1. Brief Description of the Project:

Objective: "**To Create Future Ready Workplace"** by adopting Operational Excellence practices involving World-class Manufacturing Methodologies.

Scope: This Project articulates the essential for a **Cost Competitive Plant** with **Productivity improvement** as the primary objective and applies to all the processes of the plant.

Context Setting: Plant has an installed daily Production Capacity of 9500 Vehicles, where Market demand is fulfilled as per the forecasted demand. So, to grow productivity with fluctuation in market demand, we need to **optimize the Resources** by identifying & eliminating **waste** in our processes.

Challenges: Some of the challenges include **high labor intensive** assembly areas**, age factor** of the employees in coming years, partially skilled work force for **Automations related improvements.**

2. Trigger for the Project:

Hero Haridwar Plant established in Apr 08 and received tax benefit for the initial 10 years. From FY18-19, Government of India started collecting tax of Rs 1500 per vehicle. Hence, regaining lost tax benefit of **1500 Rs. /vehicle emerged out to be our business need for the Plant.**

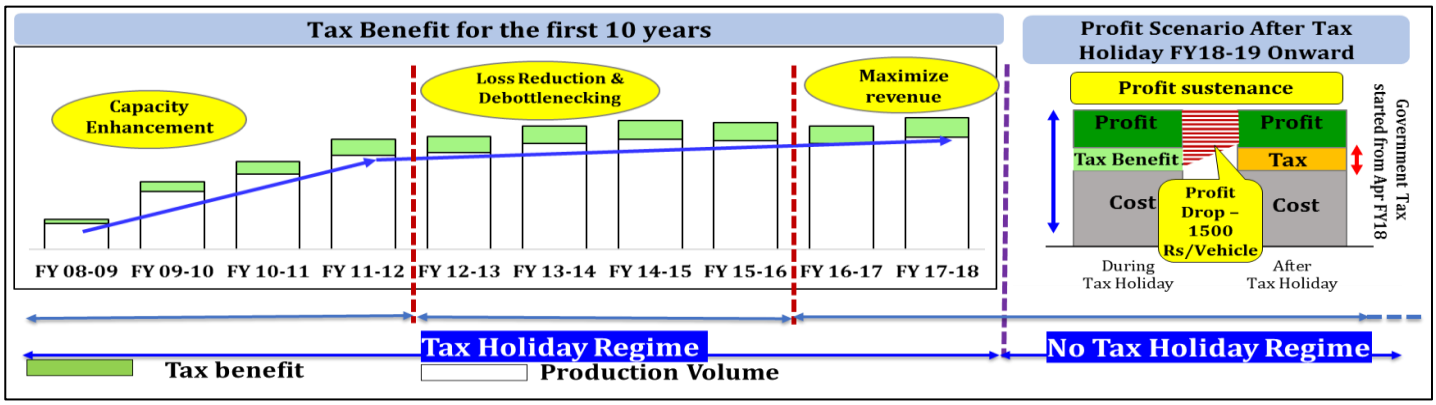


Figure: 2 (a) Journey of the Hero Haridwar Plant

During **Tax holiday regime**, we adopted steep ramp up till FY11-12, increased Production capacity through debottlenecking and loss reduction until FY15-16 and targeted maximum revenue through consistently meeting the planned forecast till FY17-18. After that from FY18-19, **No tax holiday regime** started as shown in Figure: 2(a) where 1500 Rs. /vehicle found to be loss for the plant.

Through **Hoshin Kanri** (Policy Deployment) this business need of sustaining 1500 Rs. /vehicle was cascaded from Plant Head to all the Department Heads as a **top-down approach**.

Assembly department is a high labor-intensive area. Here, Labor cost contributing 57% of the fixed cost as shown in figure 2(b). **So, Theme of Improving Productivity** deployed to Assembly department.

