Bosch Ltd.

Jay Sharad Dashrath,
Project Trainee/ 2020BME065

Nashik Plant (NaP)I JAN - MAY

Project Guide: Dr.A.R.Kadam

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Fixture Design for A/F milling ANGLE BAD

BOSCH

NaP/ MFC 2

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- OBJECTIVE
- PROBLEM STATEMENT
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- POKA YOKE
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Bosch in India

1953

1stManufacturing
Ope rations
in Bangalore

15

GroupCompanies

16

Manufacturing
Facilities

19221stSalesOffice
in Calcutta

Bosch Ltd

6 manufacturing
Facilitie sof Bosch Ltd

195

INJECTORMANUFACTURINGPLANT NaP

Associates

31,530

Billion rupees
SalesRevenue
In 2023

Bosch Ltd 100
Billion rupees

3,500
Sales Outlet

1,500
Suppliers

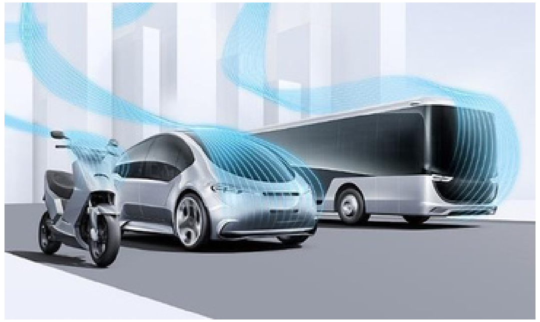
Bosch Ltd Associate s
7,550

MOBILITY SOLUTIONS | E NERGY & B UIL DI NG TE CH. | CONSUMER GOODS | I NDUST R I AL TECH

BOSCH

RBE&BS - Integratedsystemsolutions

Personalized mobility



Automated mobility

Connected mobility

Powertrain systems

fun and
fascinating

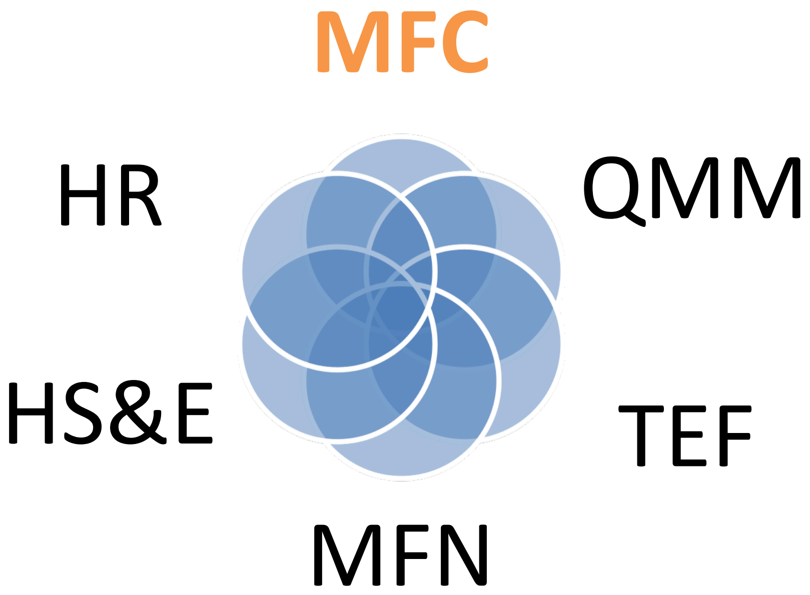
safe and
com f or t abl e

efficient and
econom i cal

COMMON RAIL INJECTOR (CRI)

Departments – Bosch (NaP)

Bosch Limited



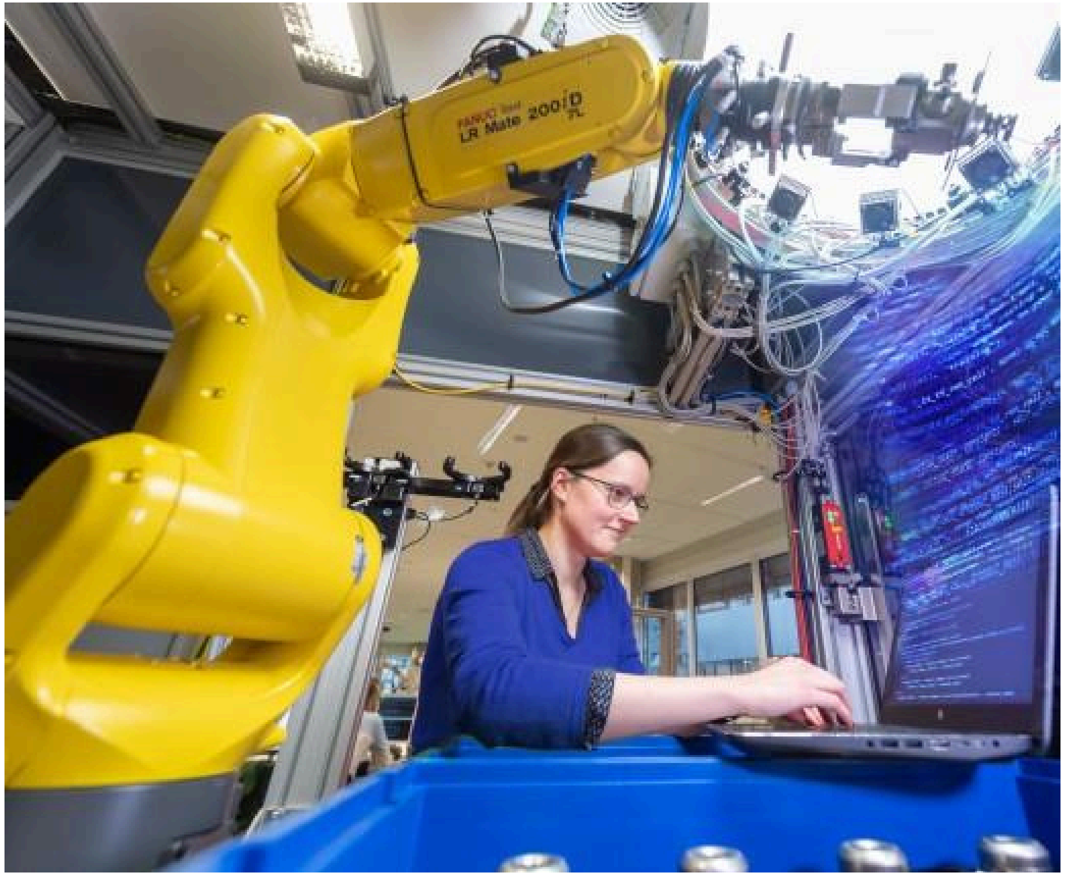
MFC - DEPT

MFC stands for **MANUFACTURING OF COMMON RAIL INJECTOR**, is the dept at Bosch Nashik plant which deals with the production of various common rail injectors.

