SHRI GURU GOBIND SINGHJI INSTITUTE OF ENGINEERING & TECHNOLOGY ,NANDED

EDUCATION OF HUMAN POWER FOR TECHNOLOGICAL EXCELLENCE

उत्कृष्ट तंत्रज्ञानार्थम जनशक्ती शिक्षणम

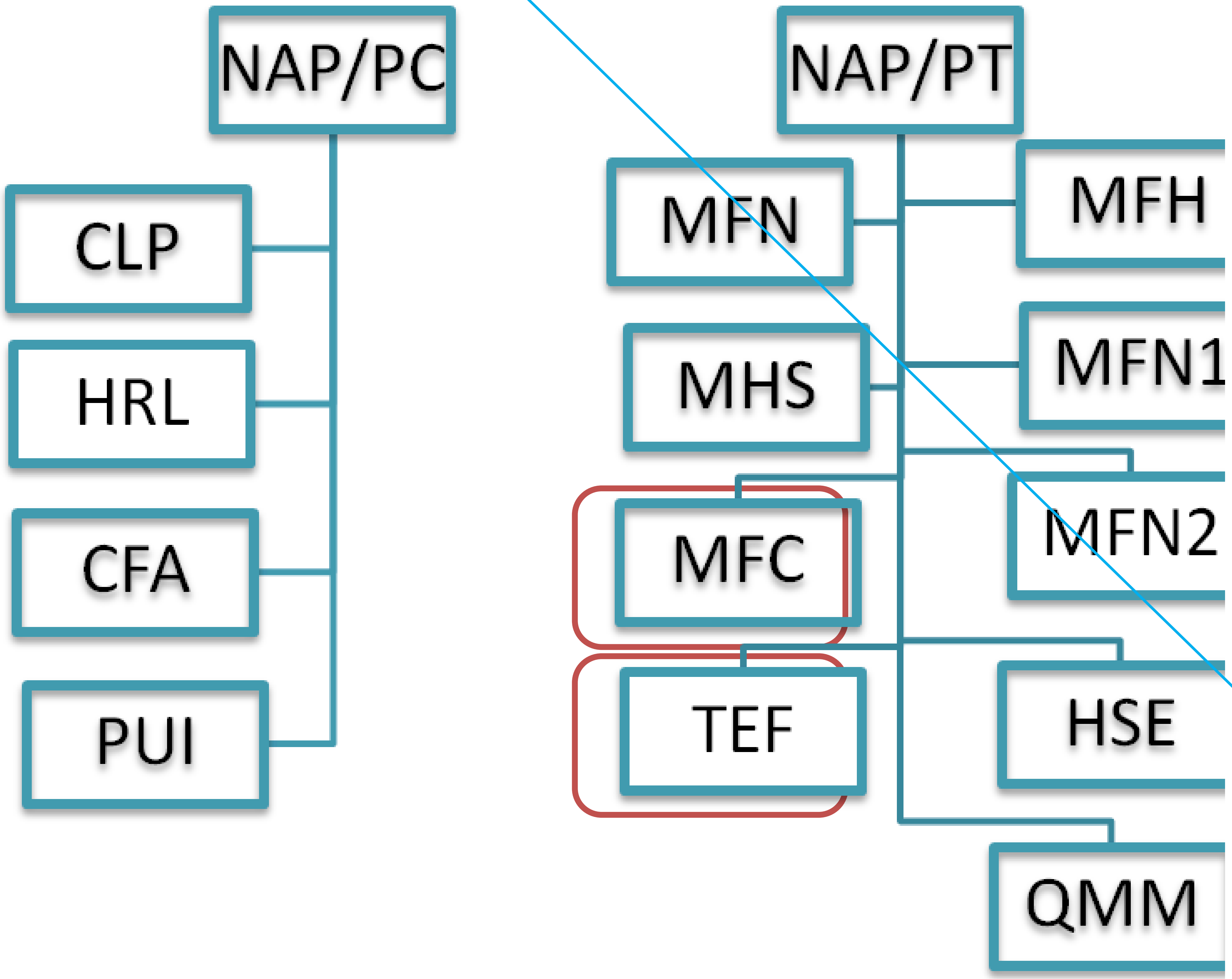