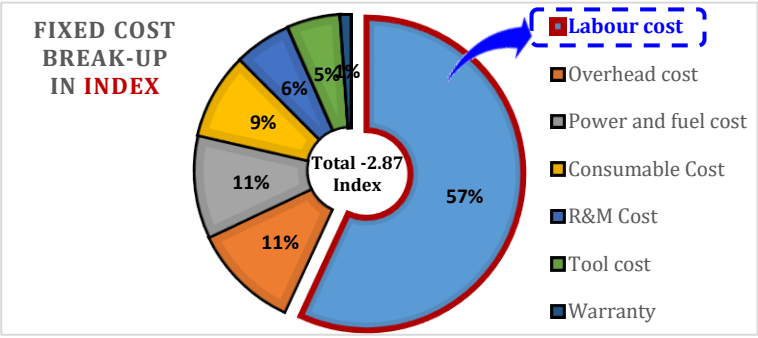


Figure: 2 (b) Plant Fixed Cost break-up

Expected Fulfilments:

S.N	Parameter	UOM	% Improvement
1	Productivity	Vehicle/Man/Day	20
2	Quality (QA Rate)	%	20
3	Safety related injuries	Nos	100
4	Operating Cost	Index	10

3. Solution generation, Innovation and Complexity:

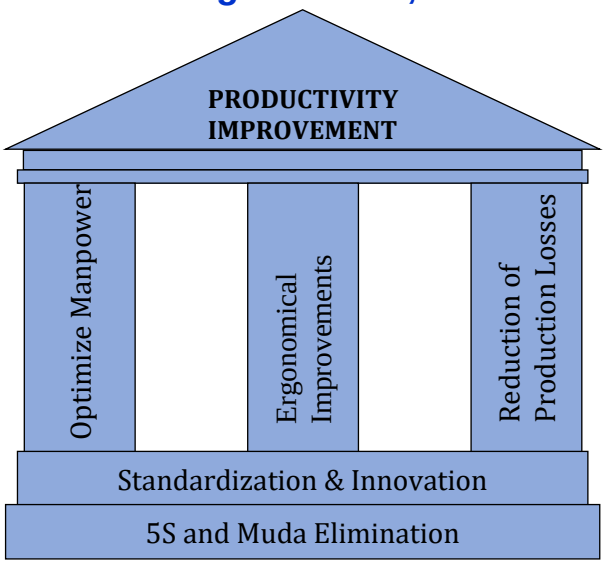


Figure: 3 (a) Productivity Improvement House

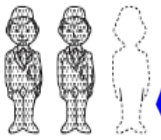
Based on the learnings from World-class manufacturing systems: Just in time **(JIT)** & Total Productive Maintenance **(TPM)**, we have created a house of Productivity Improvement where **5S and Muda Elimination** as the foundation along with **Standardization & Innovation**.

Optimize Manpower, Ergonomical improvements, & Reduction of Production losses are the **three pillars** of the Productivity Improvement as shown in figure 3 (a).

Improving Productivity being the need of the hour, emphasis is fully concentrated to create ***"Future Ready Workplace"*** for all types of workers regardless of age, gender & experience.

As discussed earlier we focused on Assembly department comprises of 4 Engine & 4 Frame (Vehicle) Assembly lines, we have taken one of the Engine Assembly line as a case study for illustration.

3.1 Optimize Manpower:



Optimizing Manpower as the first pillar (Figure: 3(a1), keeping the output constant we focused on *reducing one of our input i.e.;* ***Manpower.***

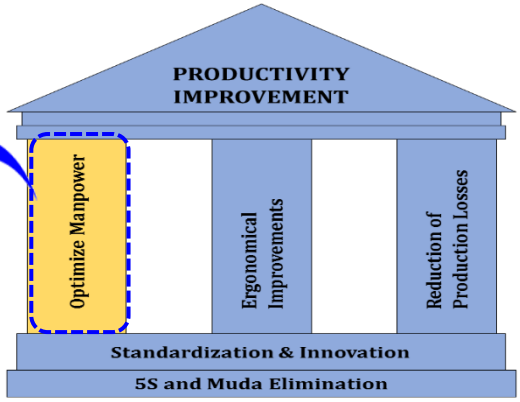
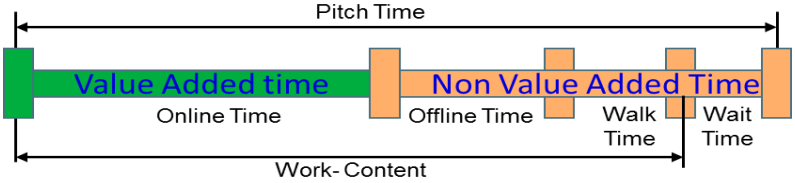


Figure: 3 (a1) Productivity Improvement House

Data collection: We started of collecting the data considering ***Industrial engineering*** tools like Maynard Operation Sequence technique (MOST), Elemental Work study, and Standard Operations Combination table.

