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Optimization of Productivity by Work Force Management through Ergonomics and Standardization of Process Activities using M.O.S.T Analysis-A Case Study

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OPTIMIZATION OF PRODUCTIVITY BY WORK FORCE MANAGEMENT THROUGH ERGONOMICS AND STANDARDIZATION OF PROCESS ACTIVITIES USING M.O.S.T ANALYSIS-A CASE STUDY

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I. Introduction

The rate at which a company produces goods or services in relation to the amount of materials and number of employees needed. This is usually expressed in ratios of inputs to outputs. That is (input) cost per (output) good/service. For calculation purpose, expression of productivity is:

$$\text{Productivity} = \text{Output/ Input}$$

ERGONOMICS (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. Ergonomics is employed to fulfill the goals of health and productivity. Proper ergonomic design is necessary to prevent repetitive strain injuries (RSI), which can develop over time and can lead to long-term disability

MAYNARD OPERATION SEQUENCE TECHNIQUE (M.O.S.T) is a predetermined motion time system that is used primarily in industrial settings to set the standard time in which a worker should perform a task.

The main objective is to achieve OPTIMIZATION of the system with integration of M.O.S.T. and Ergonomics.

II. Literature Review

a) Chronological History of M.O.S.T.

1960-Maynard in the late 1960's, detected striking similarities in the sequence of MTM defined motions whenever an object was handled. The development and release of the MOST happened in the 1960s.

1967–Basic MOST for general industrial applications was developed **Early 1970s**-A variation of MOST known as Admin MOST. Originally developed and released under the name Clerical MOST in the 1970s, it was recently updated to include modern Administrative tasks and renamed. It is on the same level of focus as Basic MOST. It was designed for the clerical activities in office and service environments.

1972-Basic MOST was released in Sweden. It is the most commonly used form of MOST.

1974-Basic MOST was released in United States.

1980-two other variations Mini MOST and Maxi MOST were released.

1991-Lehto, M.R., Sharit, J., Salvendy, G. (16) presented an article on "The application of cognitive simulation techniques to work measurement and methods analysis of production control tasks" in 1991

1996-Koelling, C.P, Ramsey, T.D. presented an article on "Multimedia in Work Measurement and Methods engineering" in 1996.

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2003-A revised Maxi MOST that includes the modification of the Part Handling Sequence Model and a clearer understanding of all of the sequence models and as well Standard method description formats for each sequence model in each MOST System.

Till now no such work is witnessed under this concept.

b) Chronological History of Ergonomics

i. *Foundation*

The foundations of the science of ergonomics appear to have been laid within the context of the culture of Ancient Greece. A good deal of evidence indicates that Greek civilization in the 5th century BC used ergonomic principles in the design of their tools, jobs, and workplaces. One outstanding example of this can be found in the description Hippocrates gave of how a surgeon's workplace should be designed and how the tools he uses should be arranged. The archaeological record also shows that the early Egyptian dynasties made tools and household equipment that illustrated ergonomic principles.

ii. *19th Century*

In the 19th century, Frederick Winslow Taylor pioneered the "scientific management" method, which proposed a way to find the optimum method of carrying out a given task. Taylor found that he could, for example, triple the amount of coal that workers were shoveling by incrementally reducing the size and weight of coal shovels until the fastest shoveling rate was reached. Taylor examined, through time and motion studies, how people carried out their activities, what movement they made and how much time it took. Next he determined how all operations could be executed as effectively as possible to produce as much as possible in the minimum amount of time. That is what is called the 'Taylor system', resulting of course in rushed systems, assembly line production etc.

iii. *Early 1900s*

Frank and Lillian Gilbreth expanded Taylor's methods in the early 1900s to develop the "time and motion study". They aimed to improve efficiency by eliminating unnecessary steps and actions. By applying this approach, the Gilbreths reduced the number of motions in bricklaying from 18 to 4.5, allowing bricklayers to increase their productivity from 120 to 350 bricks per hour.