BOSCH

P1-Time standards establishment to improve manpower utilization

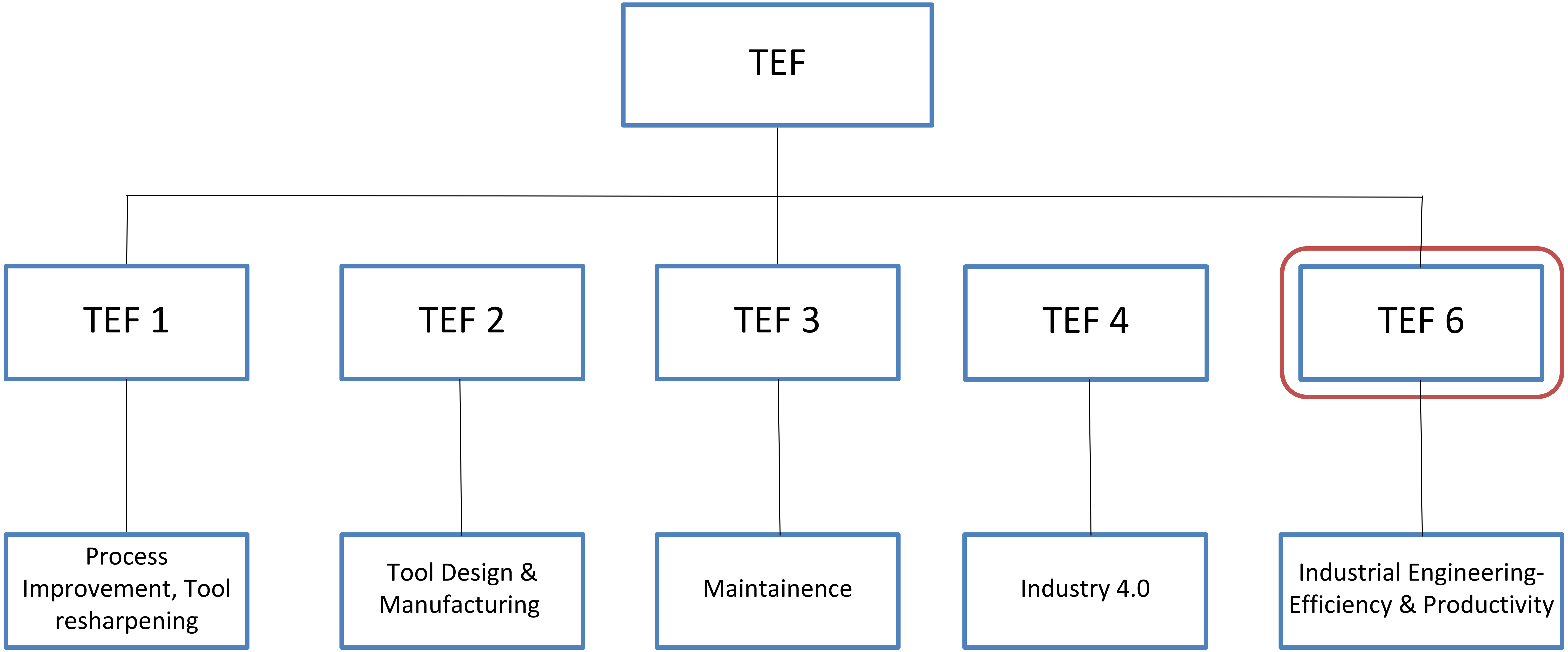
P2- Designing a gravity-based conveyor system to eliminate defects and improve the process.

