# CHAPTER 3

# EXISTING STUDY

One of the most important thing to support manager decision making is the manager has to clearly understand all aspects of existing manufacturing system and products because it will assist a decision making in which necessary step to be replaced and what is the consequence effects or benefits on the replacement in term of economical , technical system.

## 3.1 Overview

The company is a caster wheel company. Its core business is a caster wheel product serving in all kinds of business sectors such as hospital, factory, supermarket and local market for general proposes.

## 3.2 The organization chart

The organization chart of the plant is divided into 2 departments under the control of plant manager. Each department is an independent to each other

1. Production department

Production department is divided into 5 stations

1.1 Wheel frame station

1.2 Base frame station

1.3 Assembly 1 station

1.4 Assembly 2 station

1.5 Assembly 3 station

2. Die department

Die department is divided into 2 sections

2.1 Die fabrication

2.2 Die maintenance

# THE ORGANIZATION CHART

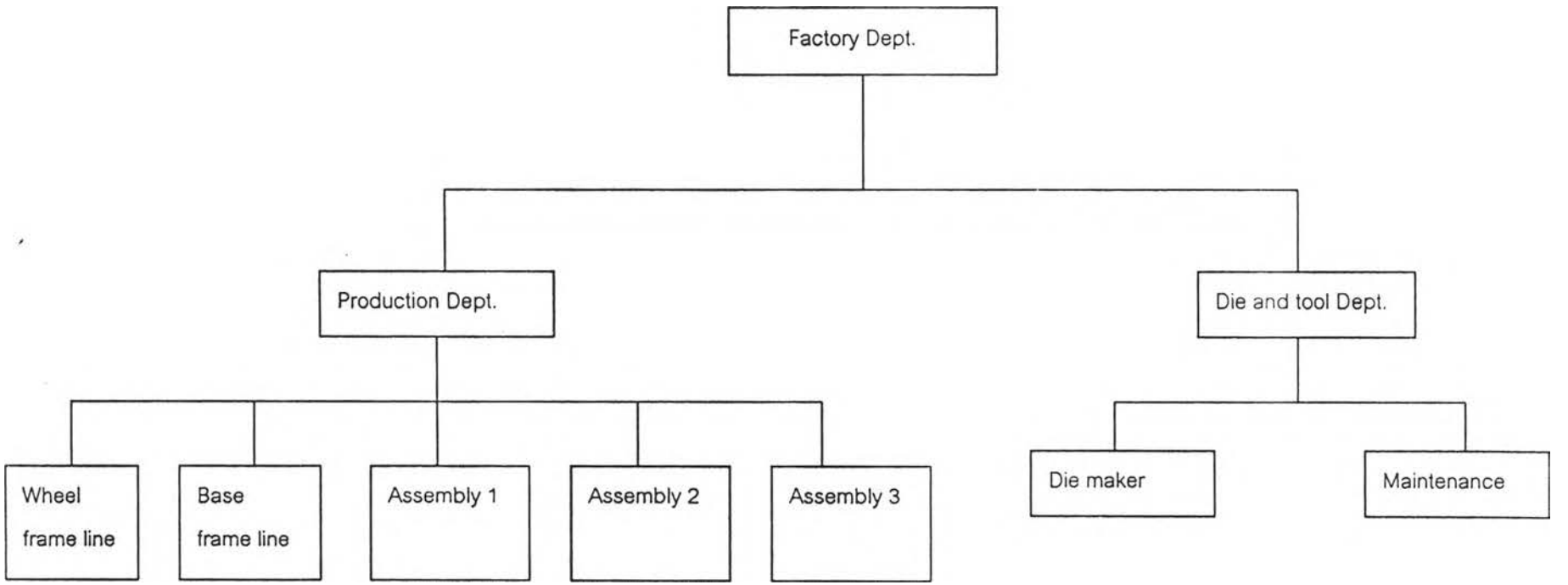



Figure 3.1 The current organization chart

3. Axial wheel

It is consisted of Washer , Bolt and nut

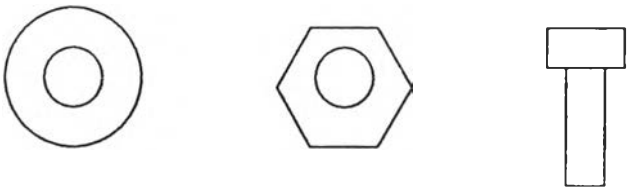


Figure 3.3 Axial wheel sub-components

4. Break panel

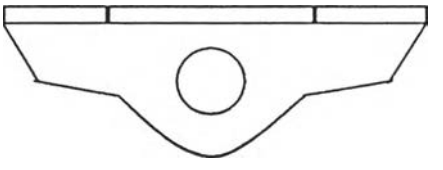


Figure 3.4 Break panel

## 3.5 Process for making wheel frame

There are 5 processes for making wheel frame.

1. Blanking
2. Forming
3. Piercing
4. Trimming
5. Finishing

Details of each process will be in next page.

1. Blanking

Blanking is the process to blank metal sheet into circle shape. The process starts when operator picks a 3- feet long metal sheet places on a lower die along a guide without stopper to make metal sheet in right position then operator activates machine by press air clutch button by foot to perform blanking. It takes 2.23 sec to complete 1 piece. Part is done one by one. The finished part is pushed by step operation and slide into a slide way located behind the machine and fall into a bin. Every 30 shots, Operator applies a coconut oil on die to prevent scratch incurred from force working on blanking process. 1 sheet metal can do 30 blank pieces.

This process uses a skilled operators in term of accuracy of the right position for metal to locate on die otherwise sheet metal may overlap circle of blanking. This process uses 1 operator with 80-ton air clutch press machine. Below is the breakdown activity in blanking process.

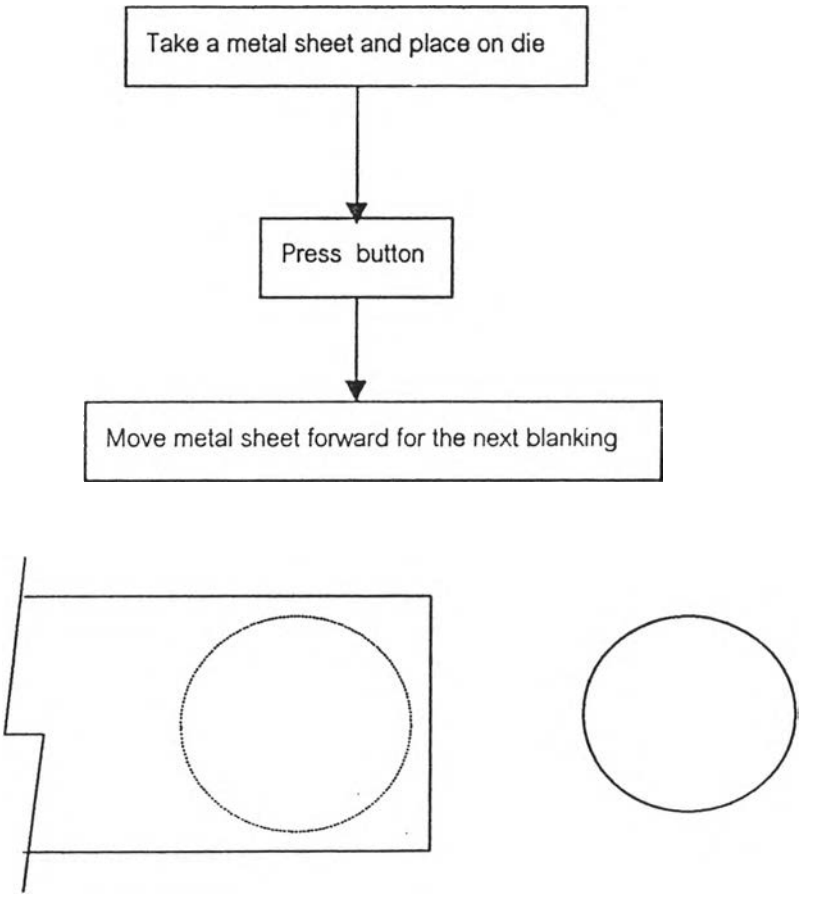



Figure 3.4 Part Before and After blanking

2. Forming

Forming is the process of press sheet that forms a wheel frame in required shape. It is done by single die with one operator in charge. This process takes 3.46 second. It starts from operator pick up work, that has been operated by blanking process place on lower single die. Then operator activates by press air clutch bottom by foot , after that forming is operated. Part is done one by one. Finished part will be pushed by the next step then sliding down on sliding way fall into the bin. Every 30 shots, Operator applies a coconut oil on die to prevent scratch incurred from force working on blanking process.

This process does not use skill as much as blanking process because part is easily located on die Machine is a power press air clutch with capacity 60 tons. Operator applies coconut oil on the lower die and upper die occasionally 10 pieces per one apply. Die in this process is a single die that has fabricated in-house and lacks of maintenance, below is the process activity of forming process.

