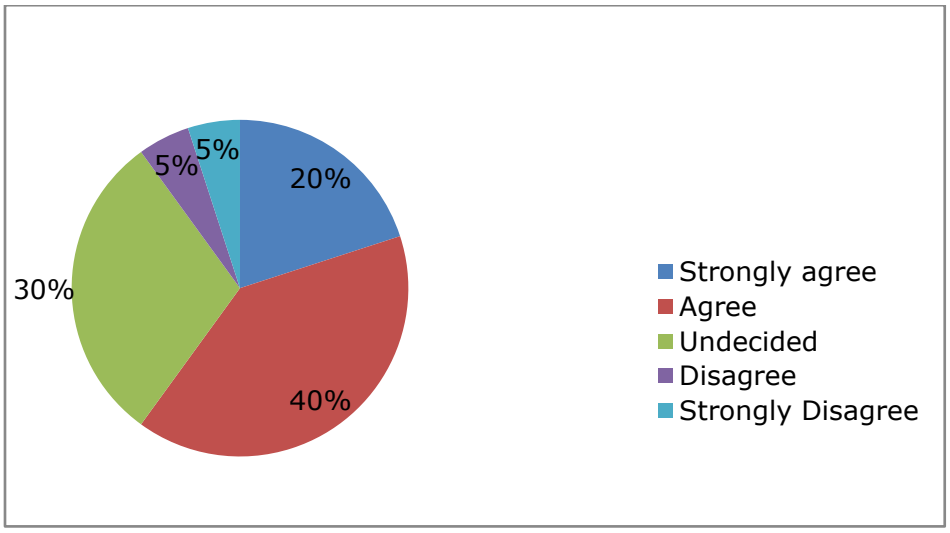
Interpretation: Majority probably feel threat to their job/career growth.

E) You very frequently face the outsourced parts timely delivery & quality related problems.



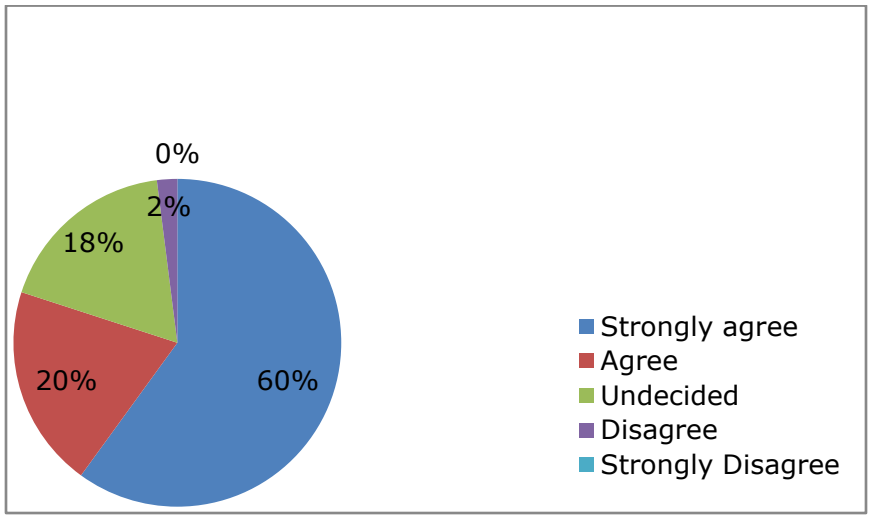
Interpretation: Gets timely & quality delivery.

F) The product cost matters in deciding whether in-house manufacturing or to be outsourced.



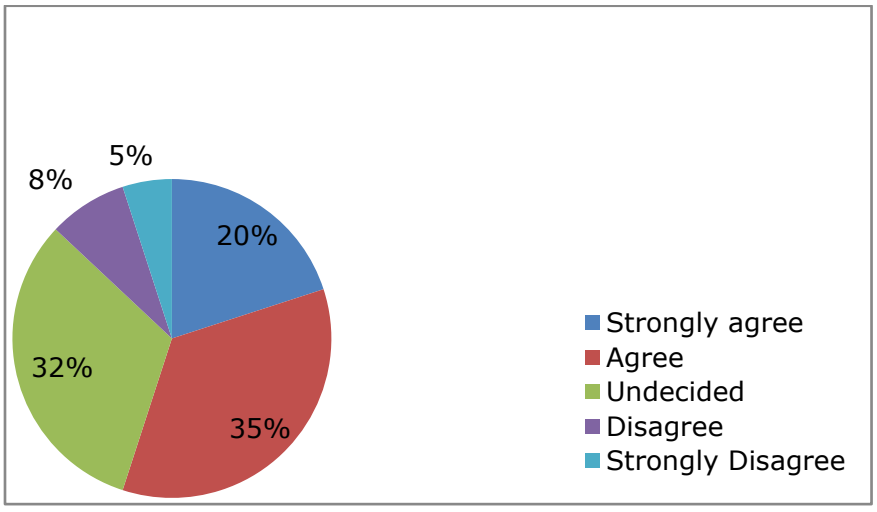
Interpretation: Yes.

G) You believe that cooperation across firm`s functional areas is an important factor for firm`s growth.



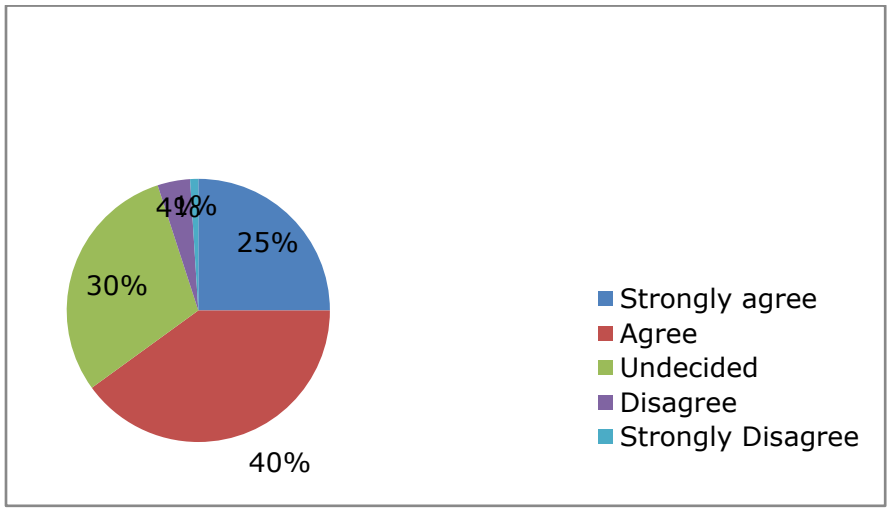
Interpretation: Majority believe recognition & information flow needed.

H) Your finance deptt is satisfied w.r.t. the cost saving in capex as well as recurring raw material purchase, after outsourcing decision is made for non-core parts.



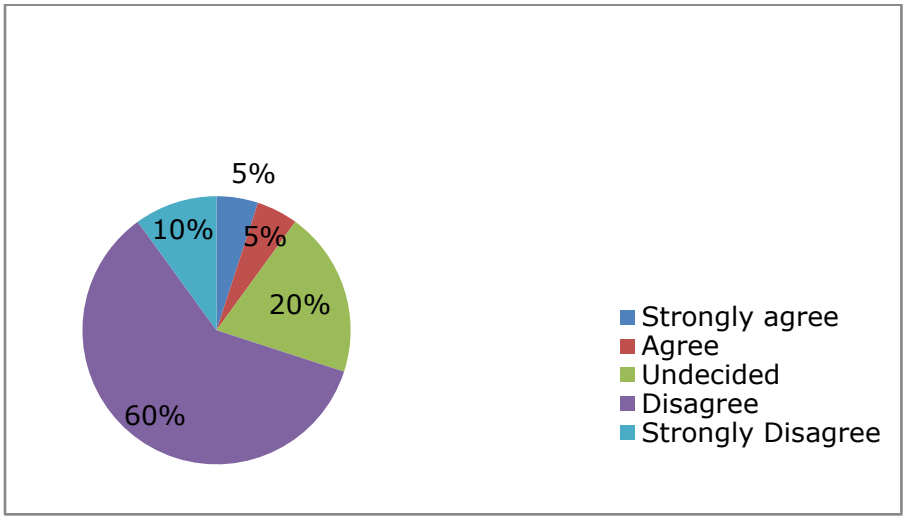
Interpretation: Majority admit it as a fact

I) You are satisfied about purchase deptt time/ efforts/ expenses incurred w.r.t. outsourced parts follow-up process with job shops.