Raw Injector Body → MFC → Assembly Line

<u>Objectives of MFC</u>: To Deliver,

- The right part
- **At the right time**
- In the right quantity
- In the right **quality**
- In the right location
- By the right SOP

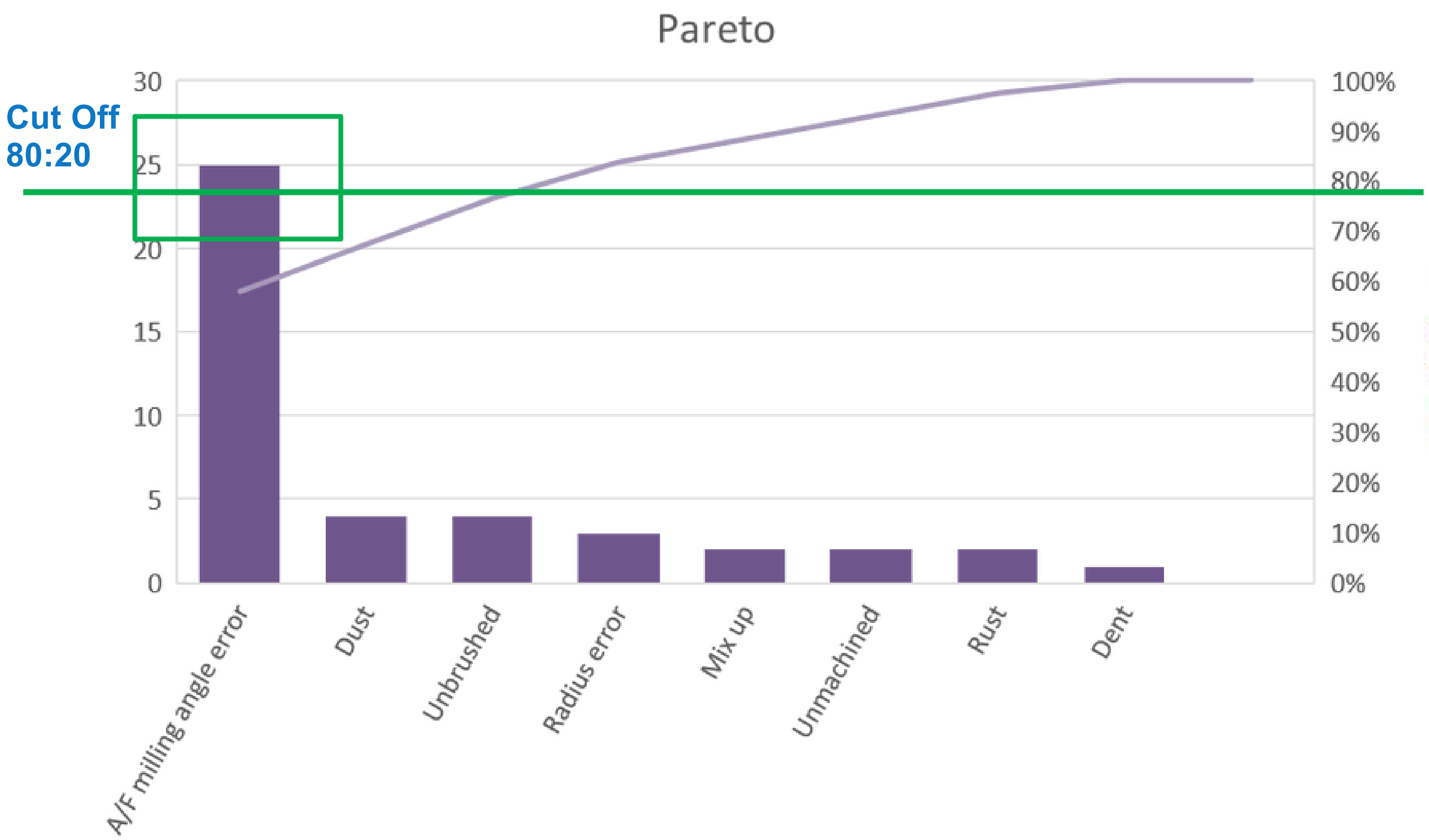


PFD – Milling station

FIFO (I) → Milling m/c → Inspection by G au gin g → Brushing process → Declamping process → FIFO (O)

*Images are subjected to v

Complaints – Assembly line of Injector



Problem statement

Across Flat Milling Angle Errors:

Significantdeviationsinmillingangles during the across flat milling operation, surpassing acceptable tolerances.

Technical Constraints:

1. Structural Complexity:
Injector body design is standardized globally, restricting modifications for injector and Gauging parameters too.
2. High-Pressure Environment:
Inability to place detection fixtures within the milling machine due to operational pressures.

Approach:

Development of a detection fixture for the declamping process to be installed on the declamping machine, utilizing robust materials and precise engineering to detect milling angle errors without additional damage to the injector bodies.

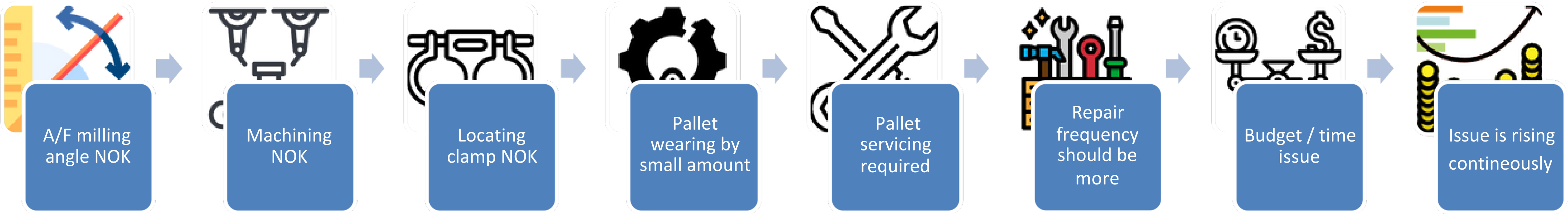
CRI – Isometric view

Root Cause Analysis – A/F milling angle NOK

To find the root cause analysis, let’s implement POKA YOKE (Mistake proofing) for existing system. Therearetwotypesof POKA YOKEthat shouldbe implemented **chronologically**.

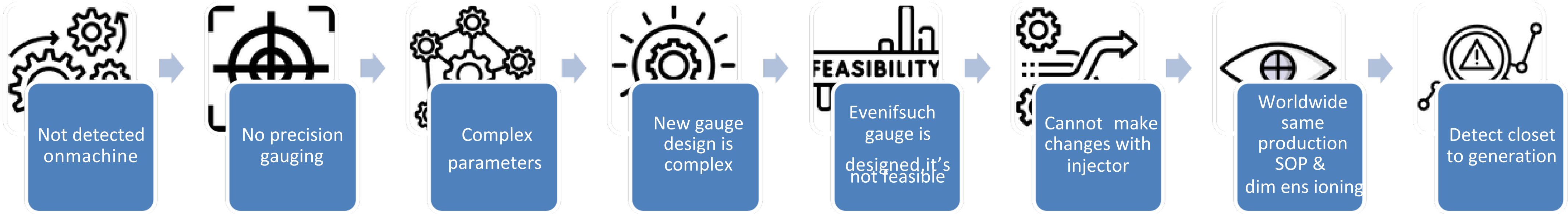
1.GENERATION poka yoke - to avoid generating the defect.
2.DETECTION poka yoke - to detect if generated.

Generation POKA YOKE



Detection POKA YOKE :

Evenifthedefectisgenerated it should be detected where it is generated.



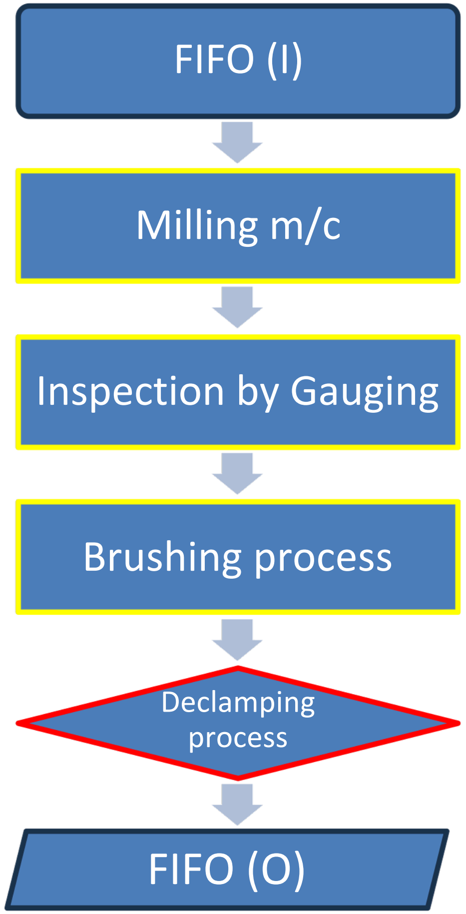
Objective:

Todetectand isolate defective injector bodies with across flat milling angle errors during the declamping process, preventing them from reaching the assembly line.