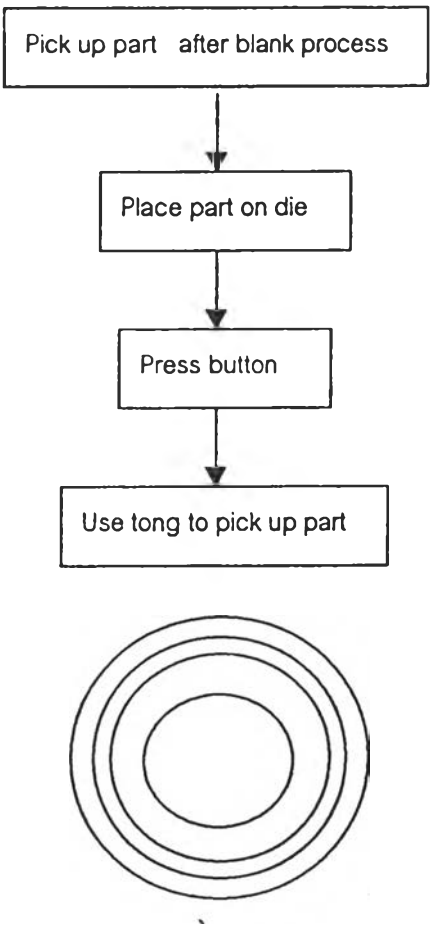
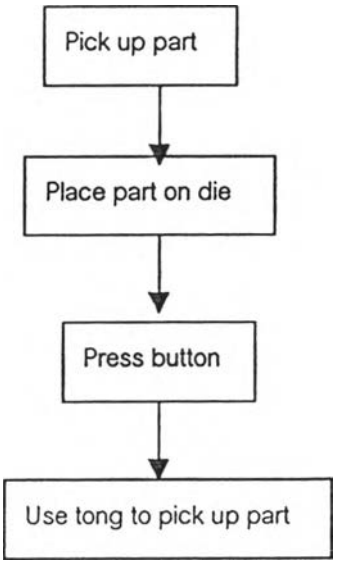



Figure 3.5 Part after forming

3. Pierce hole

Pierce hole is the process for punch hole in the center for locating wheels axial This process takes 3.62 second. This process is the longest cycle time. Machine is a power press air clutch 60 tons. The process starts from pick up work from forming process places on single piercing die, then press air clutch bottom by foot. Machine will operate pierce 5 holes at the same time. It is done part by part. Finished part will be pushed by neat step and fall onto a slide way into the bin underneath to transfer to next station. Every 30 shots, Operator applies a coconut oil on die to prevent scratch incurred due to force working on piercing process.

Die is a single die which was fabricated in house. Machine is a 60- ton machine. Problem in this process is hole of cutting is not sharply cut due to tool worn out. Action is to set number of stroke record then machine is stop automatically and get maintenance. Below is the breakdown activity in pierce process



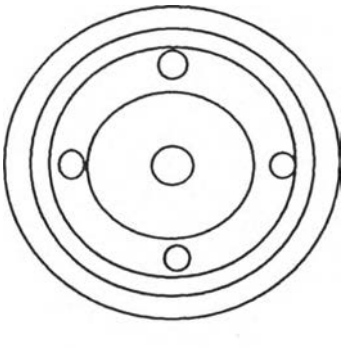



Figure 3.6 Part after pierce

4. Trimming (cut off edge)

Trimming is the process to trim the edge of part and it is the last process to complete part. This process takes 2.91 sec. The process starts when operator picks up part from piercing placed onto single cutting die. This process has to aware when places part on die because there is no full proof. Operator has to have skill. There is one operator in- charge. Machine is a power press air clutch with a 60- ton capacity. Every 30 shots, Operator applies a coconut oil on die to prevent scratch incurred due to force working on trimming process.

Die is a single die which is fabricated in house. Machine is 60 tons. Grease has been applied but not properly done. Problem in this process is hole of cutting is not sharp cut because tool has worn out. Action is to set number of stroke record then machine is stopped automatically and get maintenance. Below is the breakdown activity in blanking process.

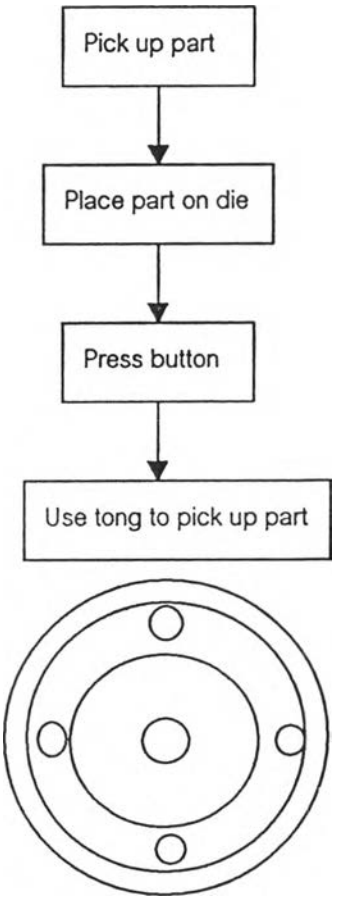



Figure 3.7 Part after trimming

Process flow chart of wheel frame

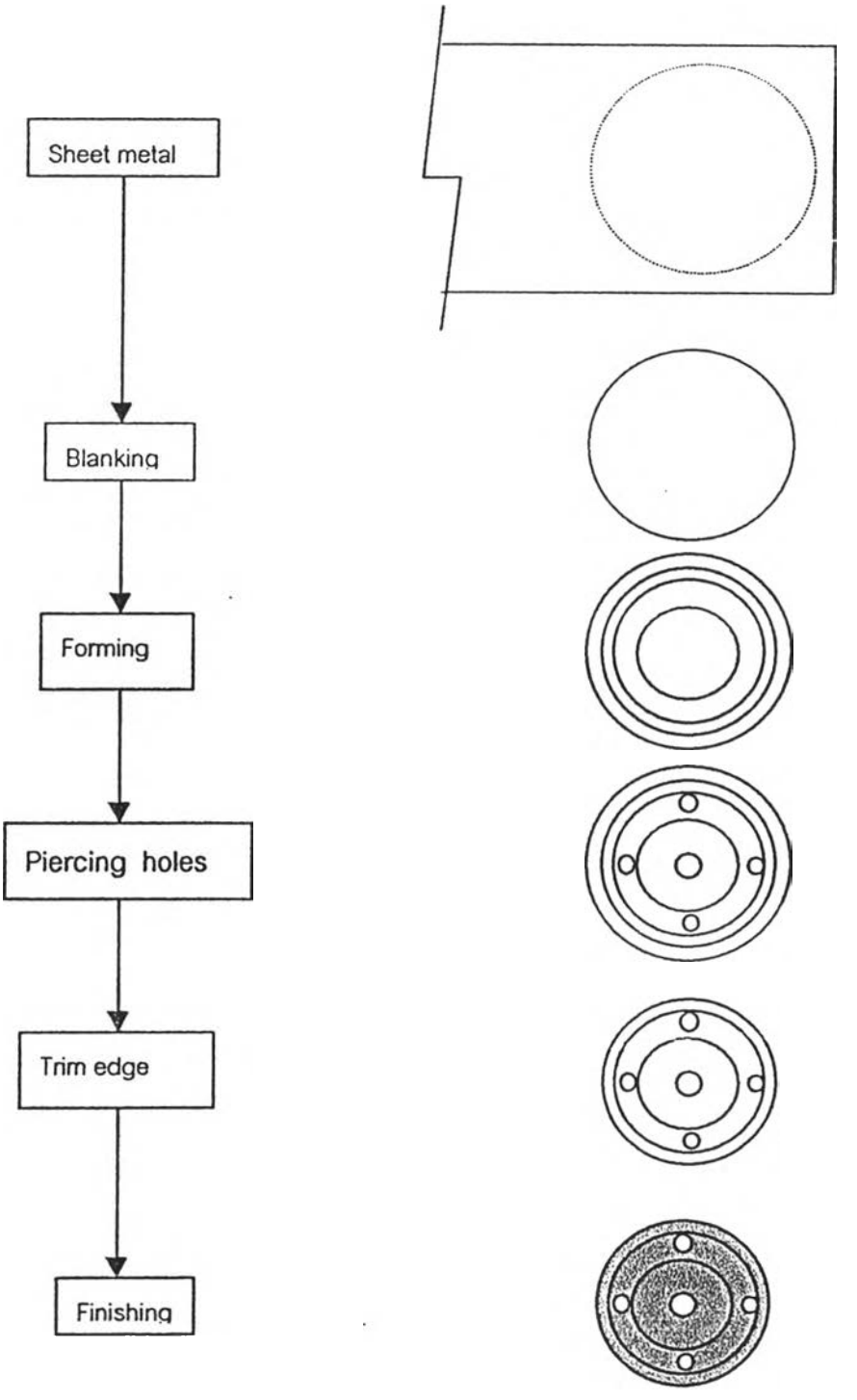



Figure 3.8 Flow process of wheel frame

## 3.6 Products (output)

Existing products can be categorized into 7 series. It is classified by the propose of work as the following

- Ball castor series for the propose of furniture work
- Ball caster break series for the propose of hospital, hotel , supermarket
- Twin wheels series for the propose of light duties
- Bed series castor for the propose of bed series
- Thread stem series (major product to be studied) for general industrial proposes
- Break series for general propose, chair ,table
- Bolt series for rusty , chemical, heat proof
- Swivel top plate caster for heavy duty

## 3.7 Capacity

The maximum capacity of making wheel is 3,000 pieces a day.

## 3.8 Performance

Performance can be measured in 3 indicators

- Cycle time is amount of time required to perform task in each process.