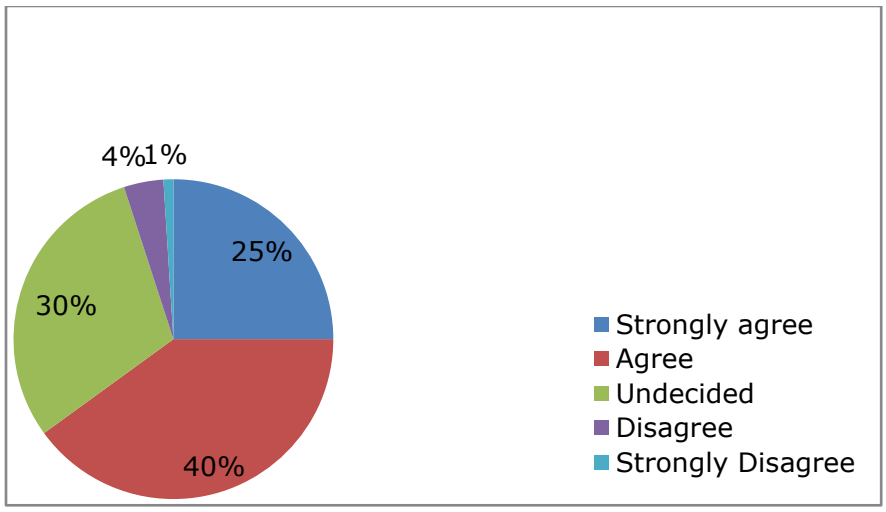
Interpretation: Majority negate the notion that profit comes from Production wing only.

J) Parts being made in-house are better in quality and economical in cost compared to outsourcing.



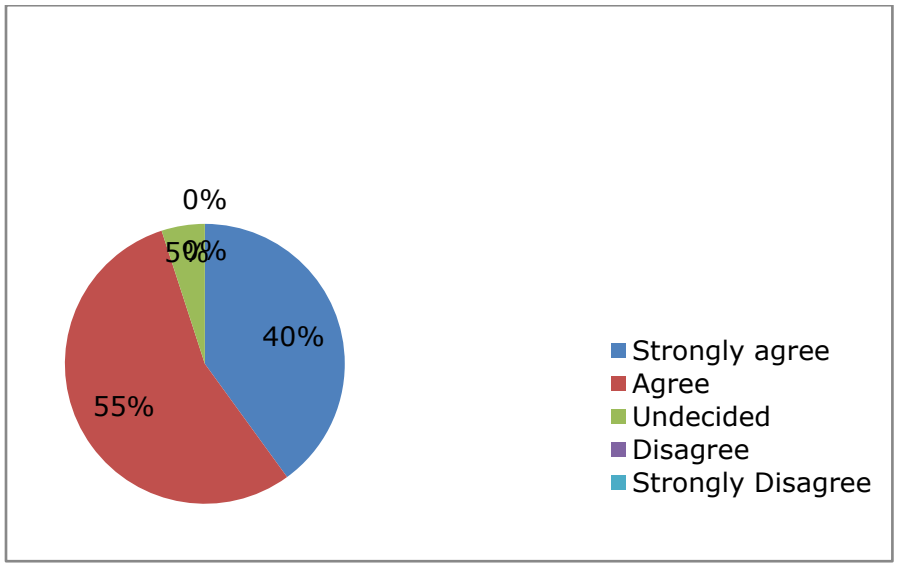
Interpretation: Majority admit only production wing not being considered as profit centre.

K) It becomes difficult to engage all the hi-tech CNC machines installed, or quickly change the set-up to accommodate any other urgent part machining.



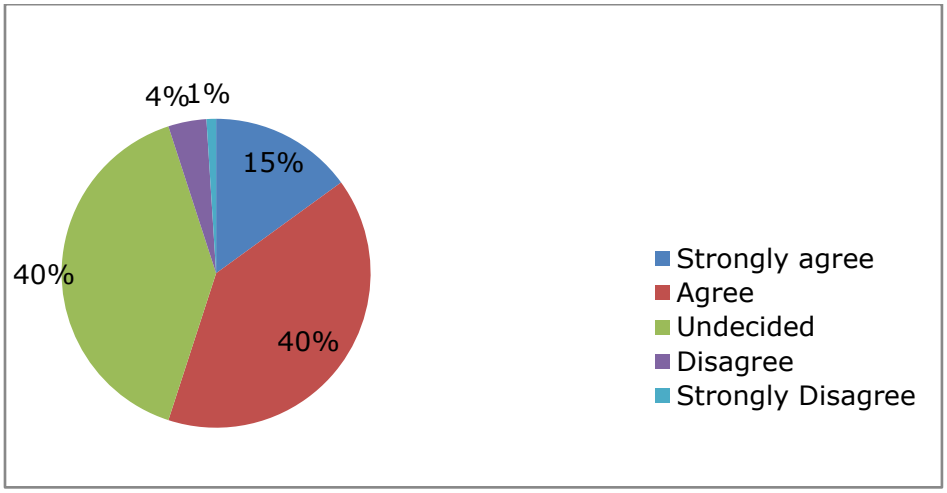
Interpretation: Majority believe in lean Production& JIT.

L) Handling employed labour is difficult in case of eventuality.



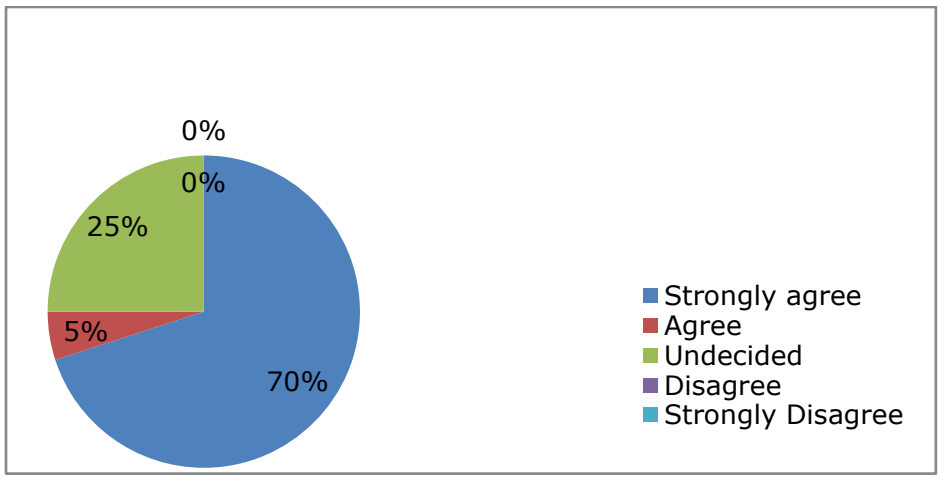
Interpretation: Though majority admit this but believe that management considers it to be critical.

M) Inventory management is the biggest issue in in-house manufacturing.



Interpretation: Majority find a Quick-Product-change-setup, very useful.