R a tiona le :

Identifying defects closest to their point of generation to minimize impact on downstream processes.

PROCESS FLOW DIAGRAM – MILLING STATION



Detection stages:

1. At FIFO input:Cannot detect as process not started.
2. At Milling machine: Cannot detect inside machine because machine geometry and high pressure inside m/c.
3. At Gauging: Cannot detect due to gauge inaccuracy.
4. At brushing: Enclosed Robotic arm.
5. At declamping: Can be detected as pressure controllable and machine is handy.

Solution Approach

FixtureDesign: Development of a detection fixture for the declamping process, utilizing robust materials and precise engineering to detect milling angle errors without additional damage to the injector bodies.

FIXTURE DESIGN

Creating a fixture with respect to the dimensions and tolerances of injector body

3-D View

Front view

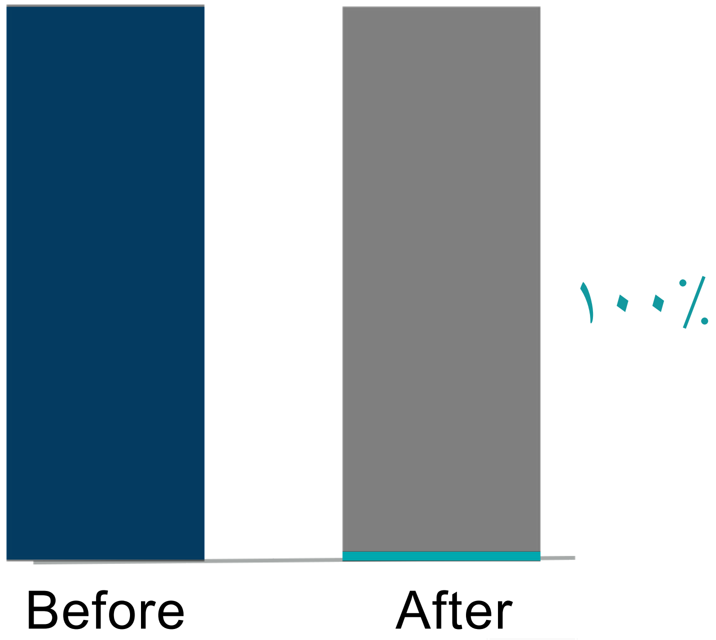
Rear view

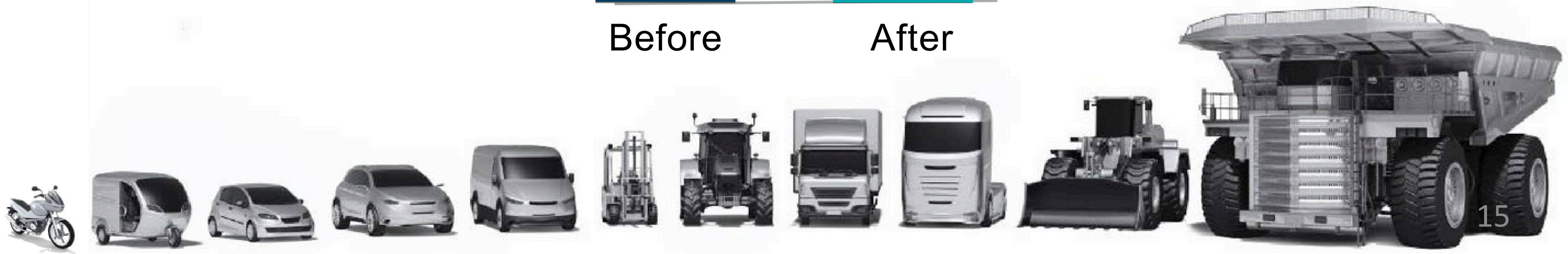
Top View

Bottom view

Results

A/F milling issues detection - Errors





Future Scope

If time and money invested,

Automated servicing station	Smart clamping pallets	Advanced sensors	Adaptive fixtures	Integrated QC
• Developmentof automatedstations for regular maintenance of clamping pallets to prevent wear and d a ma ge.	• palletswithembedded sensorsand IoT capabilities to monitor wear and alert for maintenance proactively.	• Integrationofhigh-precisionopticaland laser sensors for enhanced accuracy in detecting milling defects.	•Developmentofadaptive fixtures thatcan adjust to different injector body types and configurations automatically.	•Real-time integration of quality controlsystems within the milling process for immediate error detection and correction.

T hank-y ou!!

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Bosch Limited, Nashik (NaP)*