Table 3.1 Cycle time of each process of wheel frame

| Process | Cycle time(sec) |
|---|---|
| Blank | 2.23 |
| Form | 3.46 |
| Pierce | 3.62 |
| Trim | 2.91 |

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1. Press machine

   It is for press working process to perform a component part such as blank, pierce, form, There are 8 machines. Most of them are power press air clutch. The capacity is 60-80 tons.

2. Rivet machine

   They are power press air clutch. The capacity is 50 ton. There are 4 machines. Rivet machine is for fastening rivet ,bolt, nut in assembly process.

3.9.2 Efficiency of machine

Efficiency of machines is estimated approximately 80%

Figure 3.11 Press machine

Figure3.12 Rivet machine

- Existing Die

There are types of die used in making wheel frame and their necessary details

1. Blank die

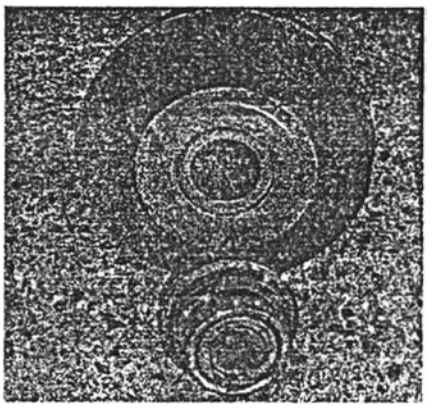


Figure 3.13 Blank die

1.1 Maintenance

Blank die is to do maintenance in every 2 months. The items to do maintenance are

- Sharpen blank punch
- Tighten bolt and nut
- Apply grease
- Apply rust proof oil
- Check worn out

1.2 Set up time

Die set up time is average 20 mins

1.3 Cost of die components (Baht)

| | | |
|---|---|---|
| 1. | Guide post | 1,200 |
| 2. | Spring | 120 |
| 3. | Upper die | 4,800 |
| 4. | Lower die | 3,200 |

2. Form die

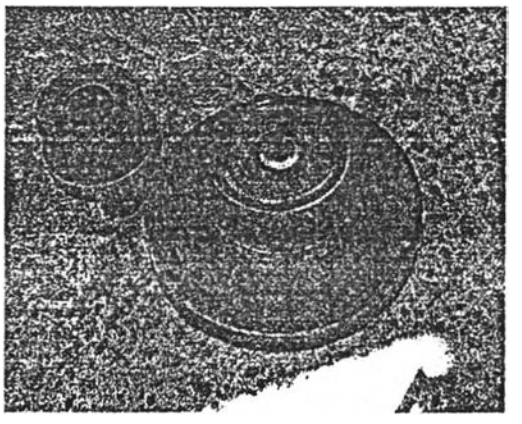


Figure 3.14 Form die

2.1 Maintenance

Form die is to do maintenance in every 2 months. The items to do are

- Sharpen form punch
- Tighten bolt and nut
- Apply grease
- Apply rust proof oil
- Check worn out

2.2 Set up time

Die set up time is average 15 mins

2.3 Cost of die

The cost of die is about 12,000 baht.

2.4 Die life

Die life is about 5 years.

3. Pierce die

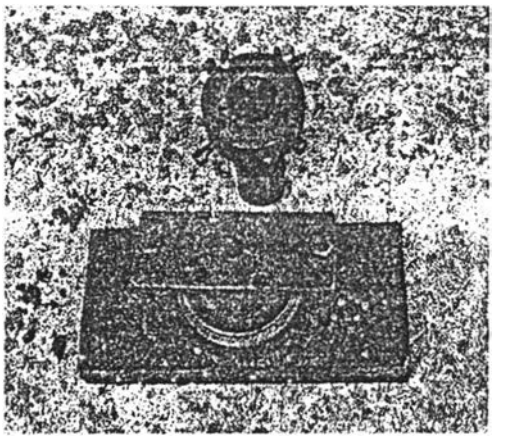


Figure 3.15 Piercing die

3.1 Maintenance

Blank die is to do maintenance in every 2 months. The items to do are

- Sharpen form punch
- Tighten bolt and nut
- Apply grease
- Apply rust proof oil
- Check worn out

3.2 Set up time

Die set up time is average 15 mins

3.3 Cost of die

Cost of die is about 13,500 Baht

3.4 Die life

Die life is about 5 years.

4. Trim die

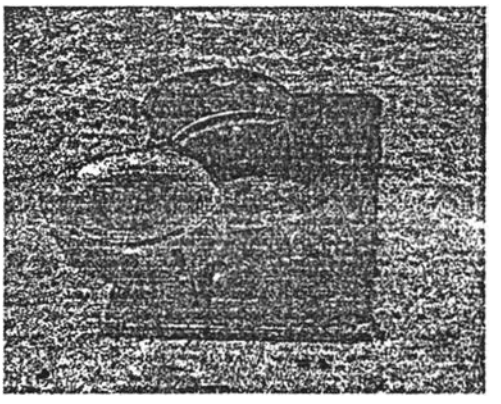


Figure 3.16 Trim die

4.1 Maintenance

Trim die is to do maintenance in every 2 months. The items to do are

- Sharpen form punch
- Tighten bolt and nut
- Apply grease
- Apply rust proof oil
- Check worn out

4.2 Set up time

Die set up time is average 22 mins.

4.3 Cost of die

Cost of die is about 8,900 Baht.

4.4 Die life

Die life is about 5 years.

- Man

3.2.3.1 Total manpower :

Total manpower in production are 18 persons.

3.2.3.2 Direct manpower:

Direct man power is defined as manpower who is directly involved in process of production such as blank operator , pierce operator , assembly operator. There are currently 13 persons.

3.2.3.3 Indirect manpower :

Indirect man power defined as manpower who involves in doing for non-productive product such as maintenance, material handling , die set up. There are currently 5 persons.

3.2.3.4 Manpower skill :

80% of man power in the company are multi skill. They are able to work for any process. In case of absenteeism of worker , any operator can be replaced. The skill matrix is recorded for each operator. The company records a manpower skill in the" Skill matrix". This skill matrix is able to identify every single operator on how much skill they are. Every operator in the station is rotated work and able to do every process. Any operator can be substituted as shown below,

Table 3.2 Skill matrix of operators

| Department: production | | | Station: wheel frame | | | | Supervisor: Chart | | |
|---|---|---|---|---|---|---|---|---|---|
| No. | Name of employees | Length of work | Skill operator in each process | | | | Score | Full score | Percent |
| | | | Blank | Form | Pierce | Trim | | | |
| 1 | Bunmee | 2.5 years | 3 | 3 | 2 | 3 | 11 | 12 | 0.92 |
| 2 | Seksak | 2.4 years | 3 | 3 | 2 | 2 | 10 | 12 | 0.83 |
| 3 | Meechai | 2.1 years | 2 | 2 | 3 | 3 | 10 | 12 | 0.83 |
| 4 | Somjai | 1.7 years | 2 | 2 | 2 | 2 | 8 | 12 | 0.67 |

Mark : 1 =Never been trained

2 =Trained need some upgrading

3 =Expert and able to train others

## 3.10 Manufacturing system

### 3.10.1 System

System is a Mass production that is "a production system characterized by mechanization, high wages, low prices, and large-volume output." (Hounshell, p.305) with a push system that parts from each operation are proceed towards to next operation until last process continuously. Therefore, each operation needs cycle time that close to the next operation's cycle time. Work in process is a measurement on how smooth system is. In the wheel frame line, cycle time of each of 5 operations is closed to each other by the semi auto work , and stable time but work in process is also need for a waiting - transported parts.

### 3.10.2 Support system

- 5 s

5s is a basic system to organized thing in proper ,classified place for its convenient use, so that it takes less time to find out. 5 s in this company is to organize its place of tooling , daily equipment, document.

- Kaizen

Kaizen is a system to eliminate waste time in each process and between process that is not added value to product. Waste to be eliminated are for example, idle time , waiting time, part delay, set up time (Hounshell, p.305). This company uses Kaizen system to improve set up time. The example of Kaizen such as,

1. Die set up

The position of block centre is marked on machine table and centre key of x exist y exist is marked for each model ,so that set up time is eliminated. The other parameters control for setting up is marked on machine. The bolt and nut is rather eliminated, and replaced by slot.

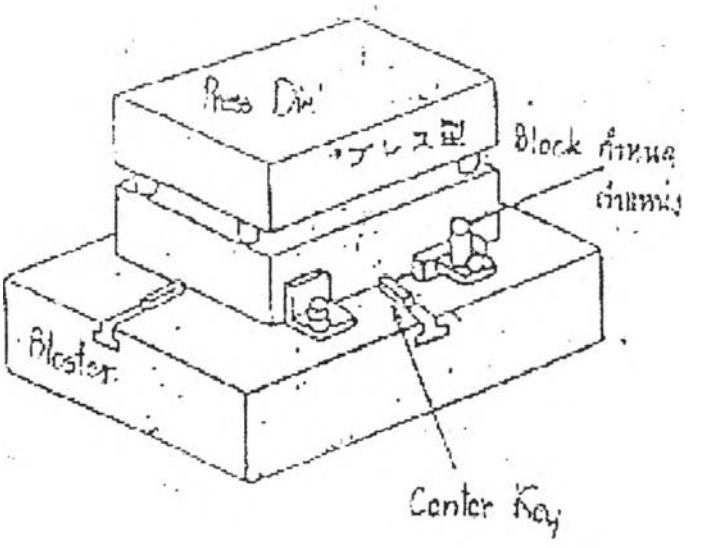



Figure 3.17 Die set up method

2.In -process

The implement of stopper and guide is located on die to make operator to do job easily and less time. Because it is able to eliminate human error and improve consistency and precision. Pokayoke or full-proof is applied to eliminate error of wrong loading causing from human error as an example shown.