Example for one of the stage shown in Figure: 3.1 (a).
The reason for this study is to calculate the Value & Non-Value added time that includes online, offline, walk & wait time where online time is the only value added time.



Objective: To *eliminate Non-value added time* in the process.

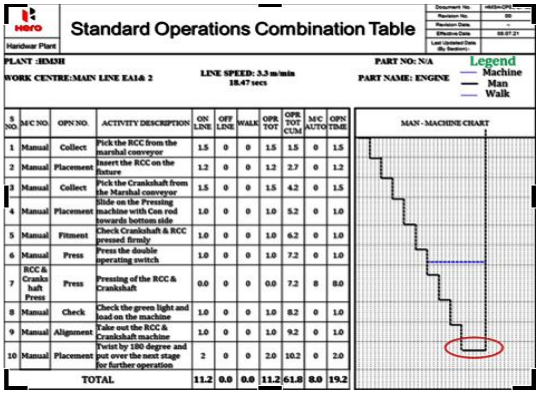


Figure: 3.1 (a) Standard Operations Combination Table

Data Analysis:

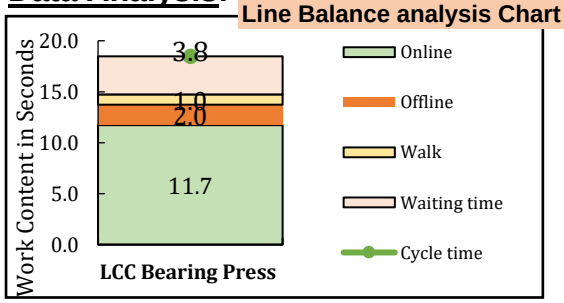
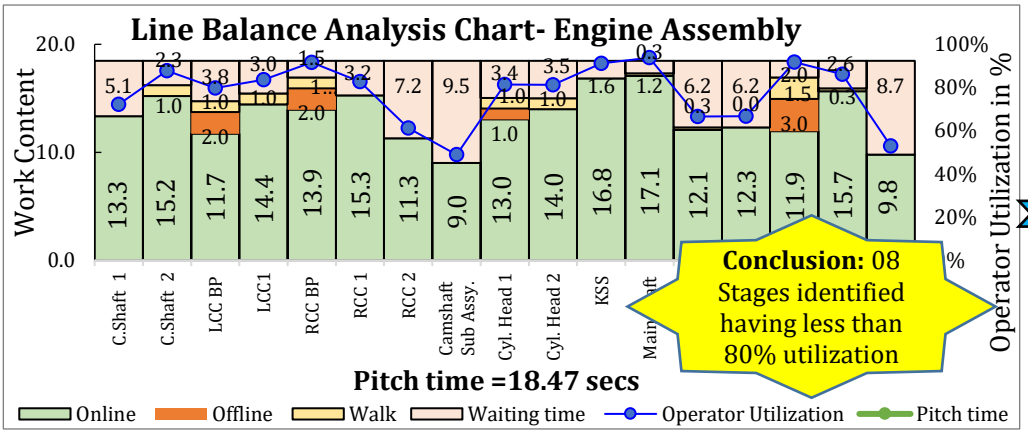


Figure: 3.1 (b) Line Balance Analysis Chart

Further, to analyze the data collected, we took help of tools like **Line Balance Analysis Chart** to identify the under-utilized stages.
This Figure: 3.1 (b) represents the example of one of the stage at Engine Assembly.
Similarly, data collection & analysis done for all the available stages of the line. Summary of this is shown below in Figure: 3.1 (c) where each & every work element is addressed.