Time standards IMPLEMENTATION

Presented by

Jay Sharad Dashrath

Project Guide: Dr. A.R.Kadam

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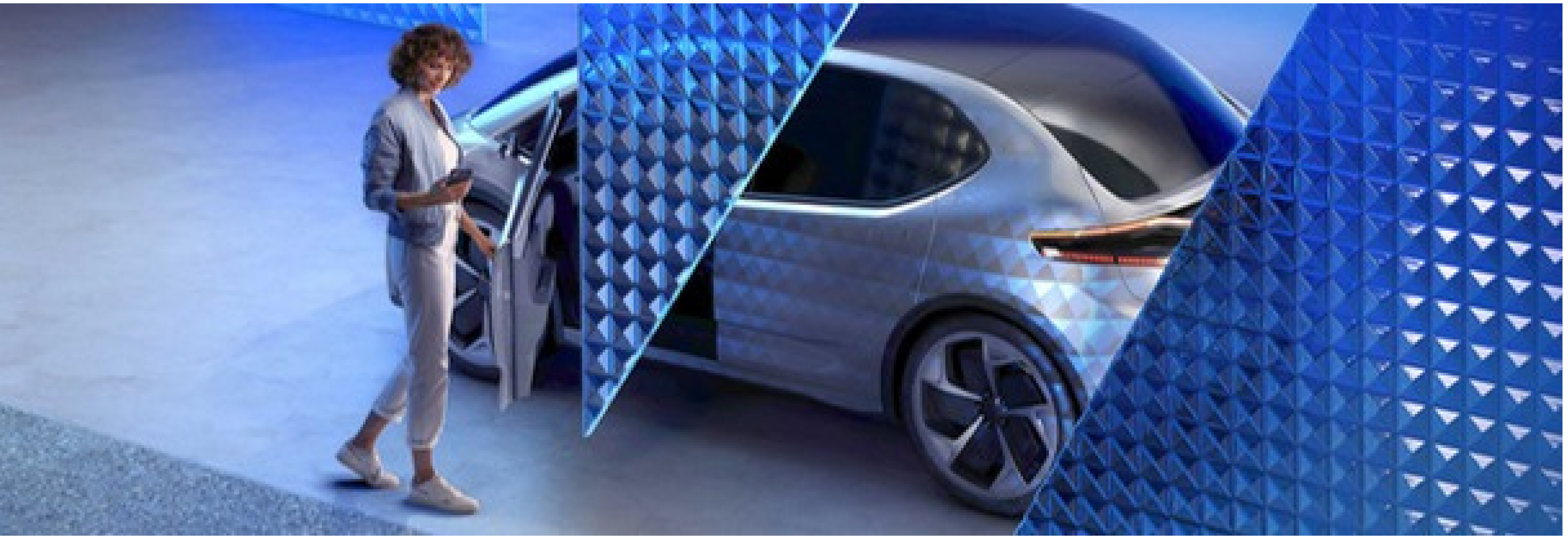
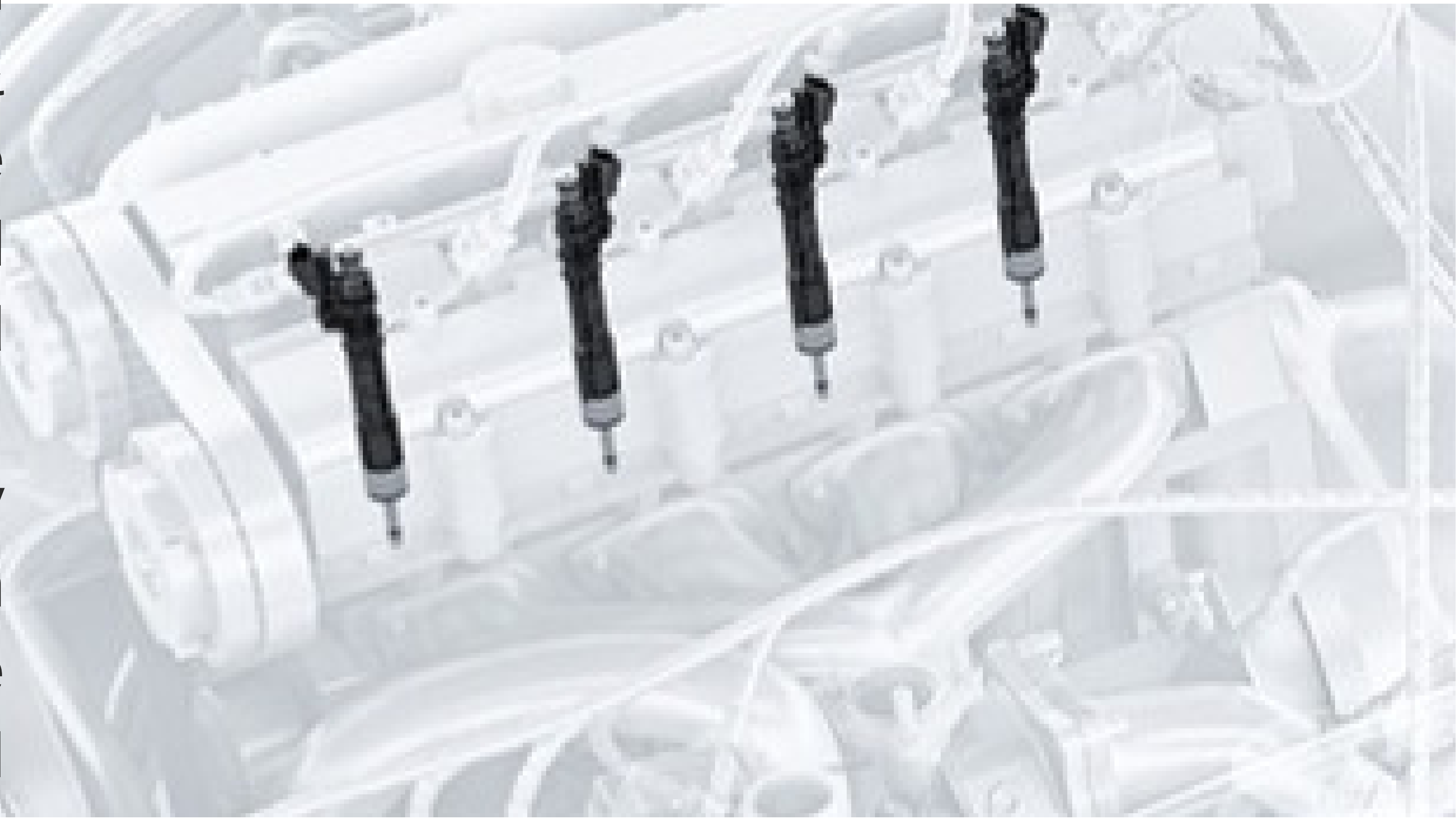


BOSCH

About the Company

- Bosch Limited's Nashik Plant has been a significant establishment in India for the past 50 years. Bosch has specialized in the production of **NOZZLE** & **INJECTOR** for classical as well as Euro series. The
- nozzle and Injector are **PIVOT** parts of the Diesel engine, A fuel injector is a device for atomizing and injecting fuel into an internal combustion engine. The injector atomizes the fuel and forces it directly into the combustion chamber at the precise point in the combustion cycle. A nozzle is part of the Injector. **Interestingly Bosch has a monopoly all**
- **over the world for the nozzle and injector.**