BOSCH LTD. – NASHIK

Plant Overview:



TEF- Technical Engineering Functions



TIME STUDY DEFINITION

Time study is a work measurement technique for recording the times standards of working for the elements of a specified job carried out under specified conditions and for analysing the data so as to obtain the time necessary for carrying out the job at defined level of performance

Objective Of Time Study

To set labour standard
To compare alternative methods
To determine standard cost
Equipments & labour requirements
Basic times / normal times
Number of machines an operator can handle
Cycle time for completion of a job

Time Study by Stop Watch

1. Select the job to be studied

- New job
- change in manufacturing method
- design change
- when labour cost is high
- when new tools are used

2. Select the Worker to be studied

- This Process is carried out to identify the qualified worker in the organization

3. Conduct Stopwatch Study

- Collect and records of information
- record the method of doing the job and breakdown to elements.

ELEMENTS: It is the distinct part of a specified job selected for convenience of observation and analysis.

Steps in making a time study

Obtaining & recording all information available about job

Recording complete description of method

Examine the detail breakdown

Measuring with timing device & record time taken

Examine the detail breakdown

At same time, assessing effective speed of working of the operative relative to observer's concept of the rate corresponding to standard rating

Extending the observed time to basic time

Basic time = Observes time*Observed rating

Determining the allowances to be made over & above the basic time for operation

Determining the standard time for the operation

Standard time= Basic time + Allowances

Summary of activities data obtained

Sr.	Activity	Avg	Count	Sum (mins)	Utilized mins	Available hrs	Utilization
		3.99	81	83.99	83.88	450	18.64
		6	8	48.17	48.17	450	10.704
		5.1	16	81.6	81.6	450	18.13
		1.65	21	34.55	34.55	450	7.677
		3.34	34	113.62	113.62	450	25.248
		9.54	22	209.81	209.81	450	46.624
		3.99	15	59.82	59.82	450	13.293
		18.6	16	279.06	279.06	450	62.013
		9.28	14	129.87	129.87	450	28.86
		42.87	16	685.87	685.87	450	152.41
		16.53	20	330.62	330.62	450	73.471
		0.9	16	14.39	14.39	450	3.1977
		2.61	12	31.32	31.32	450	6.96
		8.36	15	125.43	125.43	450	27.873
		1.93	14	27.02	27.02	450	6.0044
		4.45	20	88.91	88.91	450	19.757
		1.43	7	10.02	10.02	450	2.226
		1.99	5	9.97	9.97	450	2.215
		1.99	4	7.97	7.97	450	1.771
		1.07	4	4.28	4.28	450	0.9511
		1.88	5	9.4	9.4	450	2.088
		7.92	18	142.56	142.56	450	31.68
		14.55	4	58.2	58.2	450	12.933

43	6	14.56	14.56	450	3.235
54	6	3.27	3.27	450	0.7266
62	7	4.37	4.37	450	0.9711
65	5	3.24	3.24	450	0.72
54	5	2.69	2.69	450	0.5977
.8	5	3.99	3.99	450	0.886
91	6	5.44	5.44	450	1.208
48	6	2.9	2.9	450	0.644
64	6	3.83	3.83	450	0.851
63	6	3.81	3.81	450	0.846
34	34	113.62	113.62	450	25.248
.5	5	2.48	2.48	450	0.5511
75	7	5.24	5.24	450	1.164
58	7	4.09	4.09	450	0.908
49	6	2.95	2.95	450	0.655
58	6	3.51	3.51	450	0.78
78	7	12.47	12.47	450	2.771
98	6	5.58	5.58	450	1.24
05	5	5.25	5.25	450	1.166
.8	5	53.99	53.99	450	11.997
11	6	6.67	6.67	450	1.4822
43	5	2.13	2.13	450	0.4733
77	6	4.61	4.61	450	1.0244
59	29	45.97	45.97	450	10.215
79	65	116.58	116.58	450	25.906
.2	69	84	84	450	18.66
99	21	83.88	83.88	450	18.64
02	8	48.17	48.17	450	10.704
65	21	34.55	34.55	450	7.677
82	64	11.6.58	116.58	450	25.906
.4	13	294.1	294.1	450	65.35

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Result

- These are the list of activites that are carried out in LOGISTIC DEPARTMENT - Outbound.
- These are classified as per the process
- Req. Utilisation = Total utilisation – allowances
- Allowances = Lunch / Tea Brakes, Bio Brakes, etc
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- In Result we got the required manpower number reduction from 10 to 6.