Inferences:

Total Nos. Of Station	64
No. of Manpower Deployed	78
Avg. Manpower Utilization	79%
Σ Work Content (Secs)	917
Σ Online (Secs)	887
Σ Offline (Secs)	11
Σ Walk (Secs)	19
Σ Wait (Secs)	154

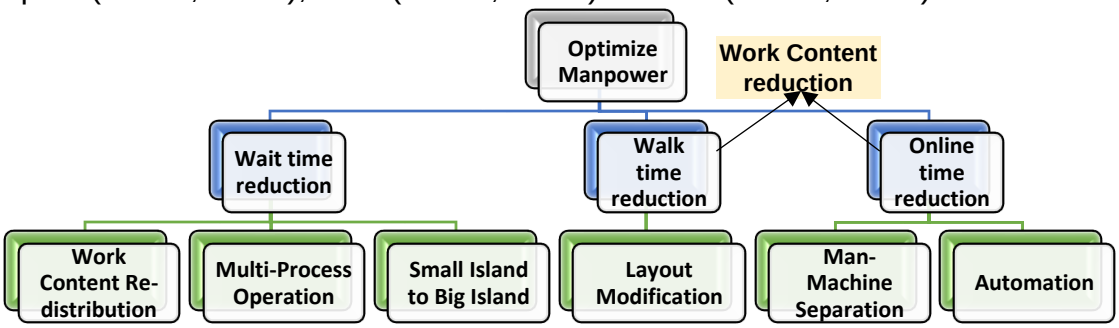
Figure: 3.1 (c) Line Balance Analysis Chart – Engine Assembly

Solutions/ Ideas generation:

All the solutions/ ideas generated for reduction in wait, walk & Online time listed for further prioritization using **ICE (Impact, Cost & Effort Tool).**

Prioritization for Alternative Solution finding based on ICE tool:

To conclude the best alternate solutions with more Impact, less cost & less effort. We used ***ICE tool*** where Impact (Max-2, Min-0), Cost (Max-1, Min-0) & Effort (Max-1, Min-0).



Example: (Multi- Process Operators)

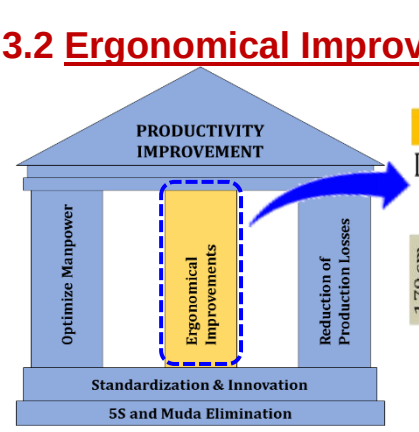
ICE	Impact	Cost	Effort	TOTAL	Selection
High	2	0	0	2	Ruled Out
Low	0	1	1		

Example: (Work content re-distribution)

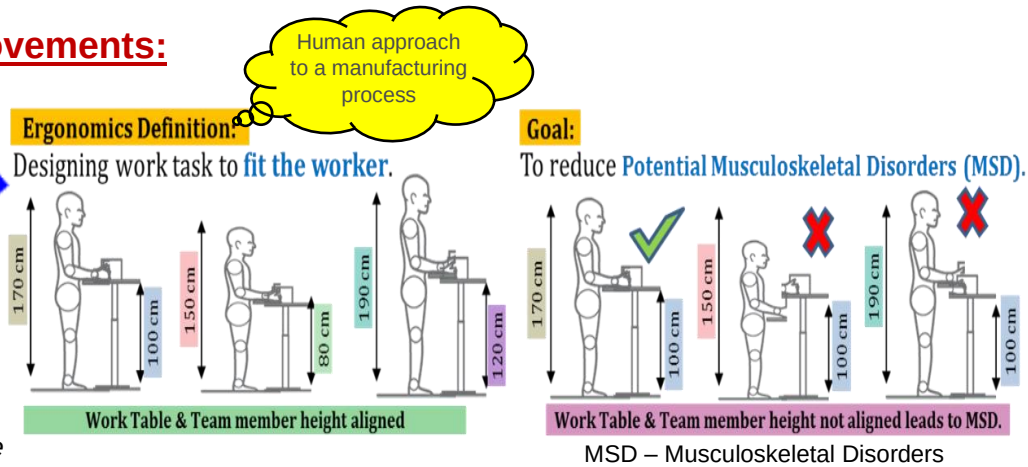
ICE	Impact	Cost	Effort	TOTAL	Selection
High	2	0	0	4	Selected
Low	0	1	1		