2.1 Stopper and guide

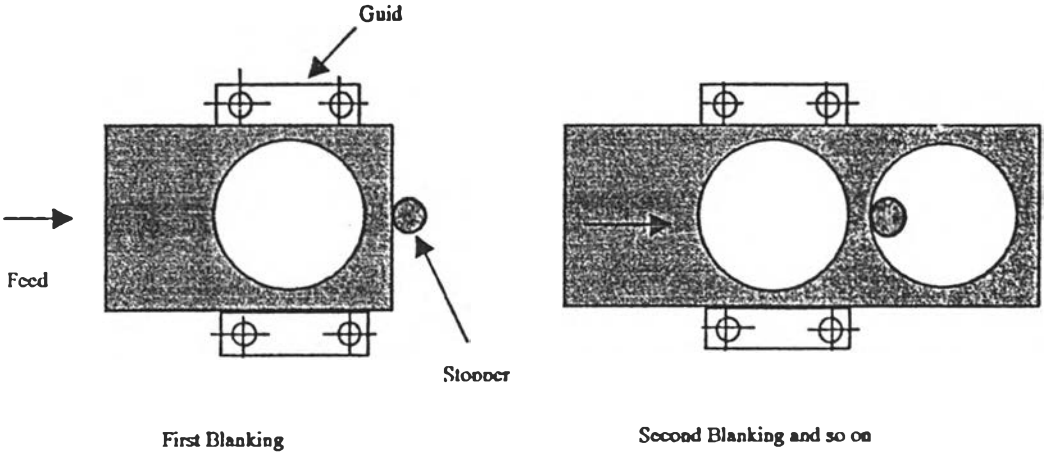
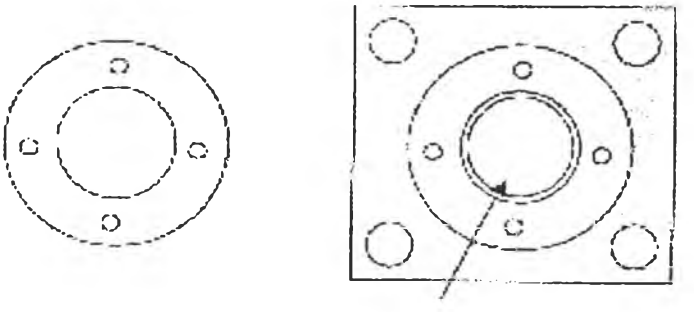



Figure 3.18 Stopper and guide location

In picture 3.18 In first blank process, operator feed metal sheet slight through guide slots until hit stopper , then operator operate button for blanking.

function in position for the next blanking as the curve of the previous blanking acting for next position.

2.2 Full proof



Slot on die to ensure the right model before operating

Figure 3.18 Fool proof

In picture 3.18 Full proof is to prevent operators from wrong model loading. Since there are many model that look alike but the different is its depth so, fool proof is designed for just fit in for that particular type. In case of wrong model ,part will not fit in properly.

## 3.11 Layout

Layout is divided into 3 mains layout

1. Layout of process flow
2. Lay out of line
3. Layout of plant

## 3.11.1 layout of process flow

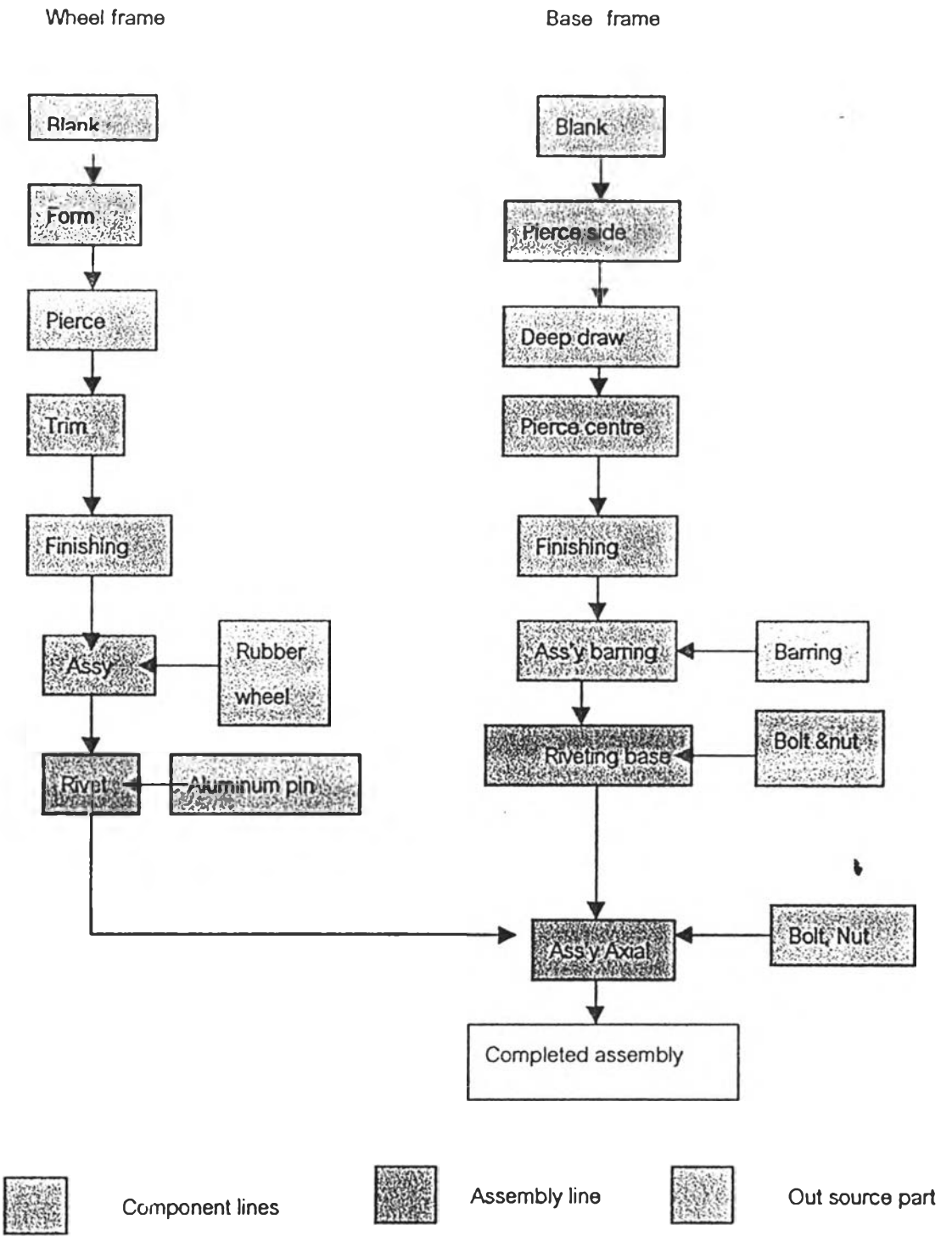



Figure 3.19 Flow process of wheel

### 3.11.2 Lay out of line

The report classified layout line into 2 group station.

- Component stations

  There are 2 component line

  1. Station 1.is Wheel frame station
  2. Station 2 is Base station.

The station are straight lines. Material gose from first process and comes out as finished component part in last process. Thus, products from each stations are pushed towards to next process because it is a mass production. Bottom neck is eliminated by work in - process area in each station. For this type of process line, operator is in charge for 1 machine each. Unlike "U shape" line that operator is able to do more than 1 machine. In this case study, plant is restricted by limited area and more concerned on smooth process flow so that straight line is the most suitable. Rework station is eliminated from main line.

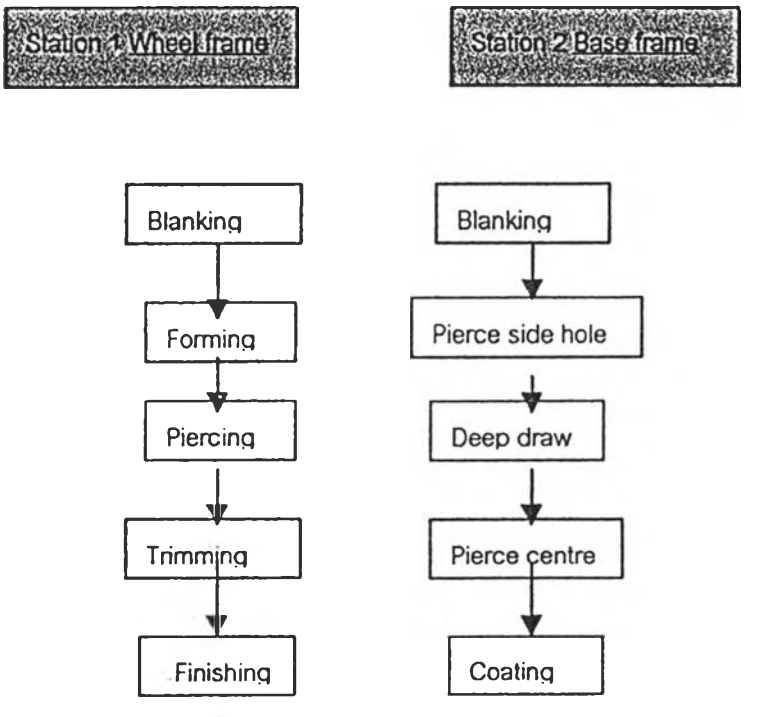



Figure 3.20 Station of process

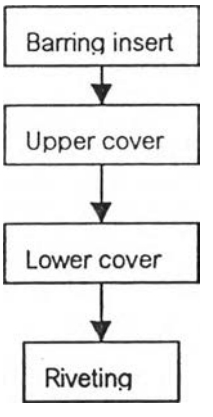
Looking at the lay out of process flow , it can be seen that each station produces component independently from another line from first process down to last process. Finished goods(component part) will be carried by trolley to the station of assembly line for assembly wheel and assembly base respectively.