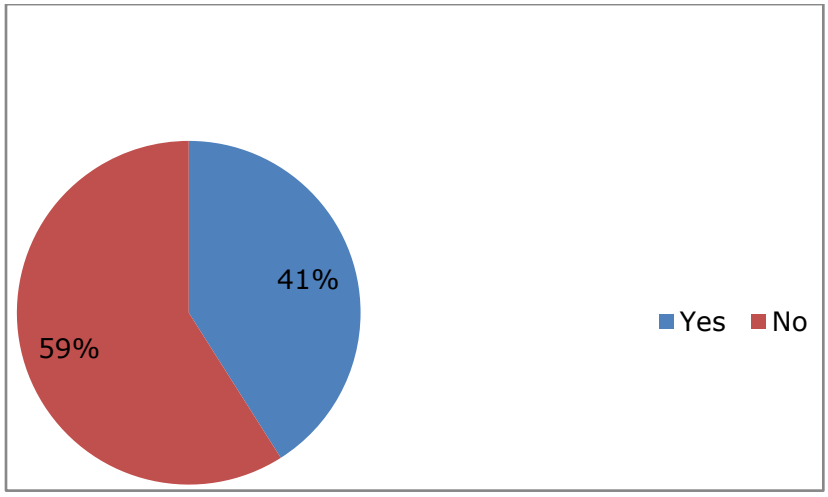
N) Jigs & Fixtures are supplied as an integral tooled-up package of the production machine being procured & are used as long as that machine/auto part life cycle.



Interpretation: Majority believe company`s reputation with the customer is at stake.

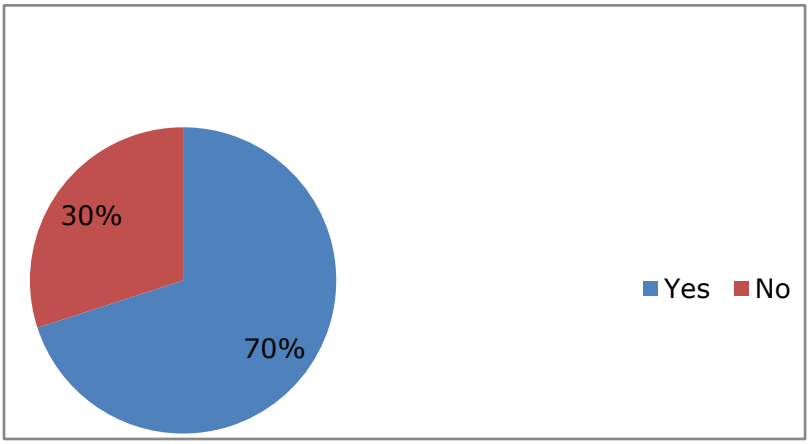
SME case:

i) Are you satisfied with your company`s turnover?



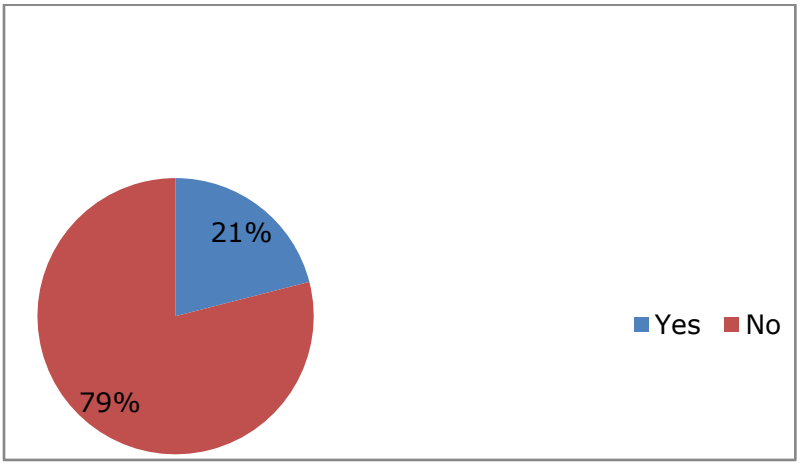
Interpretation: Majority is gripped in low turnover industry

ii) Are you satisfied with your company`s profit margins?



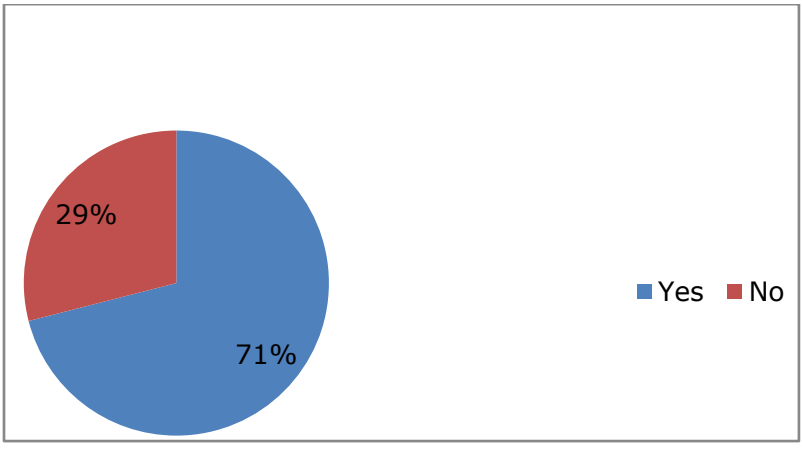
Interpretation: Majority feel good

iii) Do you believe that your company is well versed/equipped with the advancement in technology in the toolings-production field?



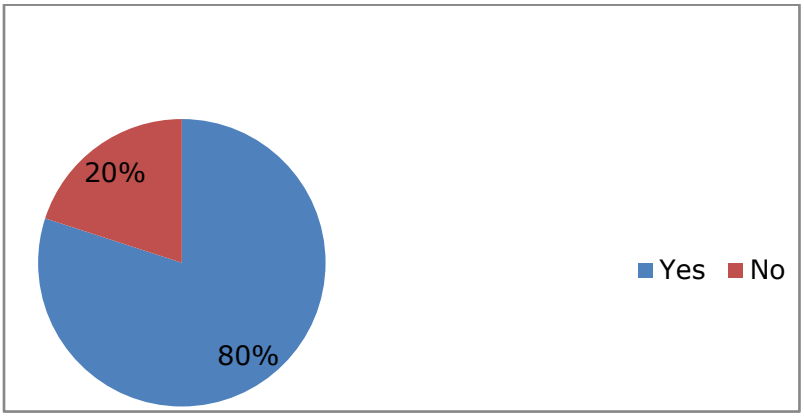
Interpretation: Capital intensive sector restricts majority to invest in technology due to constraints.

iv) Does your company`s work culture leads to increased efficiency in terms of quality & quantity of work?



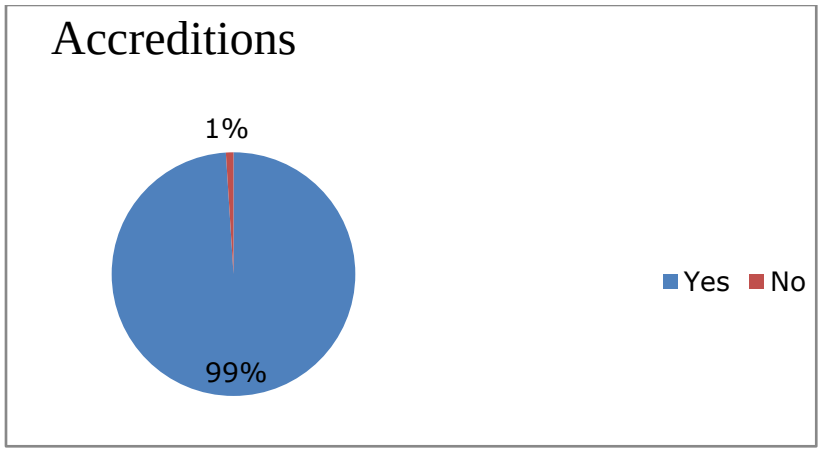
Majority believes overtime & incentive are great motivator for workforce.

v) The SMEs make best use of by-products by innovatively exploring its other applications?