	Avg Volume		Daily Work Content & MP requirement		
Part	Monthly	Daily	Work content (Mins)	Total work Content(Mins)	Manpower Req @95% Utilisation
[illegible]	72850	2914	210		
[illegible]	13877	555	60		
[illegible]	314877	12595	216		
[illegible]	72946	2918	130		
[illegible]	282567	11303	686		
[illegible]	251296	10052	331		
[illegible]	21196	848	14		
[illegible]	34008	1360	31		
[illegible]	37857	1514	125	2359	5.5
[illegible]	22580	903	27		
[illegible]	17785	711	27		
[illegible]	1250	50	27		
[illegible]	76231	3049	87		
[illegible]	NA				
[illegible]	45000	1800	125		
...ities			262		

Conclusion - Overall productivity increased by 20 % from this study for all Departments of MFN, Milkrun, LOG Outbound.

Introduction to Process Improvement Project: Gravity-Based Conveyor System

- This project aims to improve the injector manufacturing process by designing a gravity-based conveyor system.
- Currently, manual part transfers cause ergonomic strain and inefficiencies.
- The new system will automate transfers using simple mechanics, improving safety, reducing defects, and minimizing waste for a more efficient production process.

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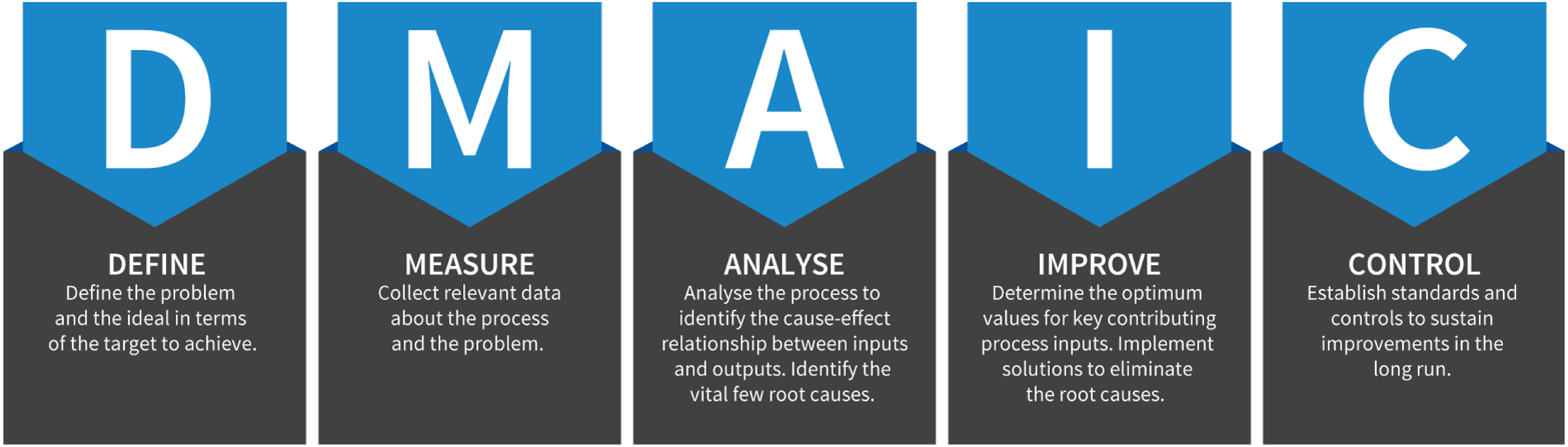
Methodology