- Assembly station

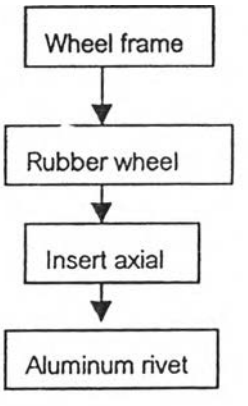
Lay out of assembly station is divided into 3 main assembly which are

1. Base frame
2. Wheel frame
3. Axial

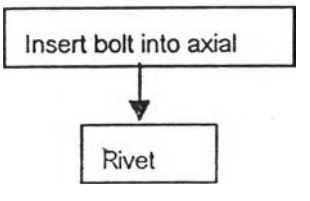
1. Base frame assembly : there are sub component to be assembly.




2 Wheel frame assembly: there are sub component to be assembly.

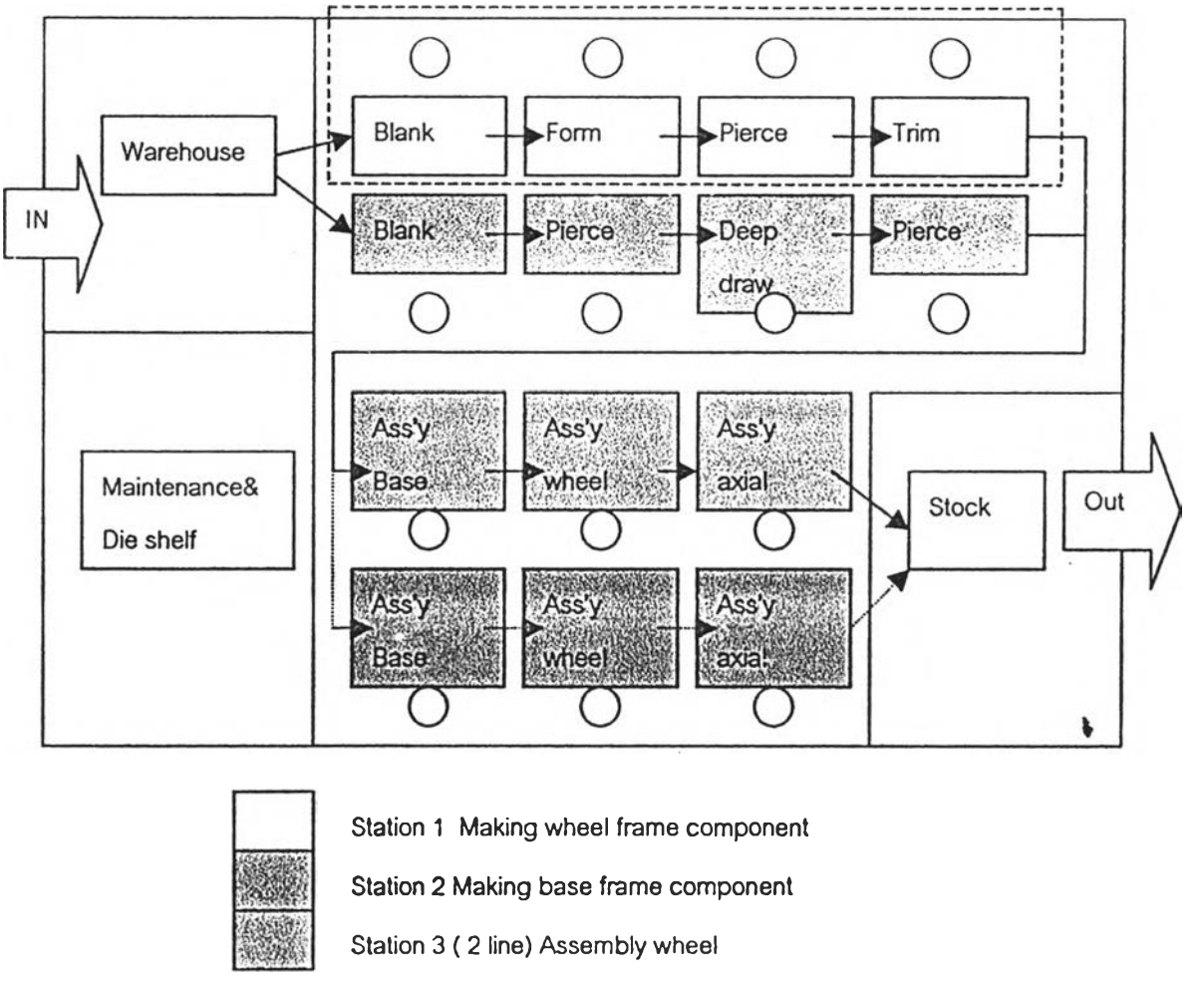



3. Axial assembly



It is noted that assembly wheel frame and wheel frame line can be done in parallel because it is independent work but for axial assembly is need to be assembly wheel frame and base fasten together.

### 1.11.3 Lay out of plant




3.21 Plant lay -out

As seen in layout of plant, Total area in plant can be assessed in ratio. Area in plant is about 270 square meter which is comprised of

- Machine is 30% of space
- Warehouse is 10 % of space
- Work in process is 50 %of space
- Working area is 10 % of space

Look at the plant, raw material can be delivered at a dock warehouse area at the back of plant so that the way of raw material and finished part to be delivered is the same way hence, there is a traffic problem in conjunction with delivery raw material from supplier and finished parts to be delivered to customer. Because of limited area, Time delivery of raw material is needed to be scheduled to prevent such a crash.

The route of process flow starts from raw material in warehouse move through process to change into finished part. Since it is a mass production so it is a push system in which part in each process will be pushed towards until finished as required lot size. Pattern of line is a strength line ,according to limited area, 2 assembly lines are quite apart from component lines. As this result , parts has to be carried in long distance . This is a time consuming.

There are 2 assembly lines while there are one line for wheel frame line and base frame line. This is because wheel frame line and base frame line is much faster cycle time than assembly line. Therefore assembly line needs 2 lines to match with cycle time of components line to prevent a bottom neck problem and solve in producing huge bunch of work in process.

Operators in assembly line in assembly base and assembly wheel are able to work in both operation. This is to help each other when some one absent or bottom neck occur. 2 Material handling for the plant are to carry raw material ,work in process and shift finished part in and out stock such as fork lift ,trolley.

Stock is located in front of plant that is easy for delivery to customers. Safety Stock is available 3-day minimum stock which depends on monthly volume order and the forecasted volume. System of stock distribution is controlled first in first out system.

## 3.10 Costing

### 3.10.1 Direct labor

Labor cost 200 baht /day

Meal 30 baht/day

There are 13 operators therefore

13x230x250= 617,500 baht /year

### 3.10.2 Direct material

- Material is steel sheet. The usage for steel per wheel (plus scrap material) is 346 g or 0.346kg
- Steel price is 15 baht /kg

  Therefore material cost = 0.42x15= 5.19 baht /wheel
- Order to be produced 3,000 per day
- Total working day 250 day/year

  Therefore total material cost is 5.19x3,000x250 = 3,892,500 baht

### 3.10.3 Indirect cost and overhead*

| | | |
|---|---|---|
| Management | 1,500,000 | baht |
| Electricity | 144,000 | baht |
| Indirect labor | 237,500 | baht |
| Equipment | 85,000 | baht |
| Tax | 90,000 | baht |
| Insurance | 25,000 | baht |
| Maintenance | 8,513 | baht |
| Rent | 300,000 | baht |
| Total indirect cost | 2,562,513 | baht |