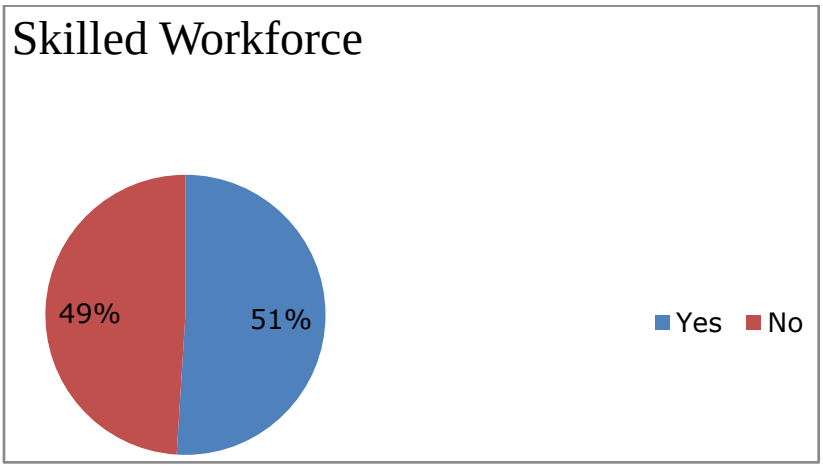
Interpretation: Less over heads compared to OEMs.

vi) Is your company accredited with any recognized quality/documentation certificates?



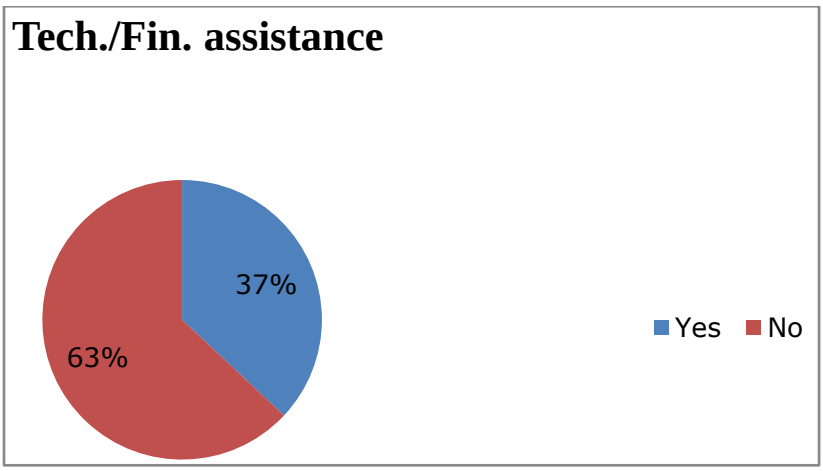
Interpretation: A must have factor today.

vii) Do you believe that arranging economical skilled/unskilled workforce for your company is never a problem issue?



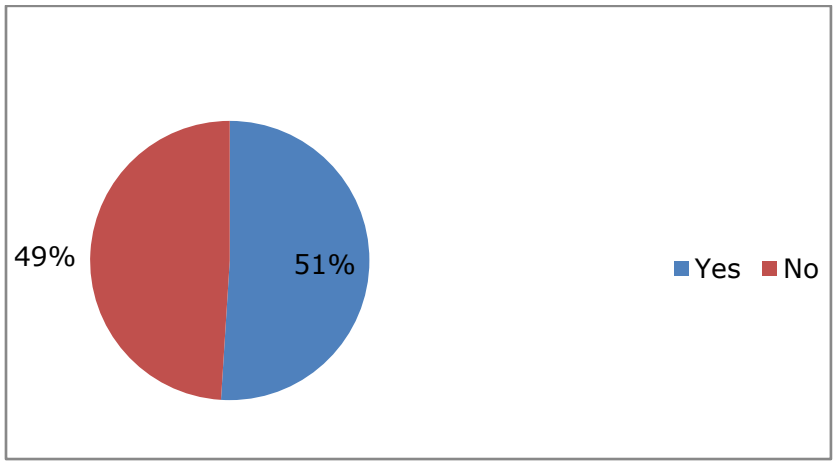
Interpretation: Skilled/semi-skilled labourforce training to upgrade their skills is a common practice. Majority agree having easy hire-fire policy.

viii) Being OEM vendor, do you get technological/financial support from them?



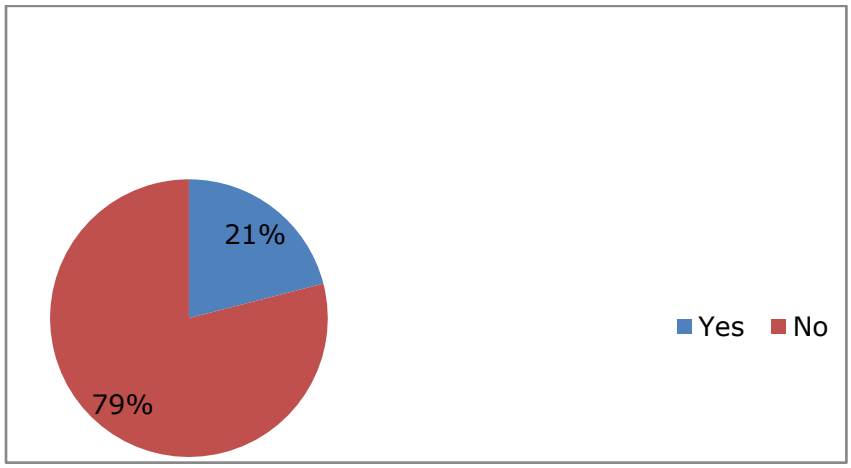
Interpretation: Majority believe OEM wants vendor to bear product design up-gradation technology cost.

ix) Do you believe that it matters to OEMs if segregated but approved specs scrap raw material is used, to make parts?



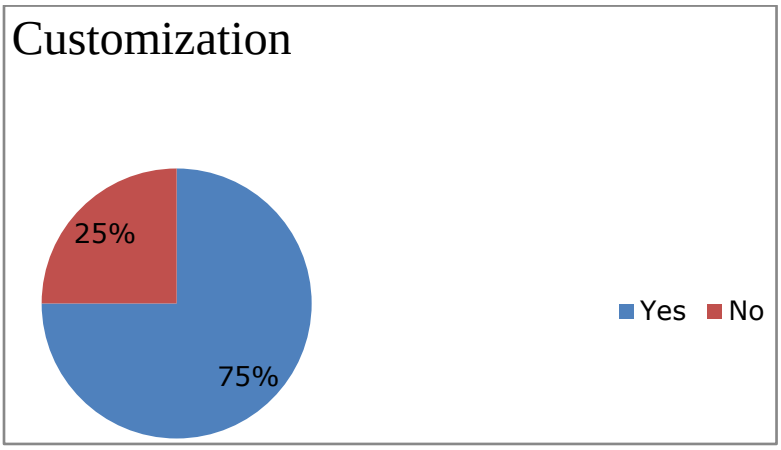
Interpretation: Attractive price & products quality elements with comparatively faster delivery, perceived a major cause of concern for OEMs.

x) Are"Make in India" and other MSME beneficial schemes by Govt. of India helpful to you to support financially or otherwise?