To Summarize, based on the ICE tool; Work re-distribution, Layout change, Automation are selected as theme activities which will be explained in detail in **Step 4 of Implementation phase.**

3.2 Ergonomical Improvements:



Productivity Improvement House



MSD – Musculoskeletal Disorders

Integration of Ergonomics in Manufacturing improves Employees Performance and Satisfaction, which ultimately **enhances the Efficiency (Productivity).** This is a very *less known fact in* ***Indian Manufacturing Industry*** as when compared to the Global Manufacturing Industries.

Why Ergonomics required for Improving Productivity?

As the Team member (operator) age increase parallel to the Plant age, chances of Health & safety concerns to be high because of **high fatigue.**

A Global study on Health & Well-being clearly states that due to bad health situation **Productivity**, Quality will be **low**, absenteeism, injuries and health care expenses will be high. **So, Ergonomics at workplace to be improved.**

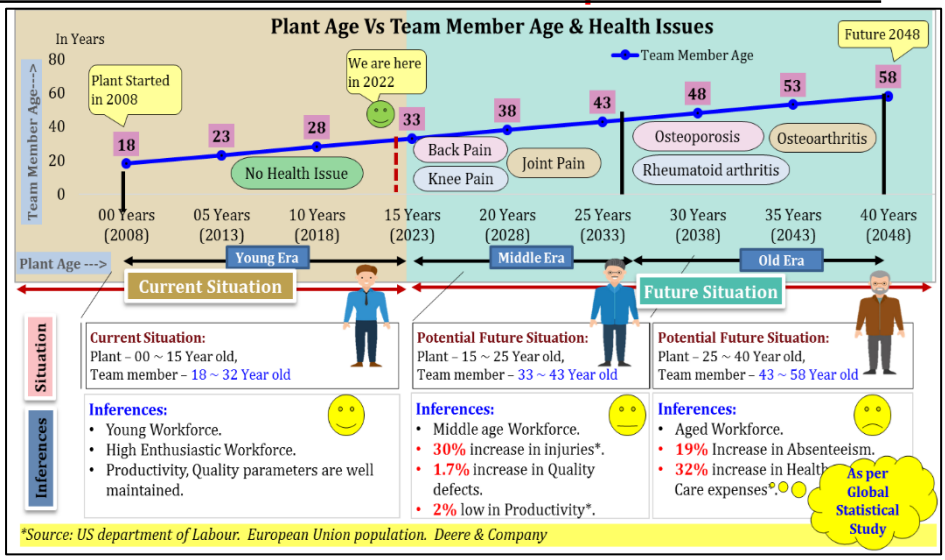


Figure: 3.2 (a) Plant Age Vs Team member Age & Health issues

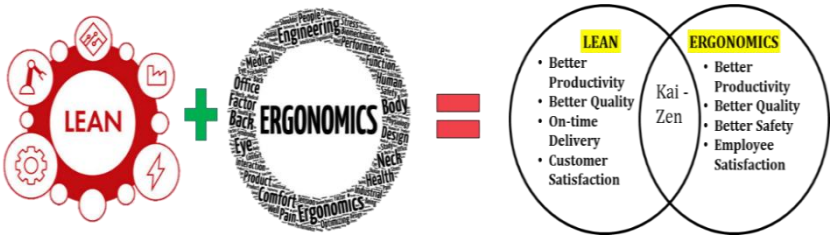


Figure: 3.2 (b) Lean Ergonomics

Lean removes the **waste** and gives the results in short time, which we already used during optimizing manpower. However, in long time perspective this may affect the **productivity**, as the operator age increasing which cause **fatigue** due to repetitive tasks.

Therefore, **Lean Ergonomics** must be taken into account for **better Productivity**, where it is **win-win strategy** for both Management & operator.