*Data is obtained from the company in case study in 2002

Total costing = 617,500+3,992,500+2,562,513=6,455,013 baht

## 3.11 Problem on existing system

The problem is identified in "fish bone diagram" in 4 main factors

3.11.1 Man

3.11.2 Machine/die

3.11.3 Method

3.11.4 Others

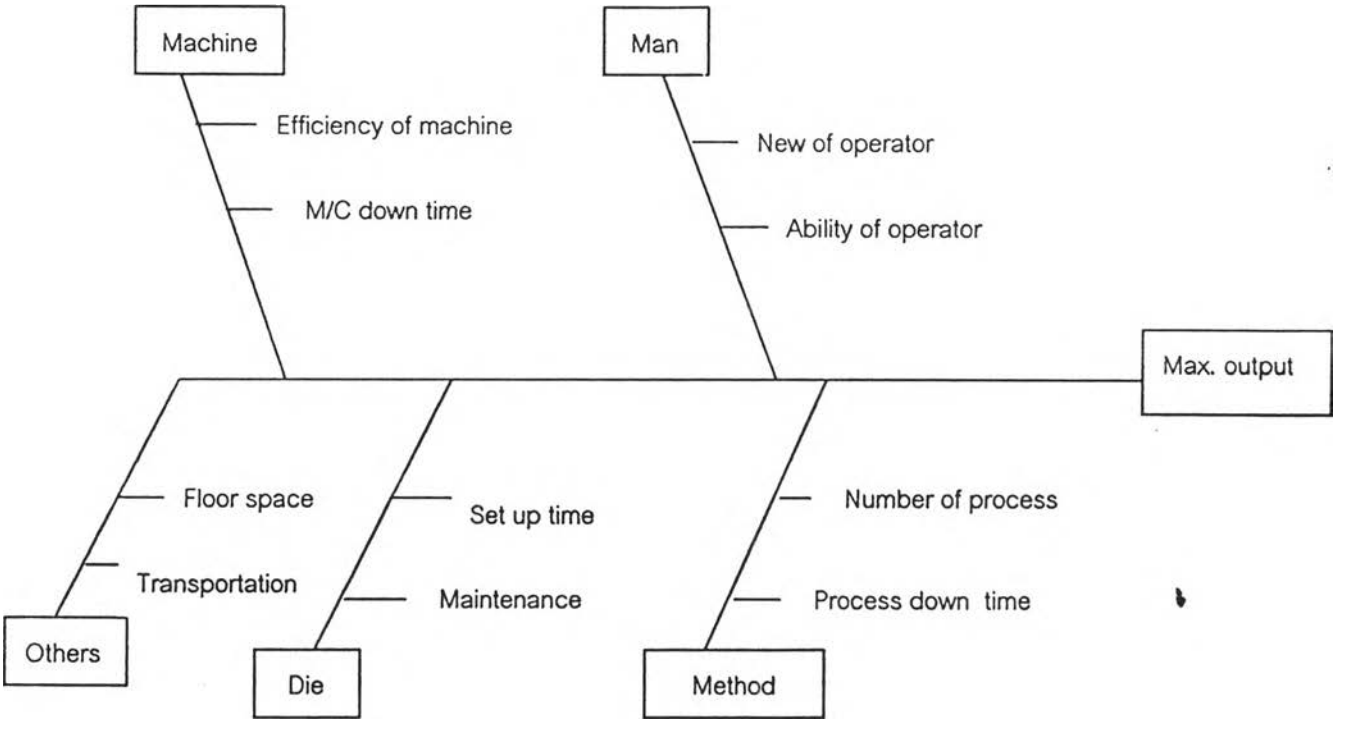



Figure 3.22 Fish bone diagram of problem analysis

Details of Problem described in each factor

3.11.1Man

- Ability of operators.

The average education is grade 6 or below. Die design is then relied on those people. Whenever problem occurs, it will be solved with improper action and that problem will comes back again. They are not looking in a root cause and solve for a root cause. Moreover there is no experienced person for a die technology.

- New operators

New operator need to be trained and takes some time of "on the job training" while some operator resign, some are absent. Therefore cycle time of each operation is not consistence. Since, the process is a semi – auto, the process is relied on operators.

3.11.2 Machine

- Machine down time

Machine Down time is one of the major problem, Machine down time is counted from machine failure until ready to used for production again. It is directly effect to output in a huge amounts depend on how severe it is. Most of the time bent or broken part can be determined the problem of machine or die failure or error. Some failure takes short time ,some takes long time, The cause of machine down time can be classified below

1.1 Lubricant system

1.2 Air system

1.3 Electrical system

1.4 Bearing

1.5 Cylinder

1.6 Break and clutch

1.7 Ram or slide

1.8 Gearing

1.9 Bent or broken components

- Machine efficiency

Most of machine are second –handed machines. It is expected to be 80% Maximum capacity.

- Maintenance

Maintenance is somehow difficult because spare part is difficult to buy in local area or no more existing in a market. Since most of machine are old and second – handed machine, the maintenance is therefore difficult in term of taking care because there is no manual to refer to. Operators need to do it and plan for preventive maintenance schedule by their own experience in every 3 -month time.

The daily maintenance check- point items are

1. Tighten crew and Nut
2. Check level of lubricant
3. Check stroke
4. Check belt

The 3 month maintenance check are

1. Lubricant system
2. Air system
3. Electrical system
4. Bearing
5. Cylinder
6. Break and clutch
7. Ram or slide
8. Gearing

3.11.3 Die

- Die design

Die has fabricated in- house about 70% with a simple traditional design by unskilled person. The design focuses only one single process and quite conservative. The die has no standard of spare part changing. More process will Therefore increase more dies and increase process step.

- Die maintenance

Since die is designed conventionally. Spare part is somehow difficult to find in local market or non existing part anymore. There is no standard of spare part changing. Once it has to be changed ,it has to change the whole part. What they normally do is to do conventional method by fixing just for temporary use for replaces substitution part.

1.11.4 Method

The flow of process is not continual. Each step part need to be transported from station to station. Work in process increase causing mixing part. One reason is a restriction of machine for example, parts from stamping from machine1 need to carry to machine 5 to do piercing then come back to machine 2 for cutting edge, therefore transport is necessary. Some machines have to be reserved for other types of product.

In term of human error , work is basically relied on the operator skill. There is rarely fool-proof for work, for example blanking of metal sheet which need a high consistency has absolutely no guide way or line to notice. If one blank has mistake, the others will get effected.

## 1.12 The analysis of existing manufacturing

The analysis will be analyzed in 2 methods

1.Analyze item by a year by year comparison

2.Analyze the relation of item by item comparison

Table 3.3 The significant items in the plant collected in 1999-2002

| Items / Year | 1999 | 2000 | 2001 | 2002 | Increase | %Increase |
|---|---|---|---|---|---|---|
| Down time(thousand mins) | 41 | 43 | 56 | 53 | 15 | 36.59 |
| Manpower( person) | 13 | 14 | 17 | 18 | 6 | 50 |

| Items Year | 1999 | 2000 | 2001 | 2002 | Increase | %Increase |
|---|---|---|---|---|---|---|
| Overtime hrs( mins) | 62 | 134 | 112 | 103 | 82 | 157.69 |
| No.of machine(unit) | 12 | 12 | 16 | 16 | 6 | 50 |
| Area occupied (sqm) | 640 | 830 | 840 | 860 | 200 | 31.25 |

- Down time

Down time is represented a non -value added production process. In the past 4 years, down time has been increasing year by year. In 2000 down time increased about 4.88% compares to year1999, In the year 2001 down time increased outstandingly 30%as this year was a new model came out and get new operators. In the year 2002 down time was slightly down about 3.57compare to 2001, because new operators got used to with their task. Down time increasing results low outputs.

| Year | 1999 | 2000 | 2001 | 2002 | Increase | %Increase |
|---|---|---|---|---|---|---|
| Down time(1000x mins) | 41 | 43 | 56 | 53 | 15 | 36.59 |

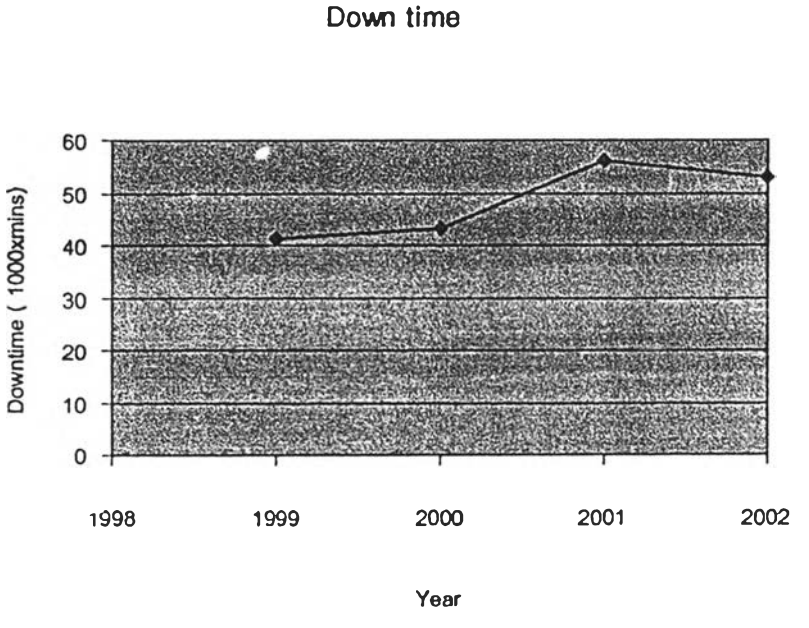



Figure 3.23 Down time year '98-02

- Man power

Man power is a direct labor who involved directly in production. The increase of man power was effect cycle time of production since learning curve of each operators need time for skill improving especially for manual task.

| Year | 1999 | 2000 | 2001 | 2002 | Increase | %Increase |
|---|---|---|---|---|---|---|
| Manpower( person) | 12 | 15 | 17 | 18 | 6 | 50 |