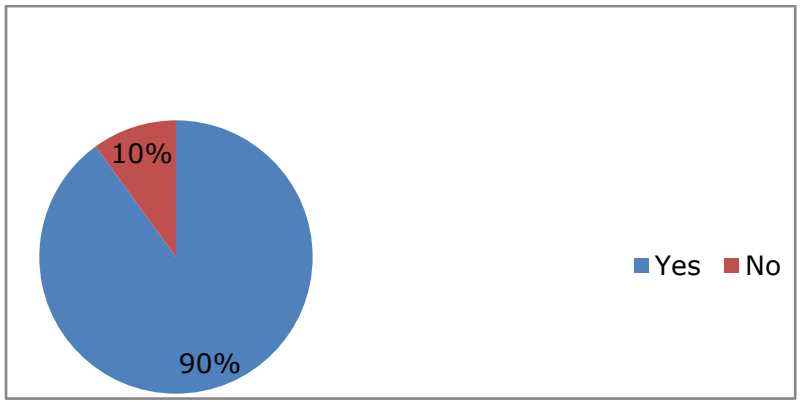
Interpretation: Majority believe cumbersome process to get benefits coupled with corrupt practices.

xi) Do you consider job-shop based batch production auto parts as a boon in this competitive technological advanced market?



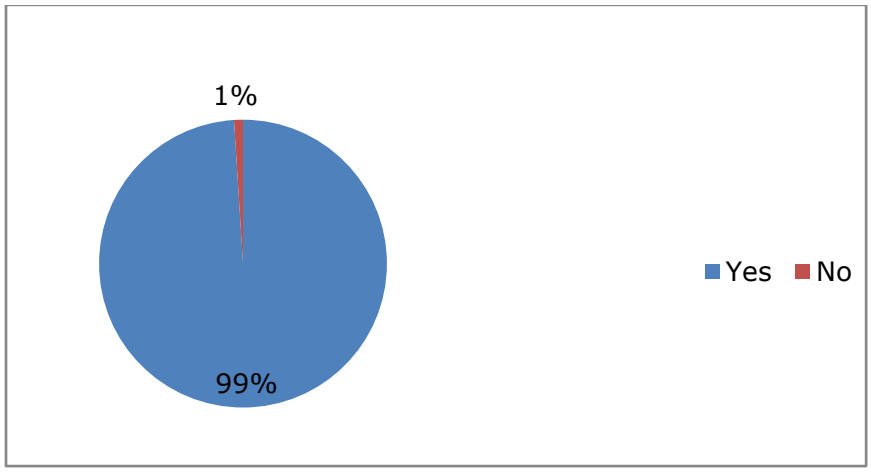
Interpretation: Majority enjoy higher profit margins in this sector due to innovative processes employed.

xii) Do you believe auto parts machining/ manufacturing, a recession proof industry?



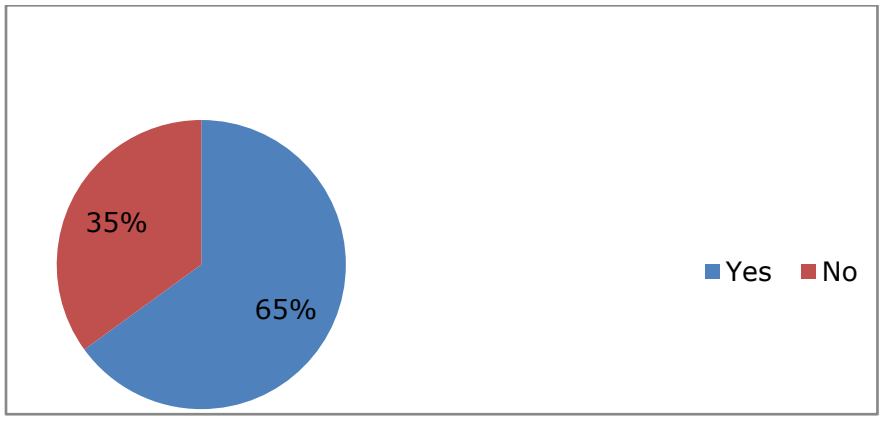
Interpretation: Majority consider it backbone among all engineering industries, even good for maintenance work when regular order are in scarcity.

xiii) Do you believe that Fixtures aided by coil fed production set-up is a best combo for the higher revenue/profits for sheet metal in your firm?



Interpretation: Unanimous view of respondents is thatfixturing, a recurring profit whereas die is one-time profit.

xiv) Do you believe that OEMs being more inclined towards their core competencies of assembling finished products in volumes, are inclined towards outsourcing?



Interpretation: Majority believe time, labour & cost as deciding factors.

FINDINGS

Auto industry`s management perception is:

a) in-house non-core items production, an expensive affair.

b) for batch production & complex parts, SMEs a quick &cheaper alternative available.

c) keeping inventory, a headache.

- Auto Industry prefers a number of vendors for critical JIT parts, limiting the growth of individual entrepreneurs.
- Auto Industry unwilling to invest in sub-assembly's process technology and its workforce training and development.
- Entrepreneurs complacency, a road block for SMEs growth.

Recommendations

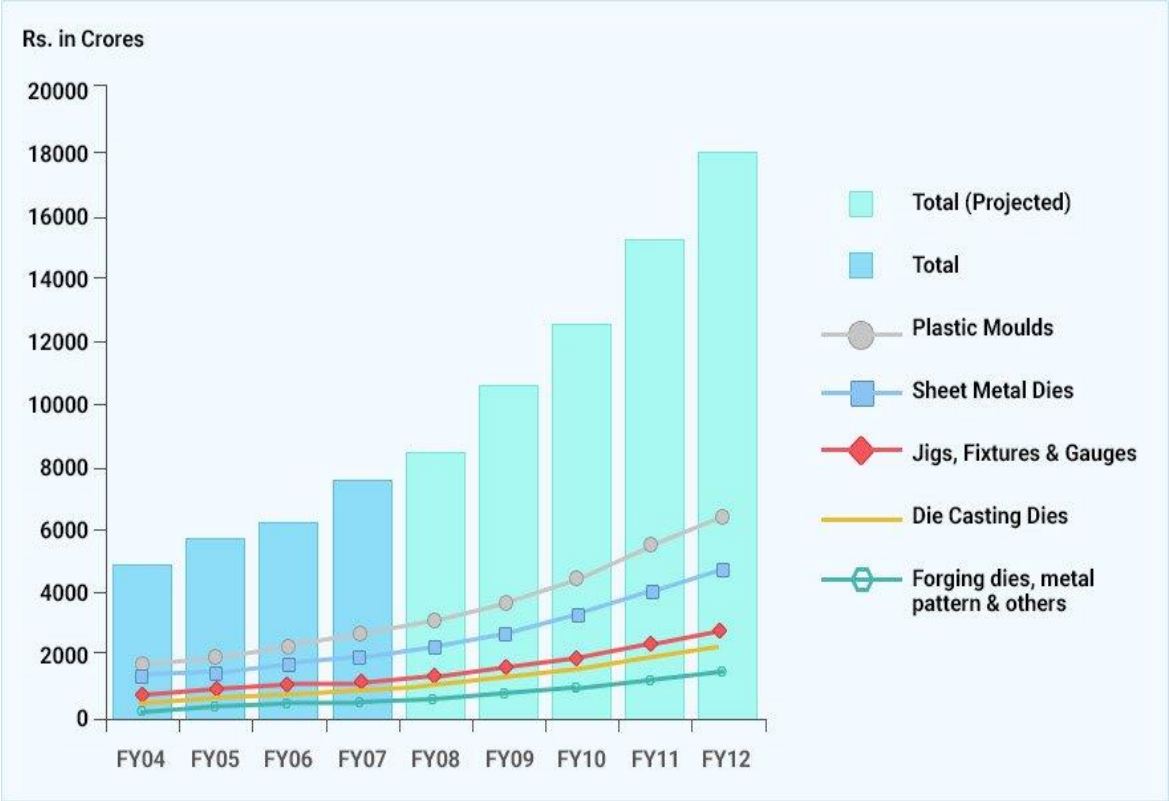
- Hi-tech production setup with latest technology is a critical requirement for organizational growth.
- SMEs need to vision the enormous business potential & upgrade their facilities, skills, technologies & supply chain to come up at industry`s expectation level.
- PPP models for skill development programs at Polytechnics/ ITIs & business incubators, is the need of the hour.
- Further research studies need to be conducted on this subject matter for more refined results.