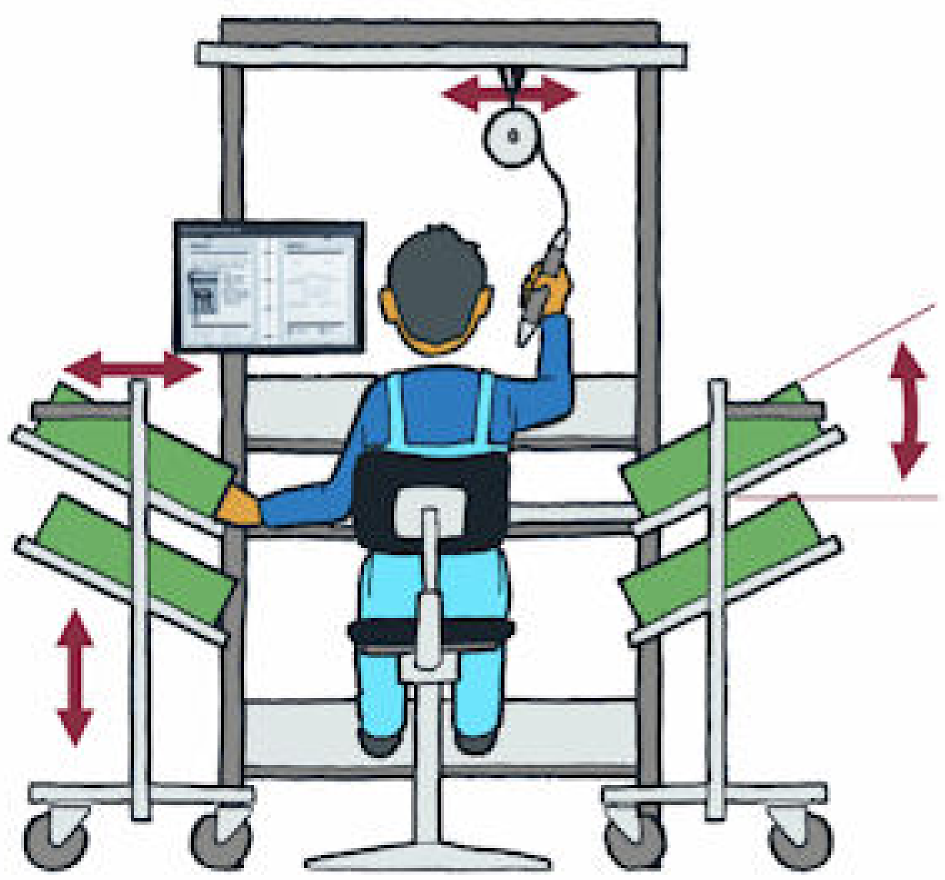
Define Steps

1. Project Risk Assessment
2. Problem Definition
3. Justify Choice
4. Team Charter
5. Project Plan
6. Past Data Analysis – Problem History
7. Process Mapping
8. Gemba Observations (4M)
9. Setup/Trials
10. Result Analysis

1. Problem Definition – Ergonomic issues

Problem Definition:

- **Repetitive Lifting and Positioning**: Operators manually transfer parts between Gun drilling 1.43 and Gun drilling 2.2.
- **Ergonomic Strain**: Task causes musculoskeletal injuries and reduces operator efficiency.
- **Increased Absenteeism and Turnover**: Physical exertion leads to higher absenteeism and turnover rates.
- **Inconsistent Part Handling**: Contributes to higher defect rates and diminished process reliability.
- **Operational Impact**: Negatively affects worker safety, satisfaction, and overall operational efficiency.



Cause and effect Diagram- Ergonomic issues

2. Problem Definition – Operation missing

WHAT

What is the problem?

Diameter hole is not properly drilled/ Missing

What has the problem?

Injector parts.

What is the impact?

Leads to rework and defective pieces.

WHERE

Which location ?

Gu 1.4-Dia 2.2

Which process detected?

During quality inspection

Which processes generated?