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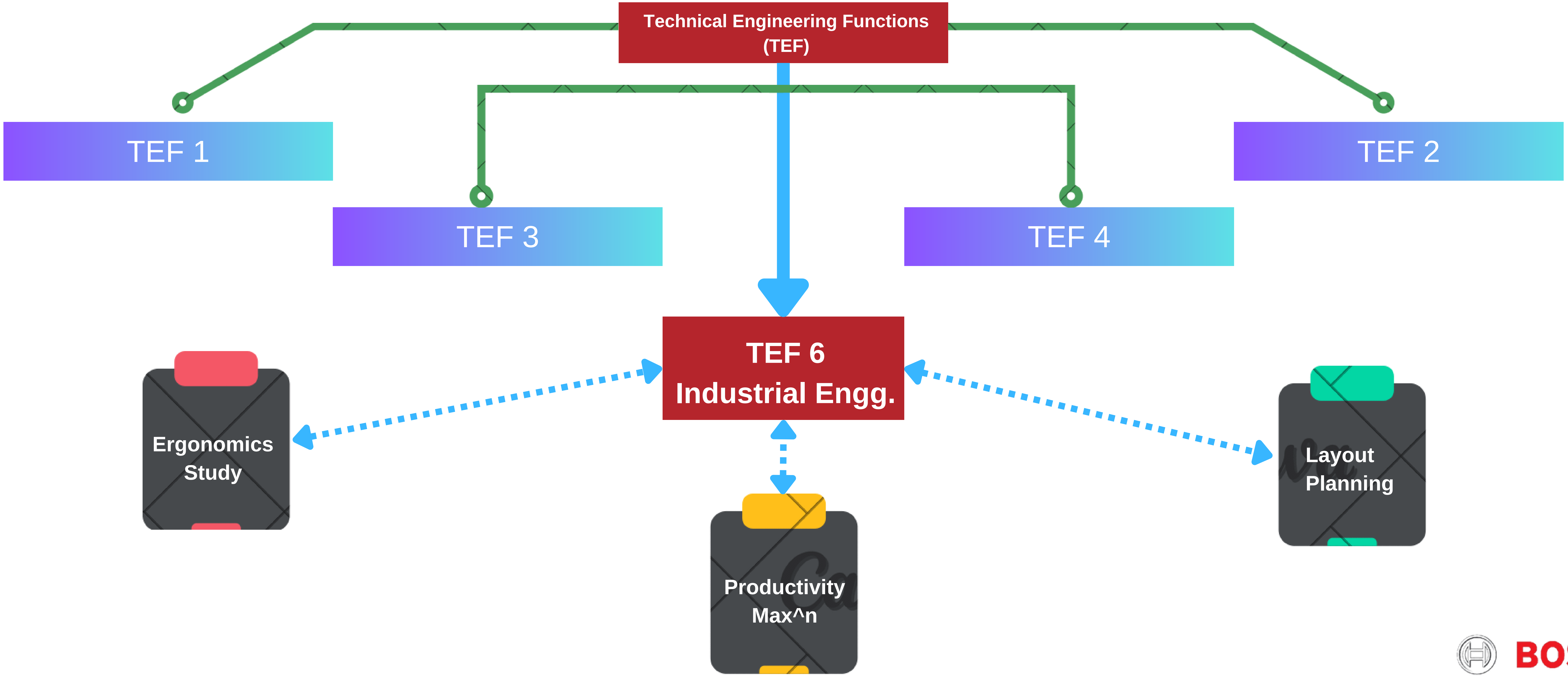
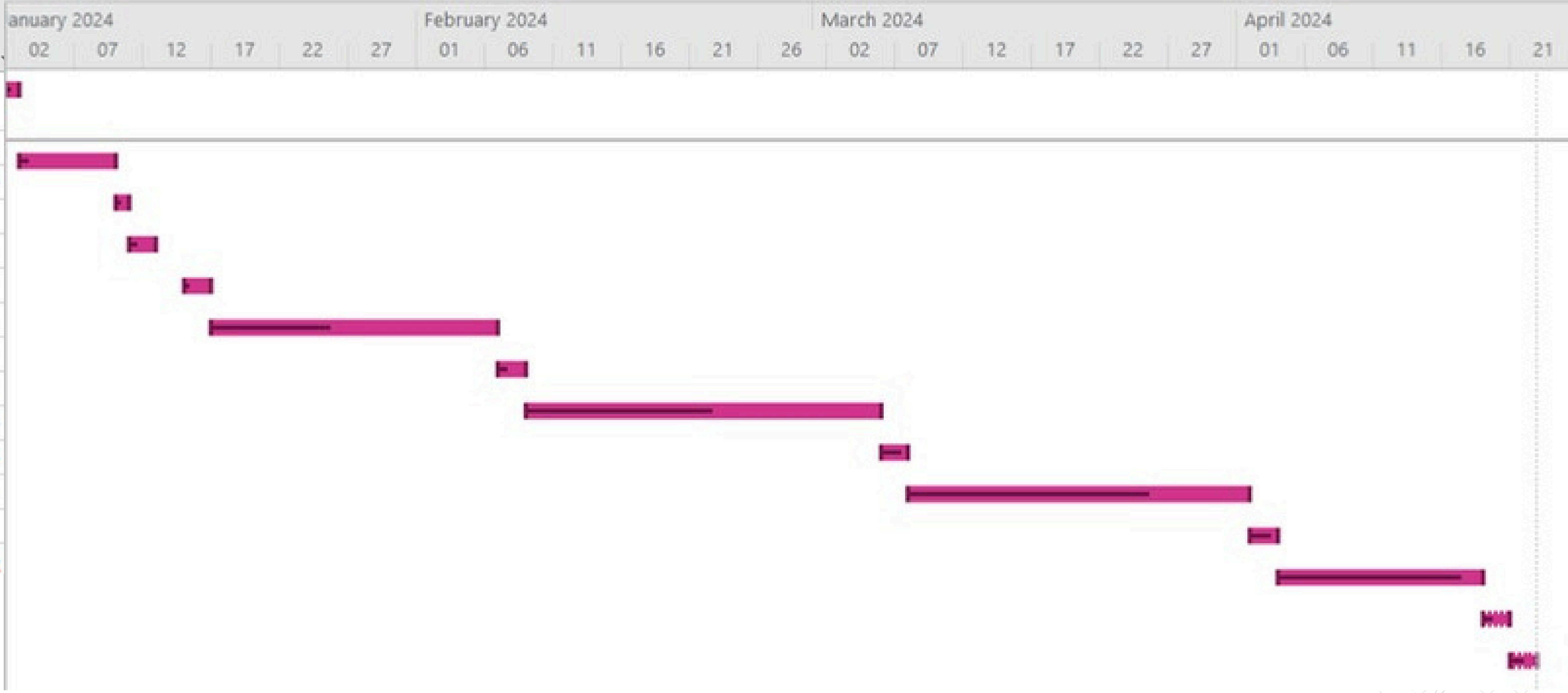
Overview of Department



Project Schedule - Gantt Chart

% Con	Task Mode	Task Name	Duration	Start	Finish
8%		Induction & Documentation	1 day	Tue 02-01-24	Tue 02-01-24
15%		Process Understanding	5 days	Wed 03-01-24	Tue 09-01-24
23%		Project Allotment	1 day	Wed 10-01-24	Wed 10-01-24
31%		Project Initiation	2 days	Thu 11-01-24	Fri 12-01-24
39%		Time study planning	2 days	Mon 15-01-24	Tue 16-01-24
45%		Dept. A time study	15 days	Wed 17-01-24	Tue 06-02-24
49%		Concluding Dept A	2 days	Wed 07-02-24	Thu 08-02-24
54%		Dept B time study	18 days	Fri 09-02-24	Tue 05-03-24
62%		concluding Dept B	2 days	Wed 06-03-24	Thu 07-03-24
69%		Dept C time study	17 days	Fri 08-03-24	Mon 01-04-24
77%		Concluding Dept C	2 days	Tue 02-04-24	Wed 03-04-24
85%		Dept D time study	11 days	Thu 04-04-24	Thu 18-04-24
91%		Dept D concluding	2 days	Fri 19-04-24	Sat 20-04-24
100%		Result validation	2 days	Sun 21-04-24	Mon 22-04-24