Limitations

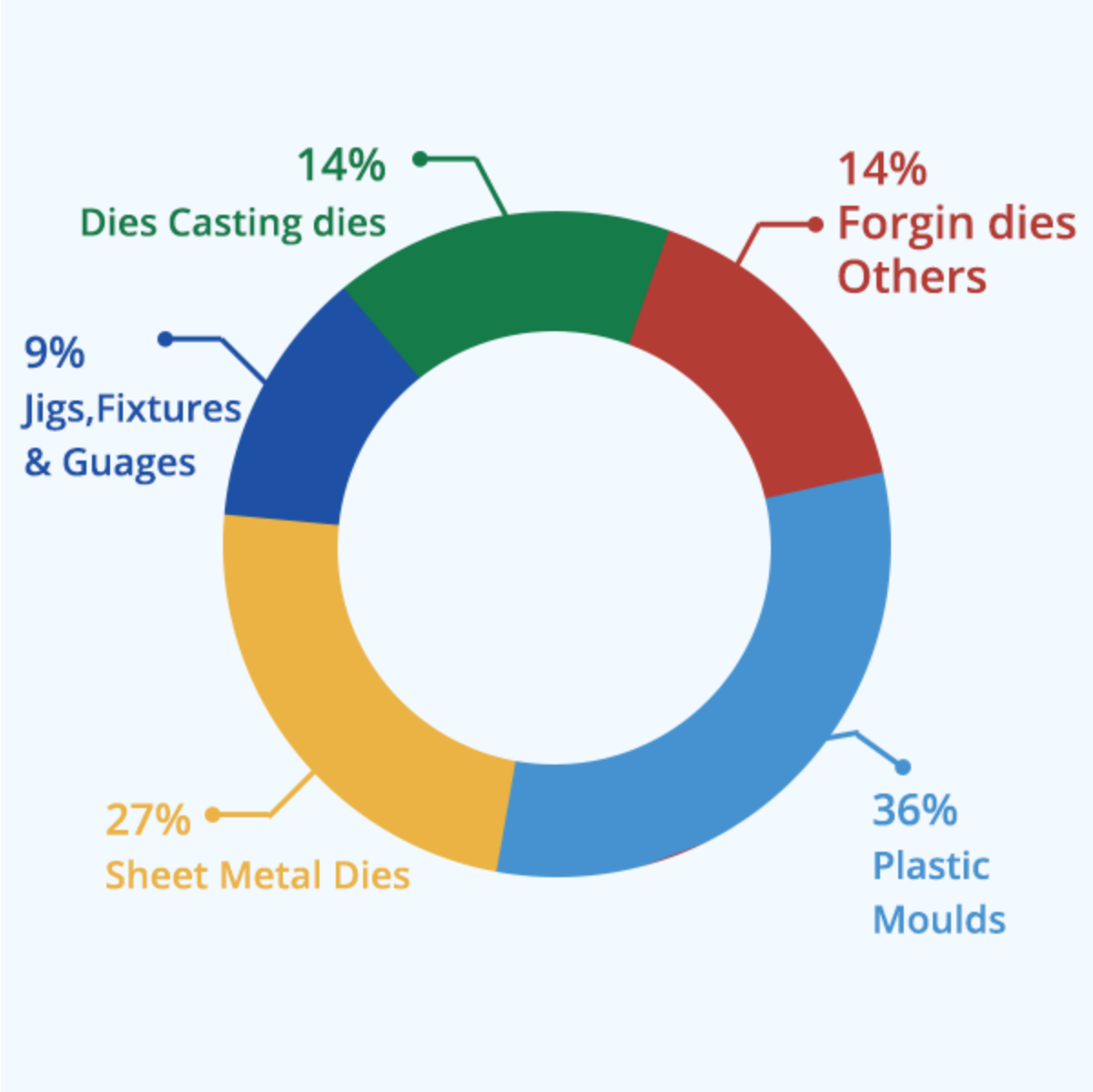
Limitations to this research could be:

- Adapting a convenience sampling technique as the subject is a highly technical.
- No secondary data inputs.
- Technical discussions with top technical staff.
- Prior appointments sought with respondents.