1935 - Essential progress, during the world war when many pilots were required and airplanes became increasingly complicated, it was discovered that the cockpits were not adequate i.e. logically organized, causing accidents to happen. This was an essential push in the progress of ergonomics. **Edwin Link** developed the first flight simulator. The trend continued and more sophisticated simulators and test equipment were developed. Another significant development was in the civilian sector, where the effects of illumination on worker productivity were examined. This led to the identification of the **Hawthorne Effect,** which suggested that motivational factors could significantly influence human performance.[8]

1949- Origin - The name ergonomics officially proposed at a 1949 meeting of the British Admiralty (July 12), by Prof. Hugh Murrell. The name 'Ergonomics' officially accepted in 1950. The name Ergonomics was derived from the Greek words: Ergon - work; Nomos - natural law. First use of the word actually can be traced to a series of four articles written by Prof. Wojciech Jastrzebowski in Poland in 1857.

1952-The Ergonomic Society was formed in 1952 with people from psychology, biology, physiology, and design in Britain.

1957-The Human Factors Society was formed in 1957. In the US "human factors engineering" was emphasized by the US military with concentration on human engineering and engineering psychology. US efforts also focused on the "role" of an individual within a complex system. **Paul M. Fitts** developed a model of human movement, Fitts's law, based on rapid, aimed movement, which went on to become one of the most highly successful and well studied mathematical models of human motion.

1960- First applied industrial ergonomics group was established by Harry along with Dr. Charles Miller in United States.

1965-The period saw a maturation of the discipline. The field has expanded with the development of the computer and computer applications.

1976-Christensen gave review of ergonomics, expresses the view that the fact that early man specially selected pebbles, made scoops from bone and fashioned tools and utensils in general, is an indication that those early hominids showed 'specific, intelligent reactions to the interactions between man and his environment', something that he considers is the very essence of ergonomics.

1980s- Decade of HCI and software ergonomics.

1982-Office of President of the Society constituted. The Israel Ergonomics Society (IES) founded.

1983- Editorial in Ergonomics concerns the issue of attempts to define ergonomics "The strength of ergonomics is that it does not consider the findings from one discipline to be an irrelevance to the conclusions drawn from another; it is the interaction between the disciplines that makes ergonomics." Brazilian Ergonomics Society (ABERGO) founded on November 30.

1984- An informal group of the Irish Ergonomics Society was formed in October 1984 and in March 1985 was accepted as a Regional Group of the UK Ergonomics Society Second Brazilian Ergonomics Congress.

1985 -The Finnish Ergonomics Society (FES) founded Ergonomics Society of Southern Africa was formally inaugurated at the Council for Scientific and Industrial Research Conference Centre in Pretoria.

1986- Separate Ergonomics Societies for New Zealand and Australia (New Zealand Ergonomics Society and the Ergonomics Society of Australia, ESA) formed.

1987 -DEF STAN 00-25 Human factors for designers of equipment.

1988-The Hellenic Ergonomics Society (HES) founded The Asociación Española de Ergonomía (AEE)/Spanish Ergonomics Association was created MOD adopts MANPRINT philosophy .

1989- Brian Shackel gives a lecture at the Annual Conference entitled "Ergonomics from Past to Future". 89/392/EEC Directive on the safety of machinery.

c) The 1990s

1990-90/269/EEC Directive on the minimum safety and health requirements for the manual handling of loads 90/270/EEC Directive on the minimum safety and health requirements for work with display screenequipment (ISO 9241 supports this).

1993- The Human Factors Society changed its name to The Human Factors and Ergonomics Society. The Ergonomics Society of Taiwan (EST) founded.

1994 -1300 members The Irish Ergonomics Society was formally launched.

1997- 1247 members The Icelandic Ergonomics Society was established under the formal name of Vinnuvistfrae DifélagÍslands or VINNÍS.

1999- The Ergonomics Society celebrates its 50th anniversary with an exhibition at the Science Museum entitled the Human Factor.

d) The new century

2001- Start of investigations into a Royal Charter for the Society.

2002-Macro Ergonomics was defined by Hendricks and Kleiner .The Ergonomics Process model presented takes a "top down" approach to the design of work systems that carry through to the human-machinesoftware interface within the organization. It also takes a "bottom up" approach by engaging employees in the process from the beginning.

2004-Lean manufacturing principles were introduced by Liker which strive to eliminate waste, errors and unnecessary actions and include only those value-added components to enhance the process flow.

2007- The Ergonomics process model was implemented.