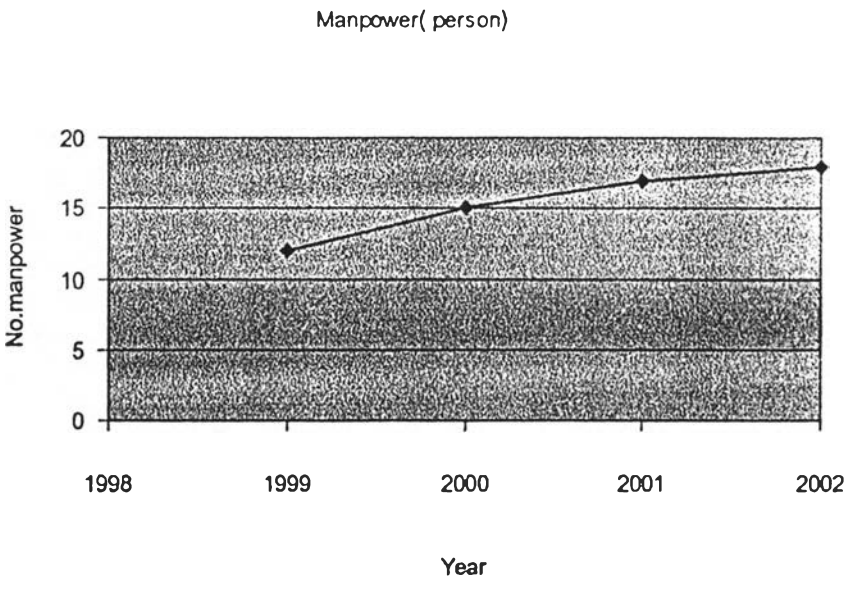



Figure3.24 Manpower year '98-02

- No. of machine

Number of machine increasing is represented the need of buying machine to cope with production and capacity. Number of machine increase years by year, It was due to over capacity of existing machine and increasing number of new model. In increasing in the years 2000 compares to year 1999 is 3 or 25 %. Year 2001increased about 2 from year 2000 Or 13 %. It is noted that when No. of machine increased, overtime then decreased. It was because No of machine increase caused high investment and high labor but in long term, investment is a must.

| Year | 1999 | 2000 | 2001 | 2002 | Increase | %Increase |
|---|---|---|---|---|---|---|
| No.of machine(unit) | 12 | 15 | 16 | 16 | 6 | 50 |

Machine(unit)

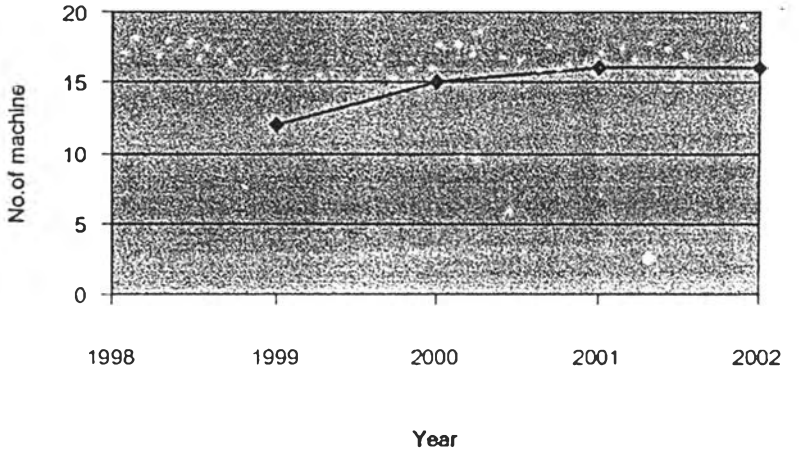



Figure 3.25 Machine trend

- Over time(M-H)

Over time is represented extra time to produce product to meet outstanding target as plan. It is also represented an increase of volume. As in table below ,Overtime in 2000 increased from 1999 about 82 or 158 % but in 2001 overtime decreased from 2000 is average 16% ,whereby year 2001and year 2002 stayed still. This was because volume to be produced is high causing high over time. In the year 2000 overtimes was produced high enough to replace by new operator and machines. The new operator was replaced because the cost of operator was lower than overtime paid. That is why in year 2001and 2002 overtime decreased gradually.

| Year | 1999 | 2000 | 2001 | 2002 | Increase | %Increase |
|---|---|---|---|---|---|---|
| Overtime hrs( mins) | 52 | 134 | 112 | 110 | 82 | 157.69 |

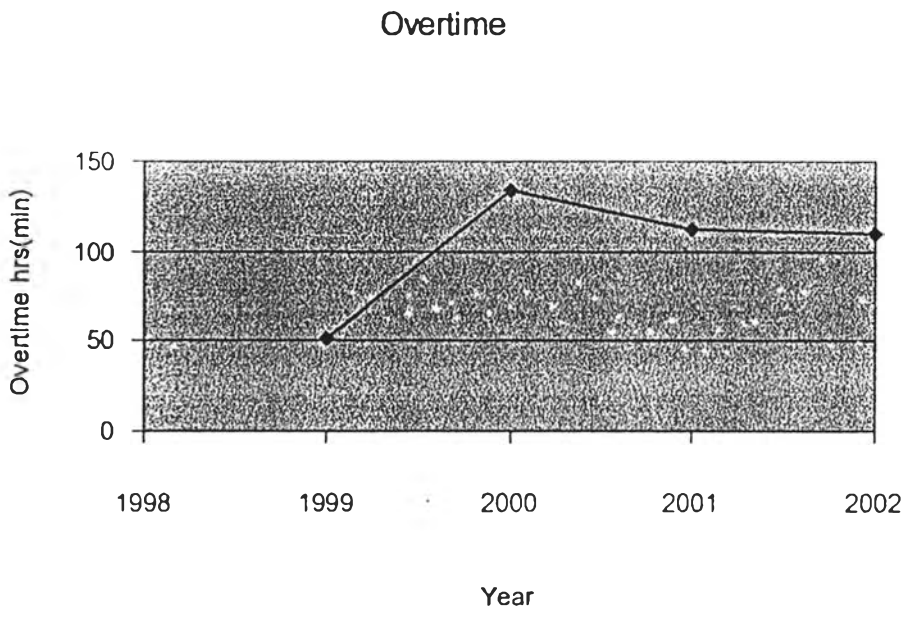



Figure 3.26 Overtime trend

- Area in plant

Area has been increasing in the past 2 years. It is filled with machines ,a number of work in process stock , containers, manpower working area ,route of transportation as below.

- Machine is 30% of space
- Warehouse is 10 % of space
- Work in process is 50 %of space
- Working area is 10 % of space

In 1990 area occupied was about 640 sqm. In 2000 area occupied up to 830 sqm. This year , machine and work in process was very much increased due to high volume. In 2001to 20012 area did not much reduce as shown.

| Year | 1999 | 2000 | 2001 | 2002 | Increase | %Increase |
|---|---|---|---|---|---|---|
| Area occupied | 640 | 830 | 840 | 860 | 200 | 31.25 |

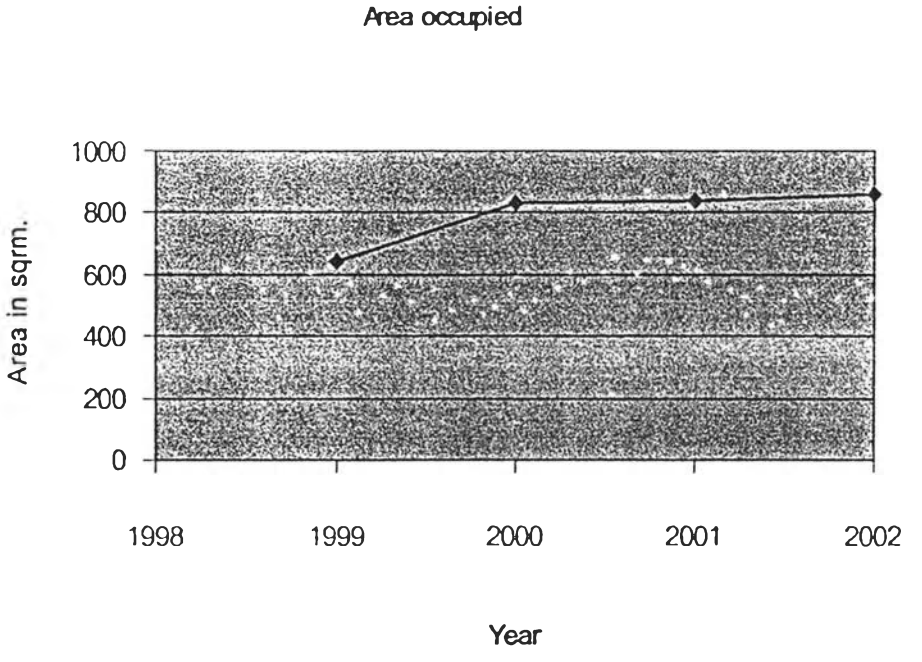



Figure 3.27 Area occupied trend

2. Analyze by item comparison

- Down time compare to working time per day
- labor compare to total output per day
- lead time of product compare to working time per day
- indirect cost compare to other costs

Down time is time that indicates non value added activities. For the case study, down time are such as allowance time, set up time, machine down time, other down time