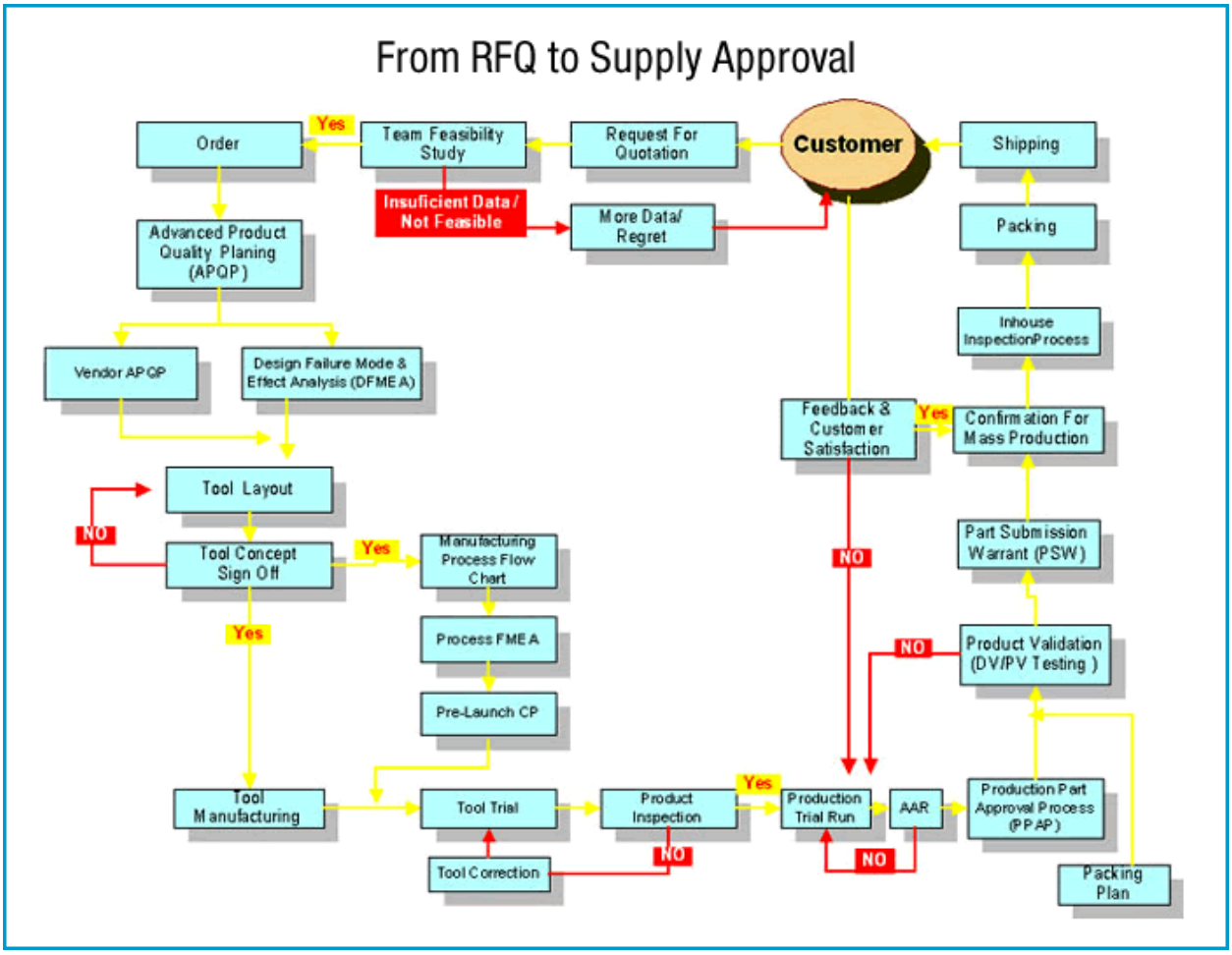
TOOLING DEMAND: MARKET GROWTH HISTORY



TOOLING DEMAND: PRODUCTWISE GROWTH HISTORY



TOOLING DEMAND: PRODUCTWISE MARKET SHARE



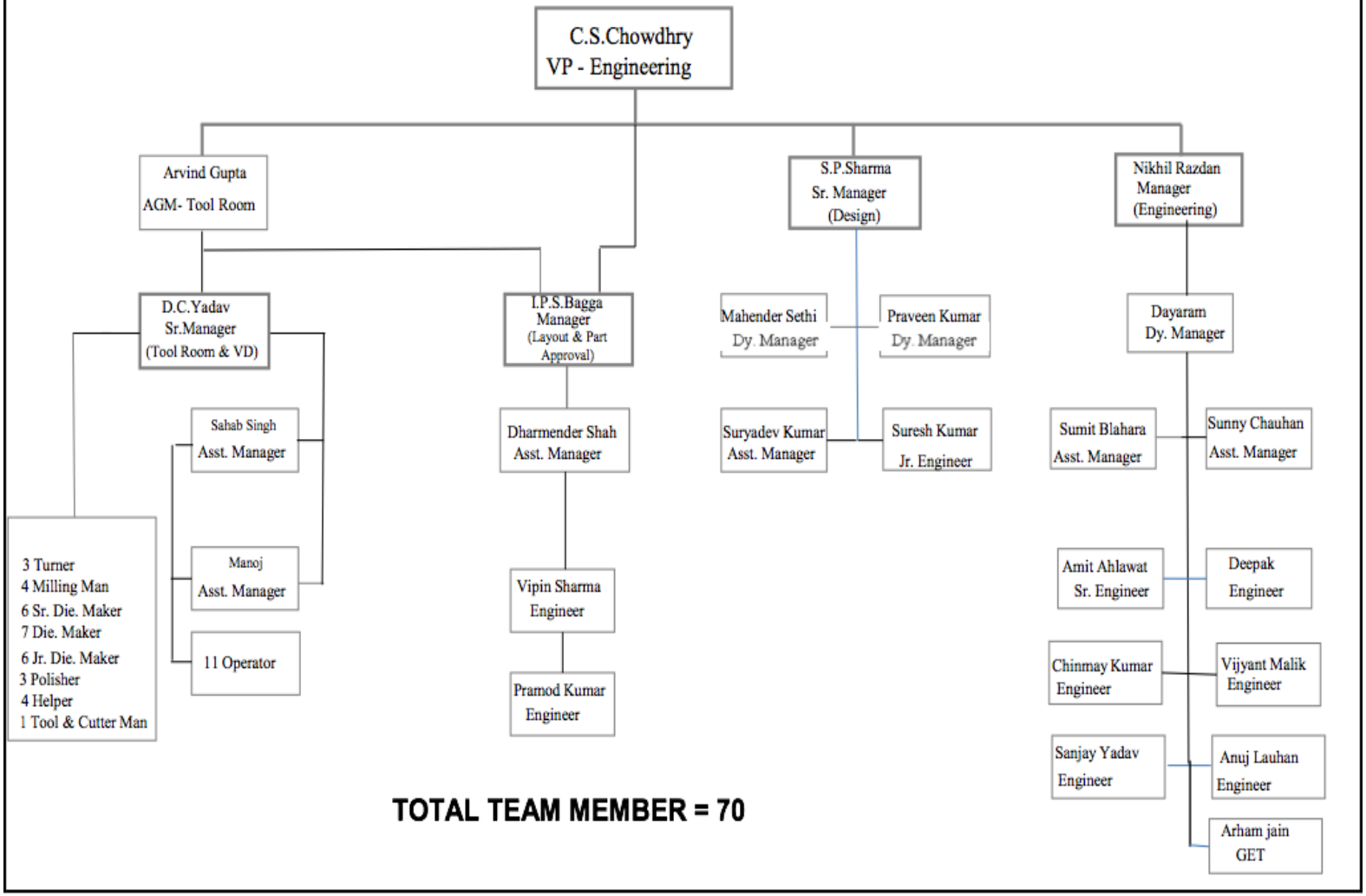
FLOW CHART JIGS-FIXTURES MAKING

ASK AUTOMOTIVE PVT. LTD.		DOCUMENT
		SECTION
		PAGE NO.
TITLE:- ORGANIZATIONAL CHART- TOOOL ROOM / ENGINEERING		REVISION NO.
		EFF. DATE
		APPD. SIGNATURE

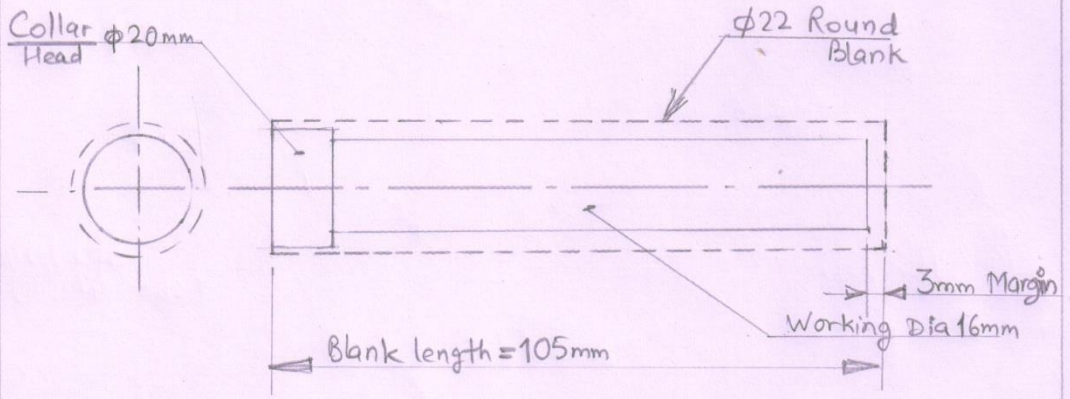
S.No.	Designation	Processes and Responsibility
1	VP – Engineering	Responsible for all Engineering & Tool Room Activities.
2	AGM - Tool Room	Responsible for all Tool Room Activities.
3	Sr. Manager – Design	Responsible Part Modeling, Design of Dies, Jigs, Fixtures & Gauges.
4	Manager - Tool Room & VD	Responsible for all Tool Room Activities and Vendor Development
5	Manager - Layout & Part Approval	Responsible Component Layout & approval, Calibration
6	Dy. Manager – Engineering	Resposible for all Engineering activities.
7	Asst. Manager – Engineering	Process Design and Process Development, APQP, PPAP, Process documents, Jigs, Fixtures & Gauges, ECN implementation, Sample Submission etc.
8	Asst. Manager – Design	Part Modeling, Design of Dies, Jigs, Fixtures & Gauges.
9	Sr. Engineer - Layout & Part Approval	Component Layout, CMM
10	Sr. Engineer - Tool Room	Responsible for all Tool Room Activities
11	Sr. Engineer – Engineering	Process Design and Process Development, APQP, PPAP, Process documents, Jigs, Fixtures & Gauges, ECN implementation, etc.
12	Sr. Engineer	Programming and Machining on VMC & Wire Cut
13	Engineer – Design	Part Modeling, Design of Dies, Jigs, Fixtures & Gauges.
14	Engineer – Engineering	Process Design and Process Development, APQP, PPAP, Process documents, Jigs, Fixtures & Gauges, ECN implementation, etc.
15	Engineer - Layout & Part Approval	Component Layout, CMM, Calibration of Measuring Instruments & Gauges.