JULY 2009- The Japan Ergonomics Society as a general corporate juridical body was founded.

JUNE 2010-The 1st annual general meeting of members was held (during the 51st conference of the JES at Hokkaido University).

Till 2013-55 institutes are been established for research and study in various displines of ergonomics.

III. Proposed Methodolgy

a) The Concept of Ergonomics

Ergonomics is the study of designing equipment and devices that fit the human body, its movements and its cognitive abilities. Ergonomics is concerned with the 'fit' between the user, equipment and their environments. It takes account of the user's capabilities and limitations in seeking to ensure that tasks, functions, information and the environment suit each user.

b) Steps Involved In Ergonomics

- GEMBA Analysis Check Sheet
- Posture Analysis Check Sheet
- Scoring sheet on the basis of posture analysis check sheet
- Summary sheet on the basis of scoring sheet.

Here the ergonomic study of any system is done with the help of 4 sheets which decides the fitness of any Unit on the basis of-

1. Safety of the worker with respect to the working environment, machinery and equipments.
2. Evaluation of manual work done by the worker on the basis of movement in BACK, NECK, SHOULDER/ARM and WRIST/HAND both by observer's assessment and worker's assessment.

1. Gemba Analysis Check Sheet

INITIAL EVALUATION SHEET

GEMBA ANALYSIS SHEET

Area:	Line:
Operation:	Workforce type:

GEMBA ANALYSIS	YES	NO	PPE	REMARKS
Fall by persons				
Falling parts				
Collision against fixed r moving obstacle				
Cuts, Wounds				
Crushing, Shearing				
Dragging by mechanicl elements				
Projection of particles				
Use of chemical producs				
Considerable presenceof smoke, aerosols, dust				
Burns				
Contact with live elemets				
Procurement/unloading:				
Parts & packaging by frk - lift truck				
Operation carriec out by the section				
Changing of tools				
Maintenance				
Noise				
other				

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2. Posture Analysis Check Sheet

Observer's Assessment

Back

A When performing the task, is the back
(select worse case situation)

A1 Almost neutral?
A2 Moderately flexed or twisted or side bent?
A3 Excessively flexed or twisted or side bent?

B Select ONLY ONE of the two following task options:

EITHER

For seated or standing stationary tasks. Does the back remain in a static position most of the time?

B1 No
B2 Yes

OR

For lifting, pushing/pulling and carrying tasks (i.e. moving a load). Is the movement of the back

B3 Infrequent (around 3 times per minute or less)?
B4 Frequent (around 8 times per minute)?
B5 Very frequent (around 12 times per minute or more)?

Shoulder/Arm

C When the task is performed, are the hands
(select worse case situation)

C1 At or below waist height?
C2 At about chest height?
C3 At or above shoulder height?

D Is the shoulder/arm movement

D1 Infrequent (some intermittent movement)?
D2 Frequent (regular movement with some pauses)?
D3 Very frequent (almost continuous movement)?

Wrist/Hand

E Is the task performed with
(select worse case situation)

E1 An almost straight wrist?
E2 A deviated or bent wrist?

F Are similar motion patterns repeated

F1 10 times per minute or less?
F2 11 to 20 times per minute?
F3 More than 20 times per minute?

Neck

G When performing the task, is the head/neck bent or twisted?

G1 No
G2 Yes, occasionally
G3 Yes, continuously

Worker's Assessment

Workers

H Is the maximum weight handled MANUALLY BY YOU in this task?

H1 Light (5 kg or less)
H2 Moderate (6 to 10 kg)
H3 Heavy (11 to 20kg)
H4 Very heavy (more than 20 kg)

J On average, how much time do you spend per day on this task?

J1 Less than 2 hours
J2 2 to 4 hours
J3 More than 4 hours

K When performing this task, is the maximum force level exerted by one hand?

K1 Low (e.g. less than 1 kg)
K2 Medium (e.g. 1 to 4 kg)
K3 High (e.g. more than 4 kg)

L Is the visual demand of this task

L1 Low (almost no need to view fine details)?
*L2 High (need to view some fine details)?
** If High, please give details in the box below*

M At work do you drive a vehicle for

M1 Less than one hour per day or Never?
M2 Between 1 and 4 hours per day?
M3 More than 4 hours per day?