Dia 1.4/Dia 2.2

Cause and effect Diagram- Operation missing

Problem Definition - Photographs

BAD

GOOD

3. Oil Wastage

Problem Definition:

- Manual handling of parts between Gun drilling 1.43 and 2.2 causes excessive oil spillage, increasing material costs and requiring additional cleanup efforts, which reduce productivity.
- Oil spillage creates hazardous working condit immediate intervention to improve workplace s
- Excessive oil wastage contributes to environmental pollution and poses challenges for regulatory compliance, emphasizing the need for more sustainable pr

Karakuri kaizen

Two stage karakuri model designs.

Model design stage

Data analysis stage.

Karakuri Kaizen Overview

Japanese Approach: Enhances productivity and quality using simple, automated mechanisms.

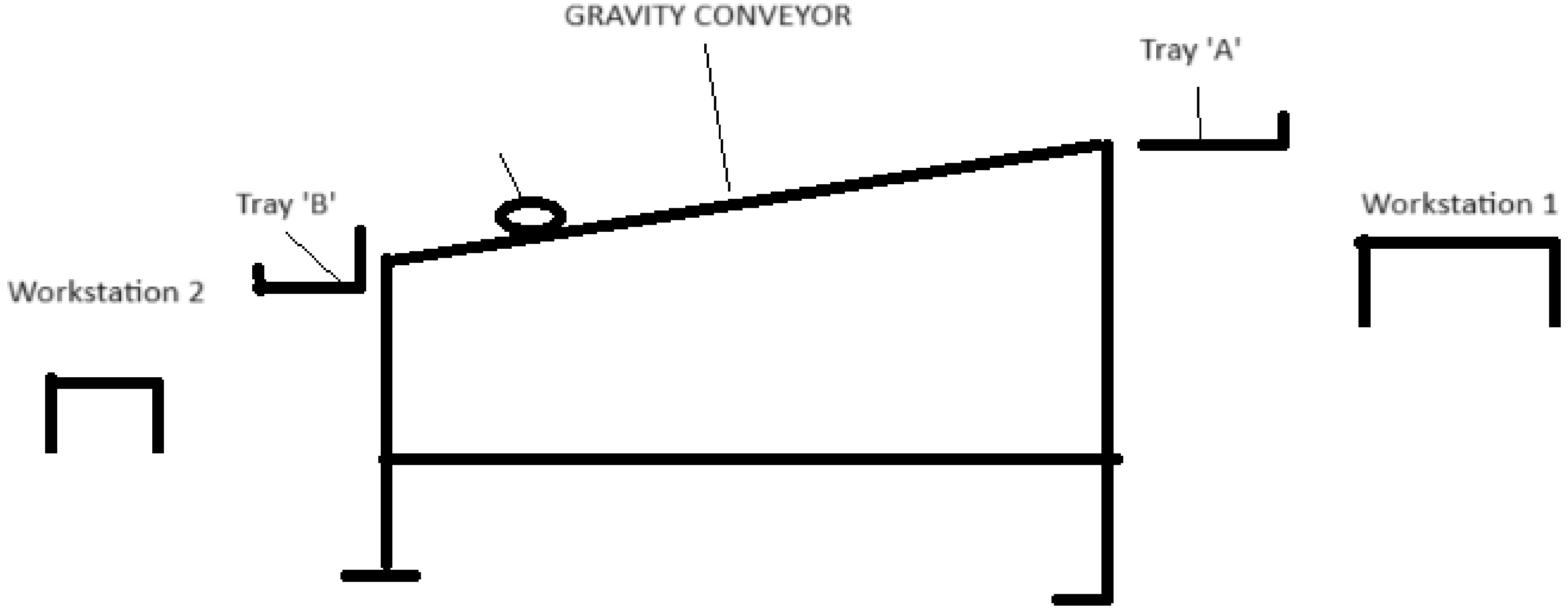
Mechanically Driven: Operates without electricity, hydraulics, or pneumatics; relies on mechanical engineering

Cost-Effective: Utilizes existing workplace machines and tools, requiring no new technology or significant investment

Productivity Boost: Designed to improve efficiency without substantial financial outlay, making it ideal for optimize processes economically.