LEAN MANUFACTURING

Increase efficiency by KAIZEN

Plan-Do-Check-Act

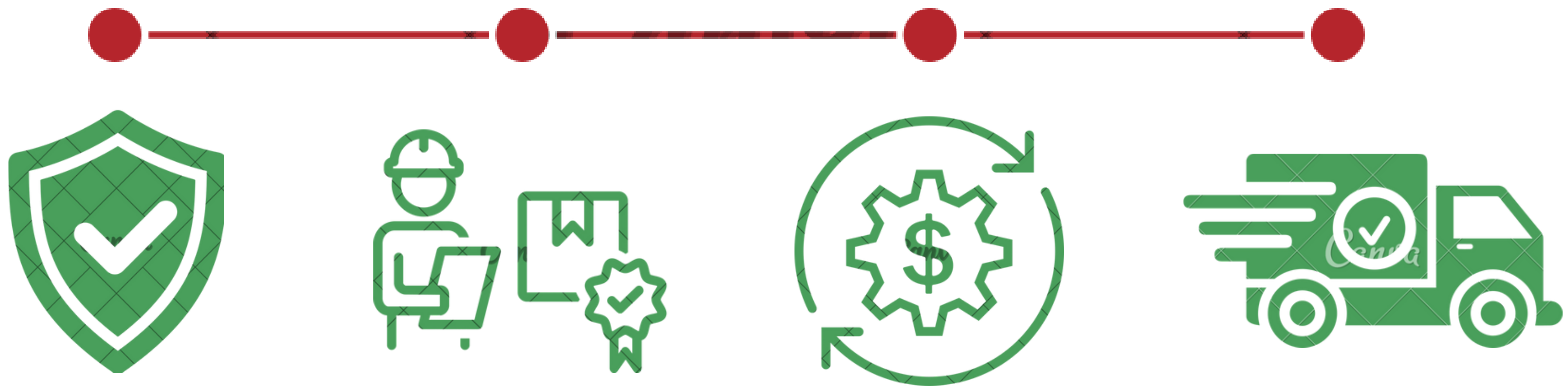
RBE&BS GOAL

Only Produce what customer requires

Just In time delivery

Quality & Cost Reduction

Monthly SQCD Analysis



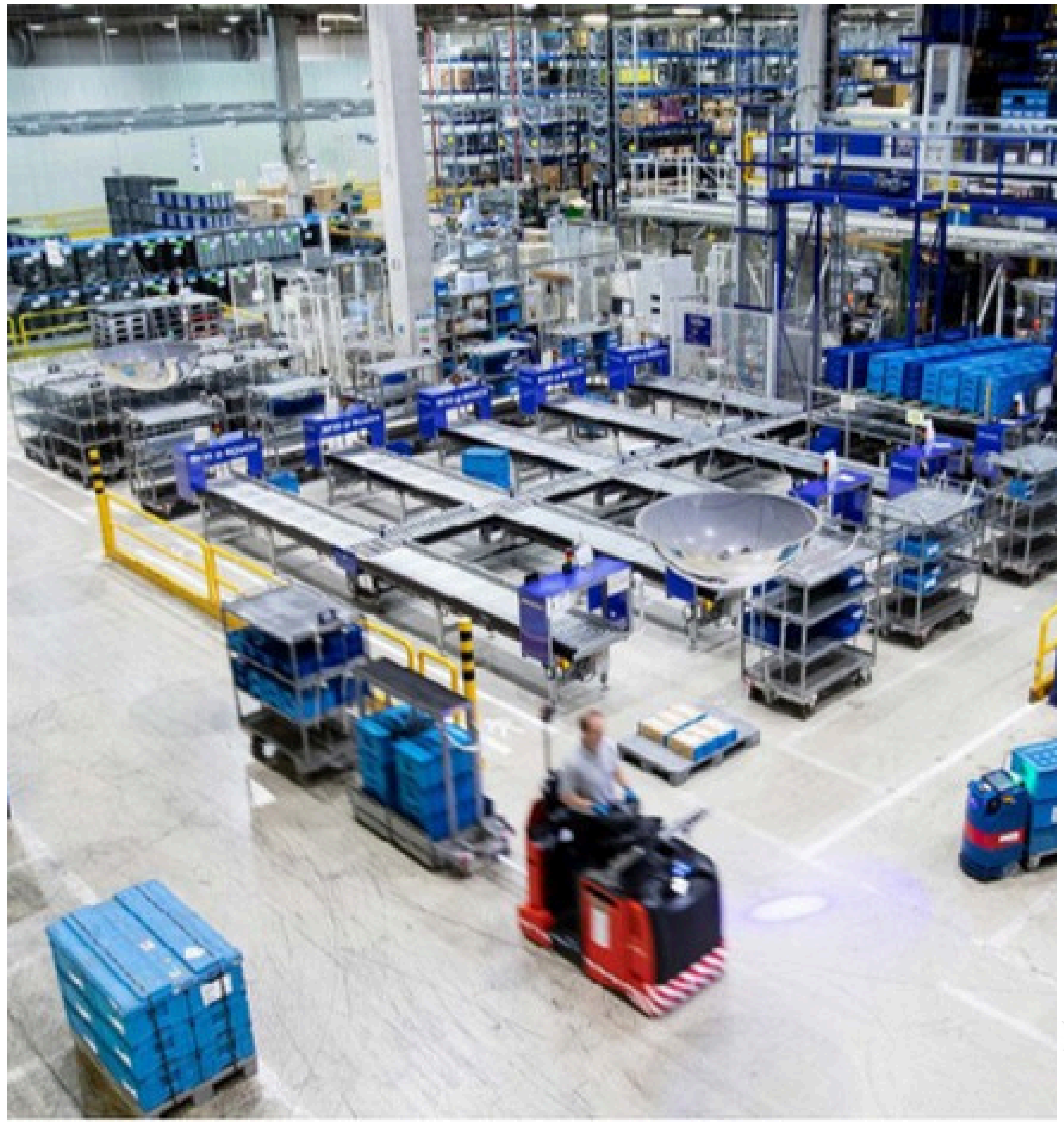
Safety **Quality** **Cost** **Delivery**

- It’s importance lies in optimizing processes, enhancing competitiveness, and delivering results such as reduced lead times, minimized defects, and improved profitability.

Problem Identification

During SQCD monthly monitoring, we countered significant challenges:

1. **Low Monthly Delivery per Labour:**
   - Delivery output per labour was observed to be below expectations, impacting overall productivity.
   - The ratio of parts produced per labour was suboptimal, exemplified by a scenario where 100 parts required the effort of 10 manpower, resulting in an inefficient 10 parts per labour.
2. **Disorganized Workflow:**
   - Unorganized work processes, lack of ergonomics, and inefficient layout were identified, hindering the smooth flow of operations.



RCA (root cause analysis)

Manpower Utilization Inconsistency:
Unorganized work methods and lack of efficiency indicate a significant gap in the effective utilization of the existing workforce.

Human Factor as a Variable: (3M)
Unlike machines and materials with organized SOPs, the human factor remains a variable, susceptible to inconsistencies in workflow.

Impact on SQCD Metrics:
Inefficient manpower utilization directly affects Safety, Quality, Cost, and Delivery (SQCD) metrics, particularly in the logistics domain.

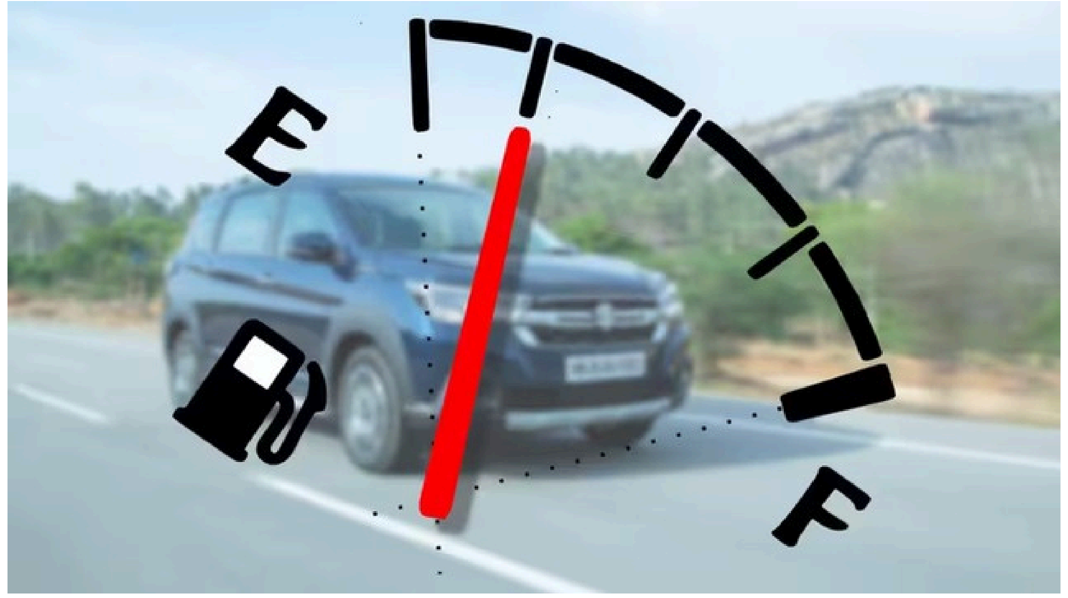
EFFICIENCY & PRODUCTIVITY

Productivity is about how much work you can get done in a certain amount of time, while efficiency means how well you use your resources (time, materials, energy) to get the work done. Even though productivity and efficiency are two separate things, we must know that they are interdependent.

Key Difference is **Productivity focuses on the amount of output**.

Efficiency focuses on **minimizing waste** and **using resources wisely** to achieve that output.

Analogy: Think of a car. Productivity is like how many miles the car can drive in an hour (speed). Efficiency is like how much fuel the car uses to drive those miles (fuel economy).