N At work do you use vibrating tools for

N1 Less than one hour per day or Never?
N2 Between 1 and 4 hours per day?
N3 More than 4 hours per day?

P Do you have difficulty keeping up with this work?

P1 Never
P2 Sometimes
*P3 Often
** If Often, please give details in the box below*

Q In general, how do you find this job

Q1 Not at all stressful?
Q2 Mildly stressful?
*Q3 Moderately stressful?
*Q4 Very stressful?
** If Moderately or Very, please give details in the box below*

** Additional details for L, P and Q if appropriate*

* L

* P

* Q

3. Marking Sheet

Exposure Scores Worker's name ____________________ Date __________

Back

Back Posture (A) & Weight (H)

	A1	A2	A3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Back Posture (A) & Duration (J)

	A1	A2	A3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Weight (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Now do **ONLY** 4 if static
OR 5 and 6 if manual handling

Static Posture (B) & Duration (J)

	B1	B2
J1	2	4
J2	4	6
J3	6	8

Score 4

Frequency (B) & Weight (H)

	B3	B4	B5
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 5

Frequency (B) & Duration (J)

	B3	B4	B5
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 6

Total score for Back
Sum of scores 1 to 4 **OR**
Scores 1 to 3 plus 5 and 6 ______

Shoulder/Arm

Height (C) & Weight (H)

	C1	C2	C3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Height (C) & Duration (J)

	C1	C2	C3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Weight (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Frequency (D) & Weight (H)

	D1	D2	D3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 4

Frequency (D) & Duration (J)

	D1	D2	D3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 5

Total score for Shoulder/Arm
Sum of Scores 1 to 5 ______

Wrist/Hand

Repeated Motion (F) & Force (K)

	F1	F2	F3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 1

Repeated Motion (F) & Duration (J)

	F1	F2	F3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Force (K)

	J1	J2	J3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 3

Wrist Posture (E) & Force (K)

	E1	E2
K1	2	4
K2	4	6
K3	6	8

Score 4

Wrist Posture (E) & Duration (J)

	E1	E2
J1	2	4
J2	4	6
J3	6	8

Score 5

Total score for Wrist/Hand
Sum of Scores 1 to 5 ______

Neck

Neck Posture (G) & Duration (J)

	G1	G2	G3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 1

Visual Demand (L) & Duration (J)

	L1	L2
J1	2	4
J2	4	6
J3	6	8

Score 2

Total score for Neck
Sum of Scores 1 to 2 ______

Driving

M1	M2	M3
1	4	9

Total for Driving ______

Vibration

N1	N2	N3
1	4	9

Total for Vibration ______

Work pace

P1	P2	P3
1	4	9

Total for Work pace ______

Stress

Q1	Q2	Q3	Q4
1	4	9	16

Total for Stress ______

4. Scoring Sheet

Microsoft Excel - 1.summary sheet [Compatibility Mode]

ERGONOMICS SUMMARY SHEET

Area:

Line:

Operation:

Workforce : Permanent / flex / temp

PHYSICAL RATING

Exposure scores for body area

Score	Exposure level			
	Low	Moderate	High	Very high
Back(static)	8-15	16-22	23-29	29-40
Back(moving)	10-20	21-30	31-40	41-56
Shoulder/arm	10-20	21-30	31-40	41-56
Wrist/hand	10-20	21-30	31-40	41-46
Neck	4-6	8-10	12-14	16-18

Exposure scores for other factors

Score	Exposure level			
	Low	Moderate	High	Very High
Driving	1	4	9	.
Vibration	1	4	9	.
Work pace	1	4	9	.
Stress	1	4	9	16

Stage status (✔ in the blank space)

< 40%	GREEN	
41-50%	YELLOW	
>51%	RED	

Page 1

OBSERVATION (IF ANY):

▼ *PHYSICAL*

-
-
-
-
-

▼ *COGNITIVE*

-
-
-
-

i. *For Static Handling*

Total sum of maximum Index Values (Back+Shoulder/Arm+Wrist/Hand+Neck) =162(value comes from above charts)

$$\% \text{ Value} = 100/162 = 0.61728$$

ii. *For Manual Handling*

Total sum of maximum Index Values (Back+Shoulder/Arm+Wrist/Hand+Neck)= 176(value comes from above charts)

$$\% \text{ Value} = 100/176$$

$$= 0.56818$$

The total index value is calculated for the BACK, SHOULDER/ARM, WRIST/HAND and NECK and the sum of all the values is multiplied by 0.61728 for static or 0.56818.