16	Sr. Foreman - Tool Room	Development of Dies, Jigs, Fixtures & Gauges, Die Maintenance and Spare Parts.
17	Jr. Engineer - Layout & Part Approval	Component Layout, CMM, Calibration of Measuring Instruments & Gauges.
18	Jr. Engineer - Engineering	Process Design and Process Development, APQP, PPAP, Process documents, Jigs, Fixtures & Gauges, ECN implementation, etc.

ASK AUTOMOTIVE PVT. LTD.		DOCUMENT	QM - 05
		SECTION	Appendix IV
		PAGE NO.	1 OF 2
TITLE:-	ORGANIZATIONAL CHART- TOOL ROOM / ENGINEERING (NPD)	REVISION NO.	1
		EFF. DATE	21/12/2016
		APPD. SIGNATURE	

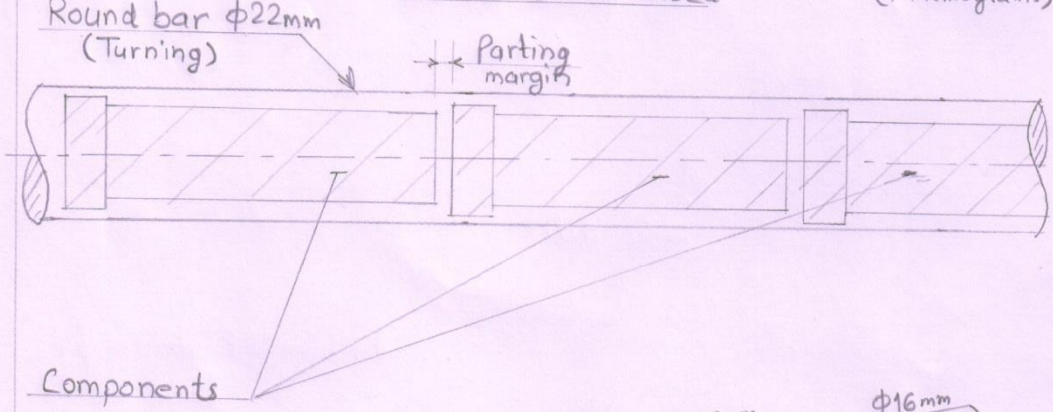


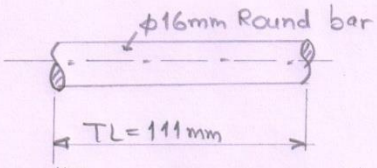
Turned/ Forged Alloy Steel Ejector Pin (Auto part)



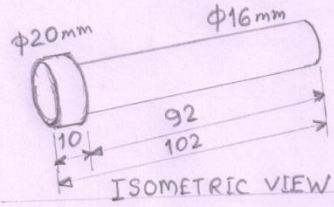
$$wt = \frac{\pi r^2 h \,(\text{sp. gravity}, \rho)}{10^6} \text{ (in kilograms)}$$

"Lathe Blank used"





"Forged Blank used"



Ejector Pin - Steel Alloy

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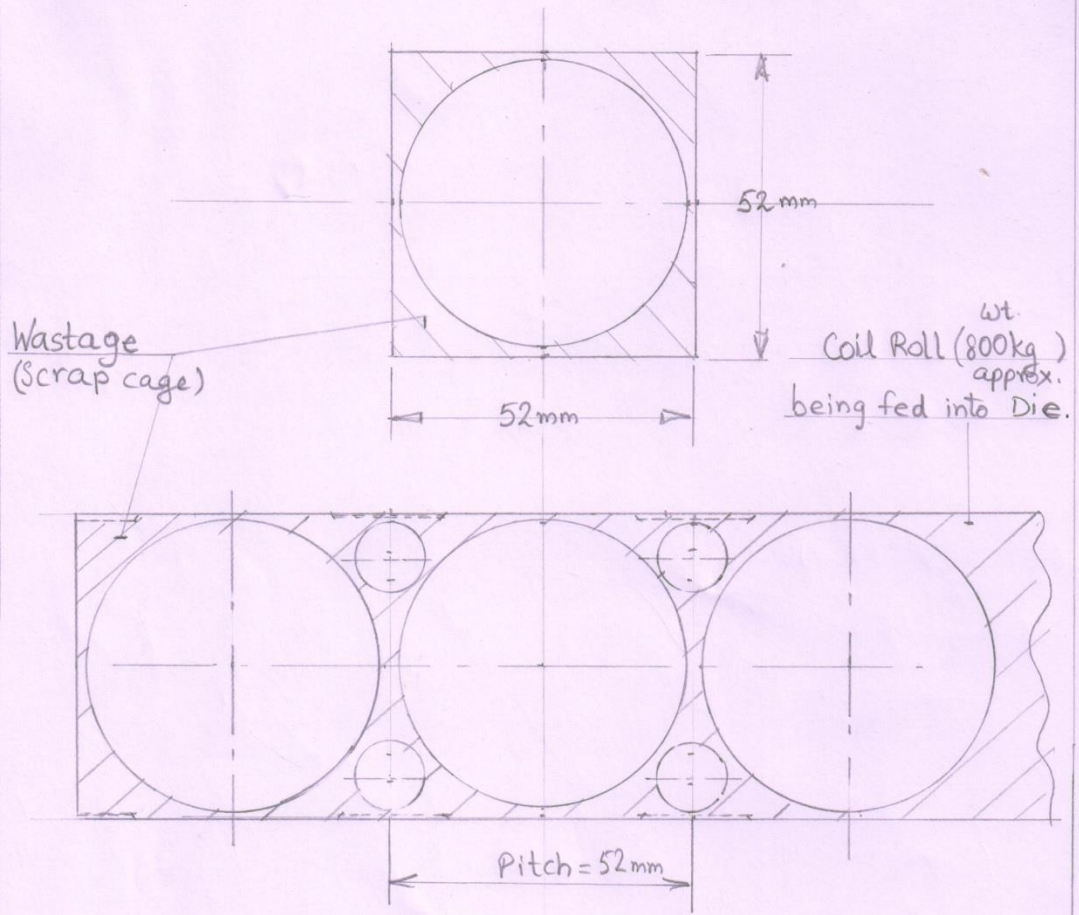
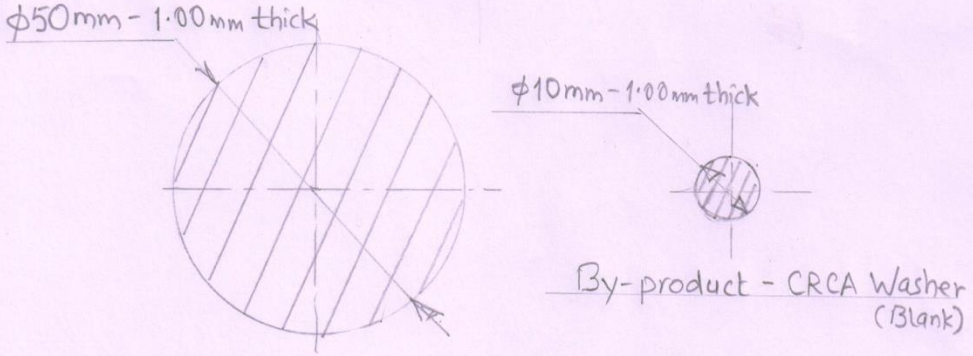
Sheet Metal Component (Blank) - Press tool.





By-product - CRCA Washer (Blank)

Main Component - CRCA drawn

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