TIME STUDY ANALYSIS

Time study is a systematic method used in manufacturing settings to analyze and measure the time required to perform a specific task or activity. It involves breaking down the task into its individual elements, measuring the time taken for each element, and analyzing the data to establish a standard time for the task

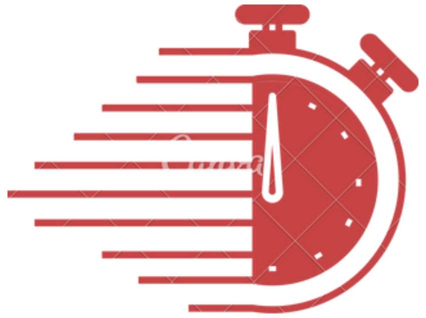
ACTIVITY	Time Taken	Qty
U		
A	55.52 sec	1200 x 5 + 600 x 4
Ir ... pty palle	14 min 9 sec	1200 x 5 + 600 x 4
V	1 min 1 sec	1200 x 5 + 600 x 4
Ir	37 sec	1200 x 5 + 600 x 4
G		
V	1 min 10 sec	

Methodology

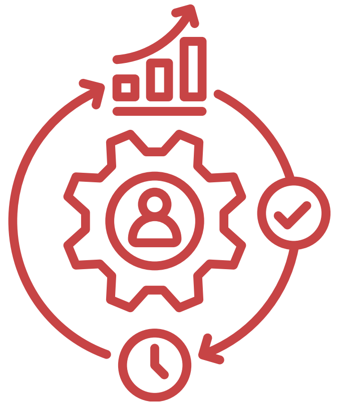
1. **Task Selection:** Choose a representative task.
2. **Observation:** Record time for each task element with the help of STOPWATCH.
3. **Analysis:** Identify patterns and inefficiencies.

Time Study Methods

Stopwatch Time Study: Involves measuring the time for each individual element or motion of a task using a stopwatch.



Predetermined Motion Time Systems (PMTS): Utilizes predetermined time values for standard motions to estimate the total time required for a task based on the observed motions performed.



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Methodology- Process mapping

Sample time study sheet

xport - Germany				
		Time Taken in mins	Qty	Frequency
Acc		20	480	10
		15	480	10
		28	480	10
Label pa	ACK	37	480	10

Current Manpower Deployed = 8

Result

Department	Activity	Monthly volume	Work Content(Mins)	Total work content	Current Manpower Deployed	Manpower Req@95% Utilisation
LOG			210.14	2364.58	8	5.16
			60			
			216			
			130			
			686.48			
			331			
			14.24			
			31			
			125.48			
			19.26			
			28.94			
			27.24			
			87			
			10			
			125.25			
			262.55			

- Req. Utilisation = Total utilisation - allowances
- Allowances = Lunch / Tea Brakes, Bio Brakes, etc

- In Result we got the required manpower number reduction from 8 to 5.

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Calculation

• Total work content in hours =

2364.58 minutes / 60 minutes/hour ≈ 39.4 hours • Subtract any planned downtime or breaks from the total 8-hour shift duration. For example, if there is 0.75 hours break for lunch and breakfast. • Total work hours = 8 hours - 45 min total break = 7.25 hours • Multiply the total work content by 95% to determine the amount of work that needs to be completed at 95% utilization. • Required output at 95% utilization = 39.4 hours * 0.95 ≈ 37.43 hours

• Divide the required output at 95% utilization by the available work hours to determine the output that needs to be achieved per hour.

• Output per hour = 37.43 hours / 7.25 hours ≈ 5.16 hours/hour
• Divide the output per hour by the individual productivity rate of each worker to estimate the number of workers required. Let's assume each worker can work for 60 minutes in an hour.

• Manpower required = 5.16 hours/hour ÷ 1 hour/worker ≈ 5.16 workers
• Round up the calculated manpower required to the nearest whole number, as it's not possible to have a fraction of a worker

This calculation ensures that the workload can be completed within the specified shift duration while maintaining a 95% utilization rate, accounting for breaks and desired productivity levels.

Conclusion

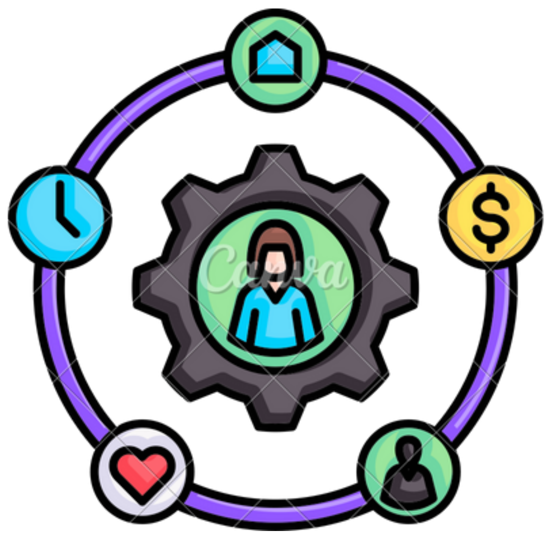
Cost Savings

Cutting the team from 10 to 6 workers saves a bunch on labor costs while keeping productivity strong.

Efficiency Boost

Streamlining how we work means we can do more with fewer people, making us super efficient.

Resource Optimization

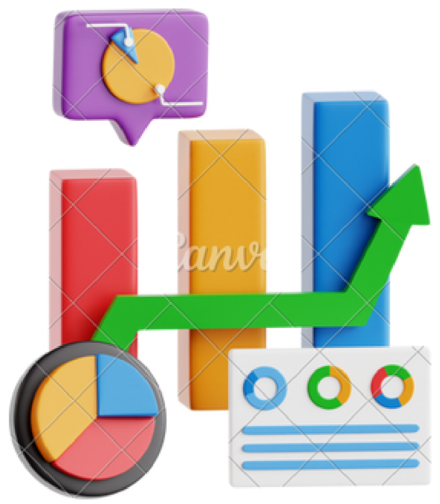


With a smaller team, we can use our resources better, directing them where they're needed most in the company.

Strategic Alignment

Smart resource use means we're putting our efforts where they matter most, hitting our company goals.