Example-Summation of index values of BACK + SHOULDER/ARM + WRIST/HAND +NECK=143 (for static handling).

$$\% \text{ value} = 143 * 0.61728$$

$$= 88.27\% \text{ (RED)}$$

The percentage achieved is checked on the basis of Y.G.R Analysis i.e. <40% GREEN, 41-50% YELLOW and >51% RED.

c) The Concept of M.O.S.T.

It was considered that all manual operations were combinations of basic elements. So these were isolated and identified so that methods could be accurately explained and improved. It was reasoned that to reduce the motion of a task was to reduce the effort and time to perform the task. The result is higher production and increased service level.

M.O.S.T. is used primarily in industrial settings to set the standard time in which a worker should perform a task. To calculate this, a task is broken down into individual motion elements, and each is assigned a numerical time value in units known as time

Time Units

1 TMU = 0.00001 hour

1 TMU = 1 Hour /1 lakh times

= 3600 / 100,000 = .036 seconds

1 TMU = 0.036 second or 1 second = 27.8 TMU

The time value in TMU for each sequence model in Basic MOST is calculated by adding the index values and multiplying the sum by 10. A fully indexed General Move Sequence Model might appear whose TMU is calculated as follows:

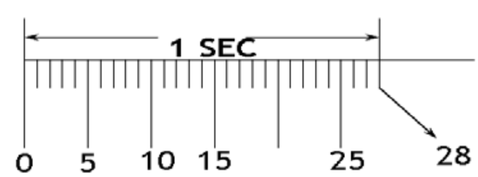
A6 B6 G1 A1 B0 P3 A0

measurement units, or TMUs, where 100,000 TMUs is equivalent to 1 hour. All the motion element times are then added together and any allowances are added, and the result is the standard time. It is much easier to use form of the older and now less common Methods Time Measurement technique, better known as MTM.

Example- walk three steps and pick up a light package from the floor arise and place the package with some adjustments on a scale to be weighed.

- The ***General Move Sequence Model*** is used for the spatial movement of an object freely through the air.
- The ***Controlled Move Sequence Model*** is used for the movement of an object when it remains in contact with a surface or is attached to another object during the movement (e.g., the movement of the object is controlled).
- The ***Tool Use Sequence Model*** is used for the use of common hand tools.

ACTIVITY	SEQUENCE MODEL	PARAMETERS
General Move	A B G A B P A	A-Action Distance B- Body Motion G-Gain Control P- Placement
Controlled Move	A B G M X I A	M-Move Controlled X-Process Time I- Alignment
Tool Use	A B G A B P * A B P A (*represents type of Tool Use)	F-Fasten L- Loosen C- Cut S- Surface Treat M- Measure R- Record T- Think



Where:

A6 = Walk three to four steps to object location

B6 = Bend and arise to gain control of the object

G1 = Gain control of one light object

A1 = Move object a distance within reach

B0 = No body motion

A0 = No return

P3 = Place object with adjustments

General Move Sequence Model : **A6 B6 G1 A1 B0 P3 A0**

Add index values : **6 + 6 + 1+ 1+ 0+ 3+ 0 = 17**

Multiply by = 7 x 10 = **170 TMU**

Or, approximately 6.1 seconds

All time values established using MOST reflect the effort of an average skilled, trained operator working at an *average performance level* or *normal pace* (3 Miles per Hour). This is often referred to as the 100% performance level that in MOST of skill and effort. Therefore when using MOST, it is not necessary to adjust times unless they must conform to particular high task plans used by some companies. This also means that a properly established time standard, using MOST, MTM or stopwatch study, will give nearly identical results in TMU.

IV. Experiment and Result

CASE STUDY 1: Manufacturing of CROWN WHEEL both Machining process and heat-Treatment processes at "TATA MOTORS", Lucknow.