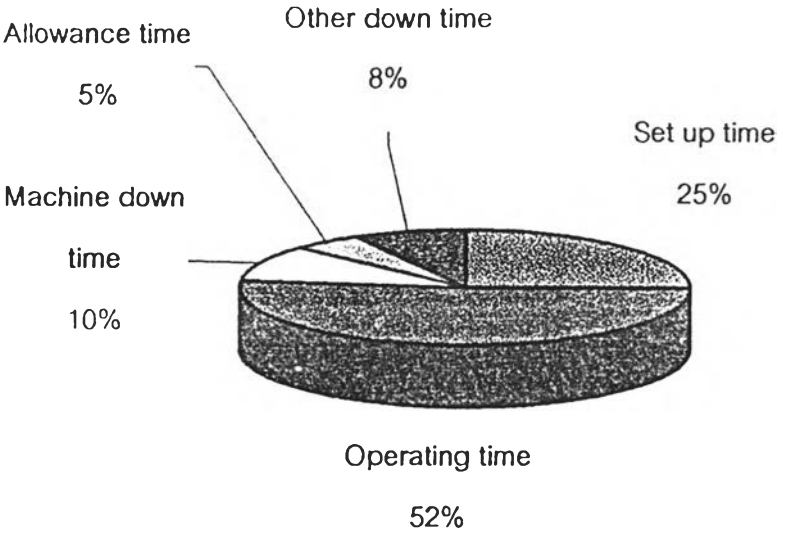



Figure 3.28 Ratio of working time ( data is obtained from Jan- Dec '02 )

In picture 3.28, it can be seen that set up time is the major down time taking up 25%of all working time. Too many processes cause too much set up time. Hence, lead-time is long. Set up time is time to prepare die to get ready for operating. In making wheel, there are many dies to set up but machines are limited. This analysis will analyze the ratio of set up time compares to total working time as shown in figure3.28

It shows that set up time is 25% of total working time per day. Operating time is about 60% per day. Idle time is 5% per day. Machine down time is about 10%, set up time is about one- forth to total working time, total working time is 480 mins. Therefore 25% of working time is 120min. Labor cost per manpower is average 120 baht per day (480 mins). Therefore it is equivalent to 30 baht per day. That means the company has to pay for non-productive 30 baht per person.

But in reality, since it is a mass production there is a sequence in process so that not only 1 manpower involved. Normally there is 1 operator in charge for set up die whereby, the other 4 operators which is in charge of single operating machine are not productive because they have to wait until die are set up completely 4 machines. Therefore cost that is non-productive per day will be 103.42 x 4 = 413.7 baht /day or103,425 per year. It can be concluded that single die has spent on set up die in a great number of expenses. Details of downtime is break-downed into activities as following,

- Details of set up time
  1. Tooling preparation
  2. Take die that located on machine table out
  3. Move a die that wanted to use
  4. Install die in machine table
  5. Tighten it
  6. Set up parameters
  7. Worm up machine
  8. Trail shot
  9. Ready to start mass production

- Details of machine down time
  1. Machine break down unexpectedly
  2. Machine preventive maintenance
  3. Machine set up /adjust

- Details of allowance time
  1. Go to toilet
  2. Fatigue time
  3. Rest time

- Details of other down time
  1. Meeting time
  2. Cleaning line
  3. Transportation
  4. Part delay

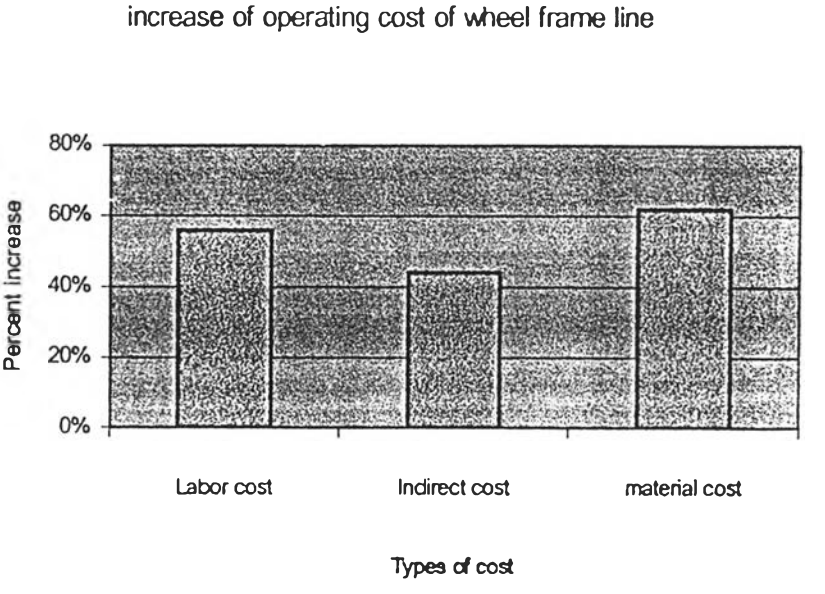



Figure 3.29 operating cost trend

- labor cost compare to output per day

According to data in the last 12-month shows that labor cost is increasing about 56 percent ,whereby indirect cost increase44 percent and material cost is 66%within 12-month time. Data shows that over times has rather permanent due to volume increase. We can see that labor cost is 56%, which is a high cost. In fact, labor is an internal factor that can be controlled. About half of all operators are in charge for press working rather than doing other manual work.

In the case of making wheel frame 10 operators are in charge in operating for processes of making wheel. 1 operator get paid 180 baht per day, so operators will be get paid 180x10 = 1,800 baht /day (not include over time) whereby output in a day is average 3,000 pieces or 17,100 baht per day. The average percentage of operator cost in process compares to unit cost is 10.5 %

Manpower varies from a number of processes, because each process is independent and single process. Especially for machine operation, manpower must be in charge of every single machine. If the company can reduce process or combine process as less as possible, it will be much save cost for labor. The consequence benefit is save machine and save indirect cost and area plant.

3. Capacity compare to demand order

Capacity in the company currently produces about 3,000 wheels a day for average types. Since demand is increasing, this capacity is not meet a customer demand, therefore overtime is almost permanent in order to meet planning volume in "takt time" ( takt time tell us how many pieces the company need to produce per day. It is determined by volume order divided by cycle-time of each station) (Hounshell, p.315). In history record shows that overtime is due to behind schedule in order to be balance in order is increasing.

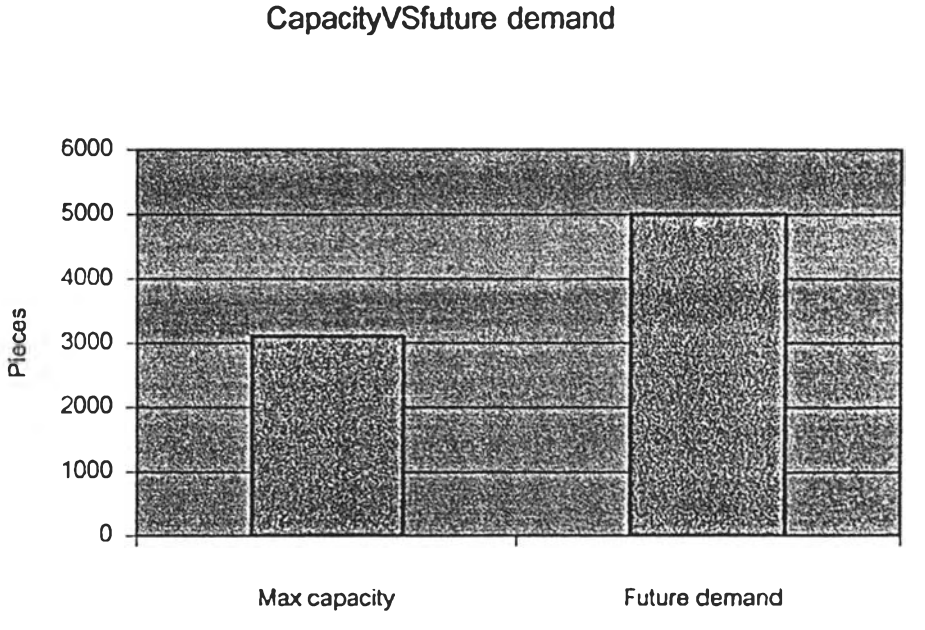



Figure 3.30 capacity VS demand comparison

## 3.13 The advantages of single die

1. Flexibility

Single die is flexibility in such a way to swap , eliminates or combines some process independently ,in case process may change later on, for any suitable circumstance. For example , in wheel frame making

Blanking ⟶ Forming ⟶ Piercing ⟶ Trimming

It can be swap to

Forming ⟶ Piercing ⟶ Blanking

To swap ,combine or eliminate ,it has to consider the consequences process and quality of product.

2. Easy to maintenance

Single die is easy to maintenance because it is less complicate part and do not need any special tool or special care. Spare part is cheaper. More over, it is easy to re-assembly and assembly when it needs to be fixed and maintenance.

3. Less time consuming for design

Single die is less time to design because it is not complicated part. It is consider only in single process. The common components are upper die lower die ,punch pack, die pack, spring, guide

## 3.14 The disadvantages of existing method

1. Lead-time is high

Lead-time of single die is high because there are many factors involved such as set up time, transportation between process, process down time ie. Human error, human allowance manual activities. This makes output per hour low.

2. Machine consuming

Single die does take machine consuming as die has to be installed in one die for one machine. The more process, the more machine consume. That means the more investment the company needs to do if volume increase.

3. Area consuming

Area in plant is limited, while machine is increasing to support single die to cope with volume. Certainly, area of plant has to be occupied by new machines and work in-process.

4. More worker and overtime

Overtime is the first priority to consider in case output does not meet plan. Overtime increase to support outstanding output plan. More workers may need to do so if necessary. That means company needs to pay for overtime or new worker.

5. Operating cost

Operating cost especially, overhead cost does highly increase mainly for labor, maintenance, overtime, and electricity. Moreover, cost to be spent for container used in work in -process increases.