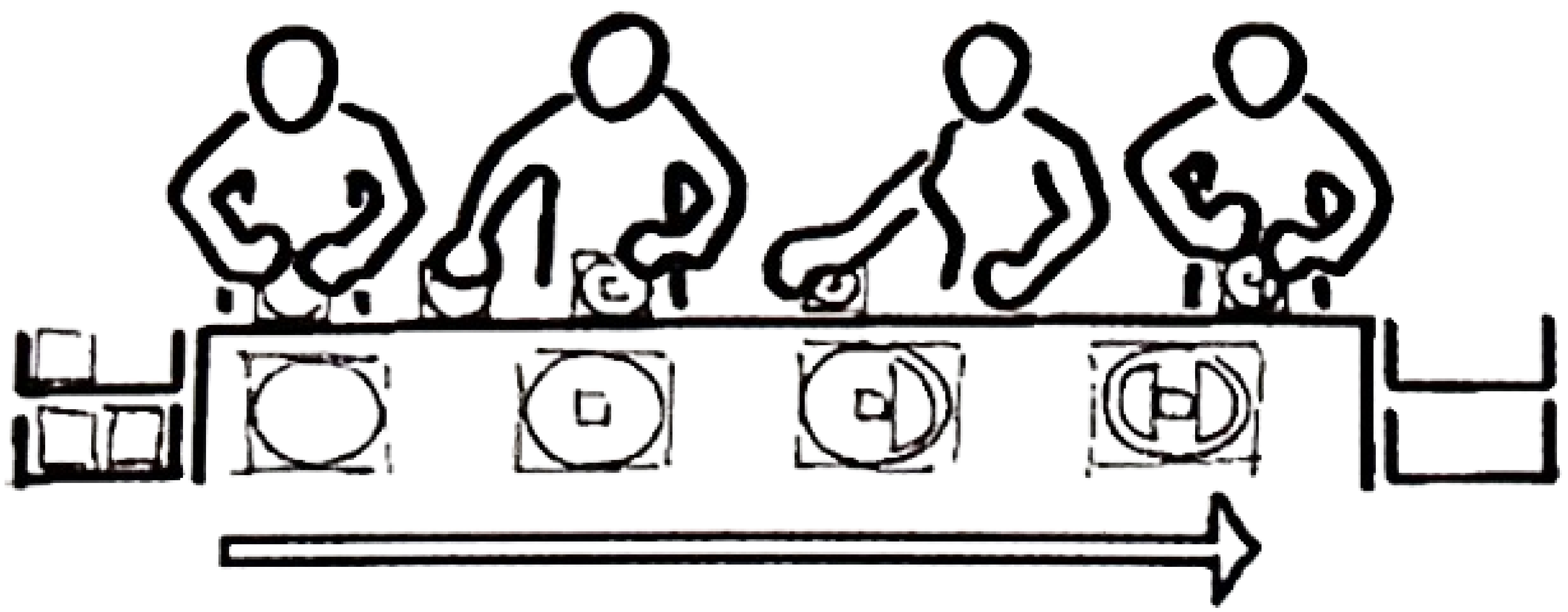
Enhanced Utilization



Doing the same job with fewer people shows we're using our resources really well, making everything run smoother.

Importance of standardization

Processes, methods and standardised. We alwaysadopttriedandtested solutions.Standardsare not static, they are being imporved all the time and are based on best on "**Best In class**". Standardisation is a requiement for mastered processes and flexibility.

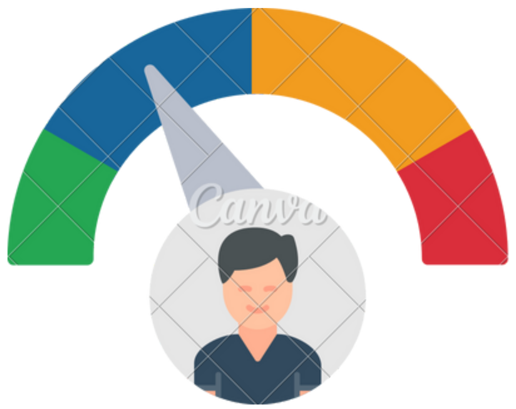


Standard workflow;

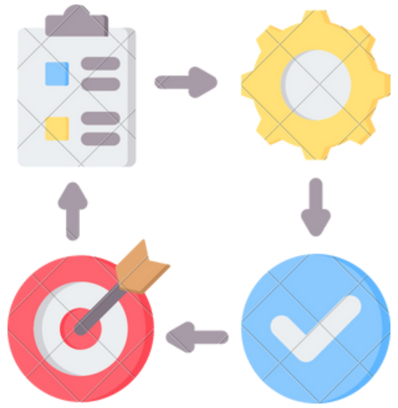
1.PICK AND POSITION THE PART
2.ASSEMBLE THE PART
3.PRIMARY PACKAGING
4. LABELLING
5. DISPACH

Benifits of standardisation

Performance Measurement:



Process Improvement



Time saving

Cost Estimation

Workforce Management

Time study objectively measures task durations, aiding performance comparison and identifying inefficiencies. Standardizing task times ensures consistency, facilitates cost estimation, and optimizes workforce management for enhanced productivity.

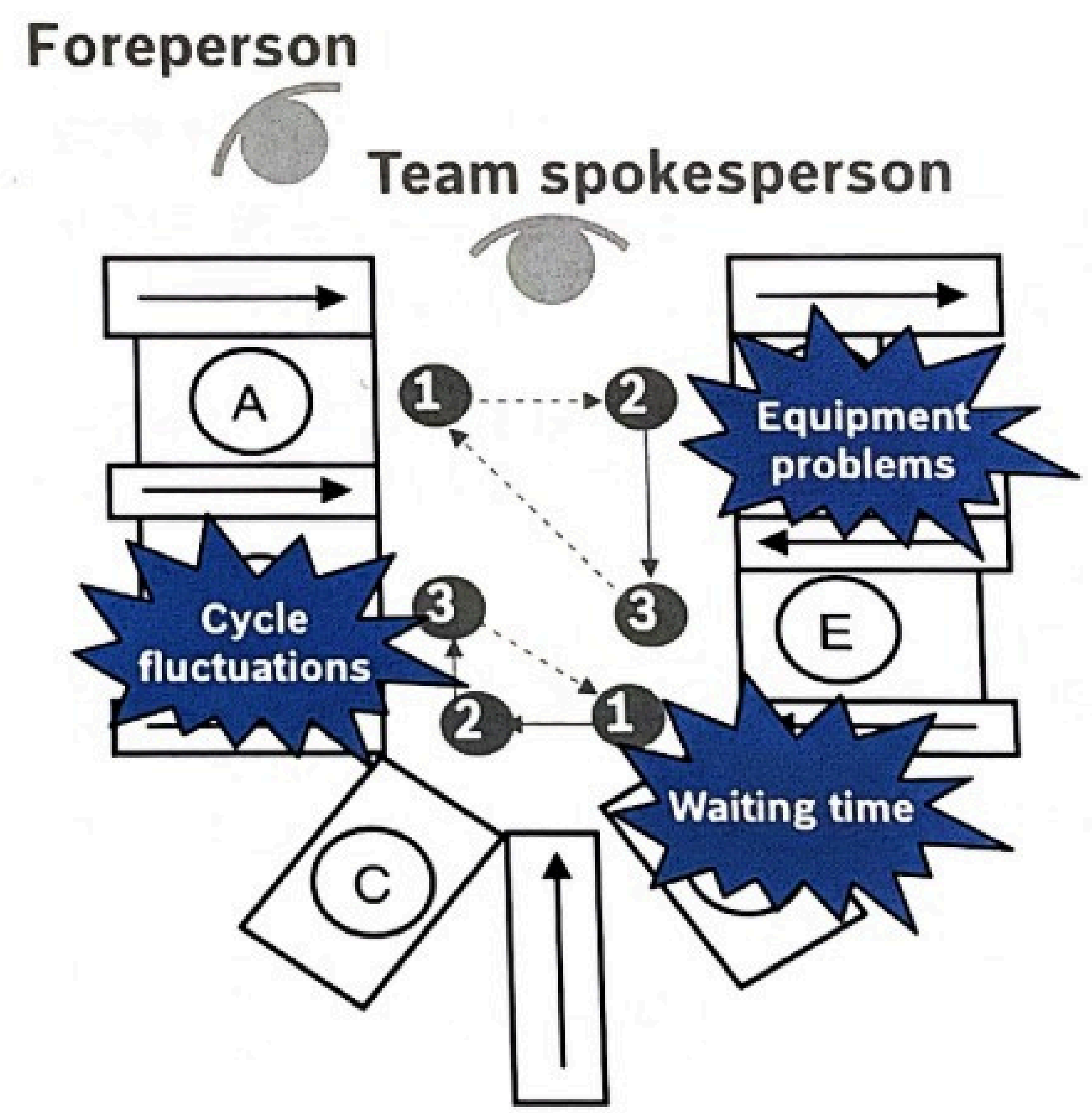
Management of Non-confirmities

If non confirmities are observed, the following questions must be answered

- we do not have standard or the existing standard is outdated?
- the associate are not aware of the standard?
- we do not work in accordance with standards?
- the existing standard is inadequate?

Process confirmation

- Ongoing comparison between actual process and standard
- HARD ON THE PROCESS, FAIR TO THE ASSOCIATE
- Daily GEMBA walk by Front line manager
- Regular cycle time checking



Thank You!!