PROCESS : Manufacturing of crown wheel includes-

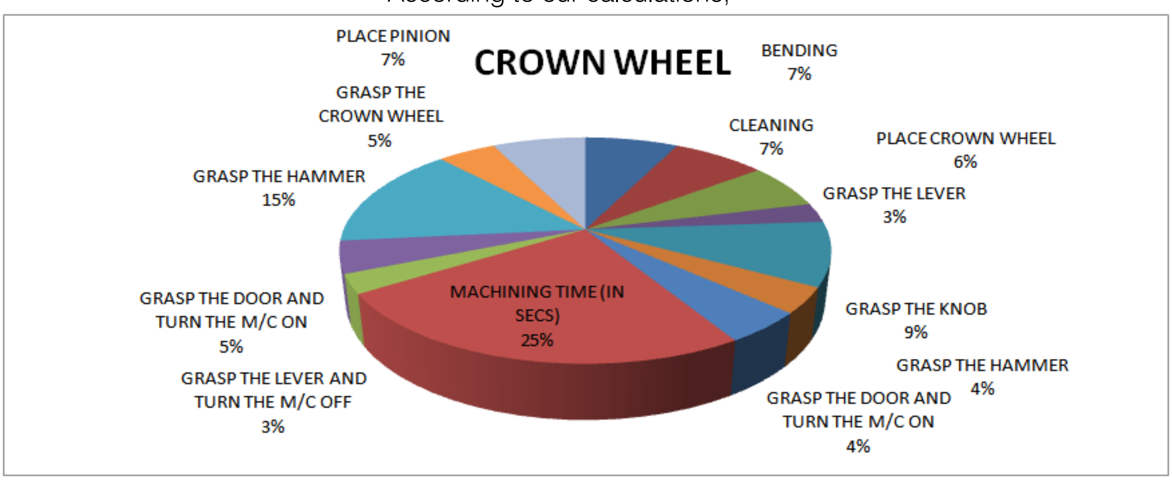
1. Loading of Crown Wheel.
2. Machining process in the Phoenix machine.
3. Unloading of Crown Wheel.
4. Loading of Crown Wheel for Heat Treatment.
5. Heat treatment
6. Unloading of Crown Wheel from the furnace.

Result

S.NO	PROCESS	T.M.U	SECONDS	MINUTES
1.	CROWN WHEEL (PRE HT)	8323.32	299.4	4.99
2.	CROWN WHEEL (HT)	17200	619.2	10.32
	TOTAL	25523.32	918.6	15.31

Total time required for complete manufacturing of 1 piece of crown wheel is 15.31 mins

According to our calculations,

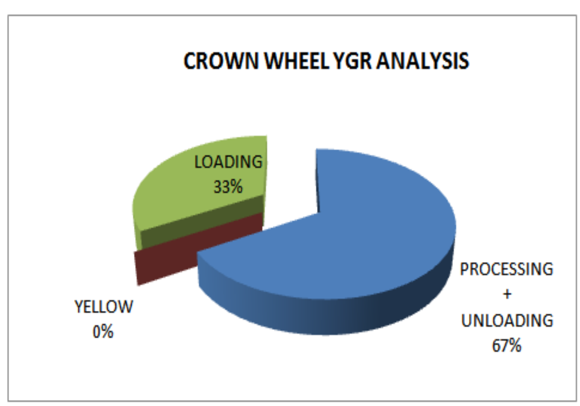


Y.G.R. Analysis

RED-Loading in Heat Treatment (71.27%) and Unloading in pre Heat Treatment (83.09%) of Crown Wheel.

GREEN-Loading (25%) in pre Heat Treatment and Unloading (28%) of Crown Wheel in Heat Treatment process.

YELLOW- Nil



a) Problems and Implementation

Problem 1 : Excessive Bending while punching no. on crown Wheel.

Implementation : Substation or platform of waist height of an average worker was constructed so that loading of crown wheel can be directly done at the platform (without bending) from the palette.

After loading at the platform punching of numbers must take place and then crown wheels must be forwarded towards the furnace .

Figure : Excessive Bending on crown Wheel

Problem 2 : Excessive push and pull while transportation between stations.

Implementation : Auto - Fork lift must be used for transportation.Stacking of pinions in trolley must be avoided.

.

Figure : Excessive push and pull while transportation between stations

Problem 3 : Excessive stress on back while loading and loading process.