Karakuri Model

overview of the karakuri model



Structure of the Karakuri model

Elements	Functions	States (Code No.: Description of Status)	Way of State Transition/Mechanism
Tray 'A'	-Work Holding -Work Transportation	0： Initial state (Before parts entry) 1： parts is at the entry point 2： parts is at the exit point	Gravity Force and Implemented Mechanisms
Tray 'B'	-Part Holding -Part Transportation	0： Initial state (Vacancy) 1： parts is loaded 2： parts is loaded	Mechanism of Stopper and Weight Slide Mechanism
Conveyor	-Deceleration of Part -Acceleration of Part forwarding by inclination mechanism	Initial state component move	Gravity Force

Table is for the definition of the elements and their states of Karakuri mechanism

Trial 1

The conveyor system was constructed and installed in accordance with the initial calculations and design specifications.

Observations:
During this trial, various parameters such as sliding speed, slope angle, stability with multiple parts, and ergonomics were observed and analyzed.

Adjustments:
Based on the observations, necessary adjustments were made to address any deviations from the expected performance. These adjustments could include fine-tuning the slope angle, modifying roller configurations, or optimizing the placement of the conveyor system.

Result:
After making the required adjustments, the conveyor system was stabilized, and initial performance benchmarks were established for subsequent trials.

Trial 2

Following the adjustments made in Trial 1, the conveyor system was maintained for Trial 2.

Observations:
During this trial, particular attention was given to the sliding speed of the injector body along the conveyor. It was observed that the sliding speed was not optimal, either being too slow or too fast.

Adjustments:
The slope of the conveyor was adjusted based on the calculated percentage to optimize the sliding speed of the injector body.

Result:
By adjusting the slope angle, an optimal sliding speed was achieved, ensuring smooth and efficient movement of parts along the conveyor.

Analysis

To address the issue of sliding speed, the slope angle of the conveyor was recalculated using the formula for slope percentage. This calculation aimed to achieve the desired sliding speed for efficient part transfer.

Trial 3

The conveyor system with the adjusted slope from Trial 2 was utilized for Trial 3.

Observations
During this trial, stability issues were identified when multiple parts were slid simultaneously along the conveyor. These stability issues resulted in inconsistent movement and potential distortion or shaking of the parts..

Solution
Plastic protections were installed over the conveyor slides to provide stability and prevent distortion or shaking of the parts during movement.

Result:
With the installation of plastic protections, enhanced stability was achieved, ensuring smooth and consistent movement of multiple parts along the conveyor.

Analysis

To assess stability, trials were conducted with multiple parts to simulate real-world manufacturing conditions.

Trial 4

The conveyor system with plastic protections installed as per Trial 3 was used for Trial 4.

Observations

This trial focused on evaluating ergonomics parameters to ensure operator comfort and efficiency during the part transfer process.

Adjustments

Based on ergonomic considerations, the positioning of the conveyor mechanism was adjusted to enhance operator comfort and efficiency.

Result

Through the adjustment of the conveyor mechanism's placement, an ergonomic design was achieved, improving the overall operator experience and productivity.

Analysis

Assessments were made regarding the optimal placement of the conveyor mechanism to minimize operator strain and fatigue.

Future Scope

- **Horizontal Deployment**: Implement across multiple production lines to standardize operations and enhance efficiency.
- **Vertical Integration**: Extend use to other manufacturing stages such as assembly and packaging.
- **Smart Factory Integration**: Incorporate IoT sensors and real-time monitoring for predictive maintenance and improved efficiency.
- **Energy Efficiency**: Develop energy-efficient designs to reduce environmental impact and operational costs.

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Conclusion

- It is possible to automate almost all simple manual tasks using Karakuri
- Karakuri solutions should be developed by doing or to get down to the "Gemba" in Lean terms.
- Ergonomics is one of the most critical factors to consider while designing Karakuri .
- Karakuri design contradicts the traditional design method of PDCA cycle.

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THANK YOU