Implementation : Trolleys of waist height of an average men must be used so that their can be no discrepancies. Bins of Standard Height / Make should be use.

Figure : Manufacturing of SHOCK ABSORBER HEAD for cars at Vinayak Lko

CASE STUDY 2 : Manufacturing of SHOCK ABSORBER HEAD for cars at Vinayak Ind Lucknow.

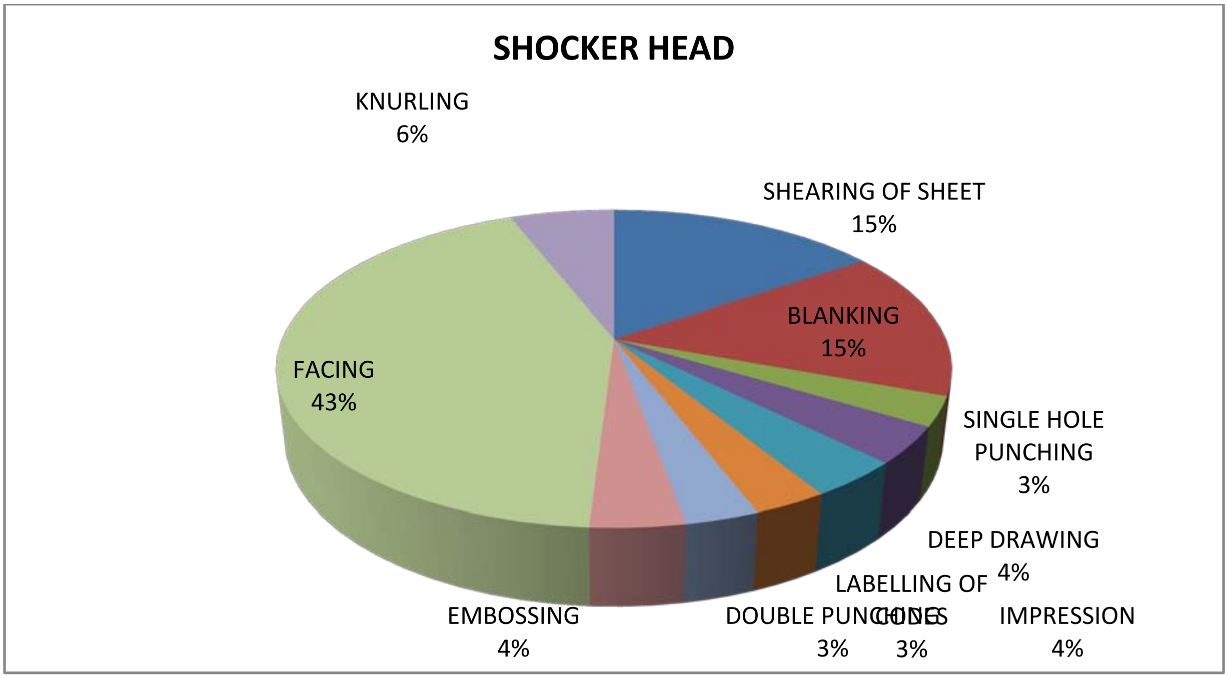
PROCESS : Manufacturing of Shock Absorber Head includes-

1. Shearing of sheets.
2 Blanking.
3. Single punching in the centre of the blanks.
4. Deep drawing.
5. Impression.
6. Labeling codes.
7. Double Hole Punching.
8. Embossing
9. Facing.
10. Knurling of bolts.

Result

S.NO	PROCESS	T.M.U	SECONDS	MINS
1.	SHEARING OF SHEETS	1341.8	48.3	0.80
2.	BLANKING	1303.6	46.93	0.78
3.	SINGLE HOLE PUNCHING	257.8	9.2808	0.15
4.	DEEP DRAWING	257.8	9.2808	0.15
5.	IMPRESSION	325.6	11.72	1.20
6.	LABELLING	325.6	11.72	1.20
7.	DOUBLE HOLE PUNCHING	257.8	9.2808	0.15
8.	EMBOSSING	327.8	11.801	0.20
9.	FACING	3714	133.7	2.23
10.	KNURLING OF BOLTS	515.6	18.562	0.31
	TOTAL	8627.4	310.5754	7.17

Total time required for complete manufacturing of 1 piece of shocker head is 7.17 mins According to our calculations

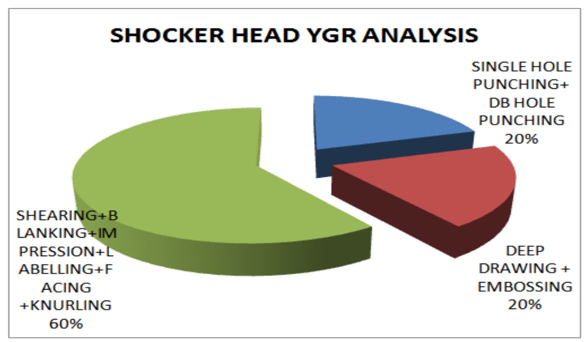


Y.G.R ANALYSIS

RED-Shearing of Sheets (65.48%).Blanking (67%), Impression (50.76%),Labeling of Codes (53%), Facing (57.86%) and Knurling of Bolts (67%).

GREEN-Double Punching (32%) and Single Hole Punching (25.88%).

YELLOW-Deep Drawing (50%) and Embossing (47%)



b) Problems and Implementation

PROBLEM 1 : Absence of Spot Welding Unit due to which fitment is sent out of plant for the purpose which effects the production time per piece. Spot Welding of 1 lot of 1000 parts takes 7 days for completion.

IMPLEMENTATION : Spot Welding Unit must be established with in the plant so that no extra time is wasted in unnecessary part handling.

PROBLEM 2 : Poor material handling and storage facilities which increases the NON- VALUE ADDED Cost with increase in wastage of parts.

Vinayak Ind Lko (Shows Poor material handling and storage facilities)

IMPLEMENTATION : Proper storage of finished parts should be done and material handling should be done carefully to avoid any extra wastage of time or material.

PROBLEM 3: Parts are sent out of plant for zinc plating which take minimum 3 days per 1000 parts.

IMPLEMENTATION: Zinc plating of the parts must be done in the plant to avoid excess wastage of time.

PROBLEM 4: Excessive Bending of back D
uring loading and unloading of parts in Shearing of sheets,Blanking,Impression,Facing, Labeling of Codes and Knurling of Bolts.

IMPLEMENTATION : Trolleys and Bins of average Human Waist height are used so that bending while Loading and Unloading of parts is avoided.

CHALLENGES FACED DURING THE ANALYSIS: Challenges faced during the completion of whole project are-

- Mixed dropping of different models.
- Workers were unaware of ergonomics and M.O.S.T and hence could not understand questions properly.
- Visibility problems of fitment especially in taking videos for the MOST.
- Safety risk involved on the line due to the use of heavy load machines.
- To cope up with the rate of production.
- Work on some stations was not according to the station description card of that station.

V. Conclusion

The purpose of this RESEARCH was to give an idea of the basic functioning of a real industry. This ANALYSIS has not only given an exposure to the various techniques employed in production units but also has added a new dimension to vision of knowledge. It has given the basic idea of the working of an industry and the core of every industry lie its fundamentals MAN MACHINE AND MATERIAL and how the cohesion between them is needed for the smooth running of any industrial organization.

The productivity of any system depends on the INPUT and OUTPUT associated with the work function. **Hence for the overall OPTIMIZATION of any system requires-**

1. INCREASE THE OUTPUT **STANDARIZATION** of the process is needed which is achieved by evaluating STANDARD TIME REQUIRED PER PROCESS.
2. M.O.S.T helps in evaluating the standard time per cycle and it also ignores the unnecessary activities.
3. Hence M.O.S.T helps in complete **STANDARI-ZATION** of the process
4. INCREASE THE INPUT **WORK FORCE MANAGEMENT** is required which is successfully achieved by ERGONOMICS. The plant layout and designing of the machinery is done keeping in mind the fitness of the worker so that it may not lead to any temperamental or chronic hazard as well as VA/NVA of the product is calculated so that least value of NVA is invested per product.
5. Hence Ergonomics helps in complete **WORK FORCE MAANGEMENT** of the system.
6. **So together the integration of M.O.S.T and ERGONOMICS leads to OPTIMIZATION of PRODUCTIVITY.**

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