Data Collection: We have taken the help of **REBA (Rapid Entire Body Assessment)** as a tool for Ergonomic study, which analyzes the entire body Posture, Force/load and repetitive tasks.

One of the example of a stage where body movement is high & repetitive, REBA score came out to be 10 which lies in high fatigue category as shown in Figure: 3.2 (c).

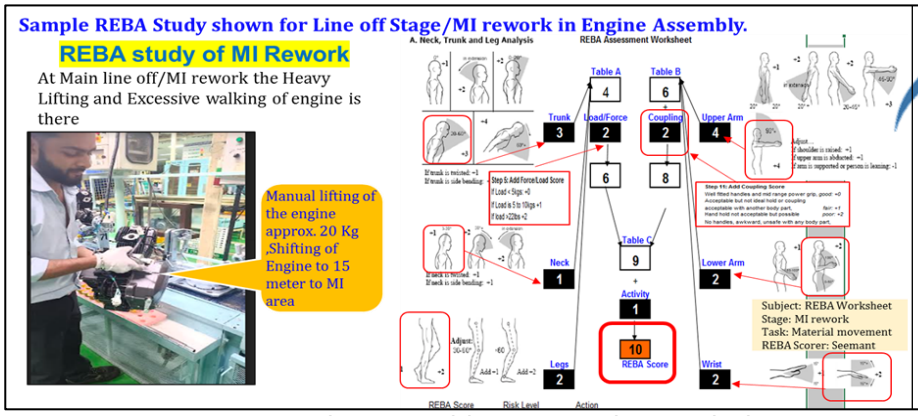
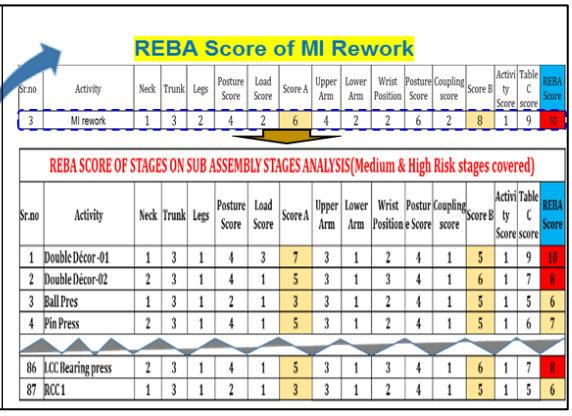


Figure: 3.2 (c) REBA Study – Particular Stage



Sr.no	Activity	Neck	Trunk	Legs	Posture Score	Load Score	Score A	Upper Arm	Lower Arm	Wrist Position	Posture Score	Coupling score	Score B	Activity Score	Table C score	REBA Score
3	MI rework	1	3	2	4	2	6	4	2	2	6	2	8	1	9	10

Sr.no	Activity	Neck	Trunk	Legs	Posture Score	Load Score	Score A	Upper Arm	Lower Arm	Wrist Position	Posture Score	Coupling score	Score B	Activity Score	Table C score	REBA Score
1	Double Décor-01	1	3	1	4	3	7	3	1	2	4	1	5	1	9	10
2	Double Décor-02	2	3	1	4	1	5	3	1	3	4	1	6	1	7	8
3	Ball Pres	1	3	1	2	1	3	3	1	2	4	1	5	1	5	6
4	Pin Press	2	3	1	4	1	5	3	1	2	4	1	5	1	6	7
86	LCC Bearing press	2	3	1	4	1	5	3	1	3	4	1	6	1	7	8
87	RCC 1	1	3	1	2	1	3	3	1	2	4	1	5	1	5	6

Figure: 3.2 (d) REBA Study – Engine Assy.

REBA study conducted across all the stages and summarized as shown in Figure: 3.2 (d). **The study is matched with team member feedback.**

Data Analysis & Inferences:

REBA SCORE

REBA Score	Fatigue Stages	Stage Summary
2 - 3	Low Fatigue	70
4 – 7	Medium Fatigue	70
>8	High Fatigue	26
Total		166

Causes for Fatigue

SN	Cause of Fatigue	Stages
1	Bending	3
2	Twisting	4
3	Stretching	6
4	Lifting	6
5	Walking	7

Solutions/ Ideas generation:

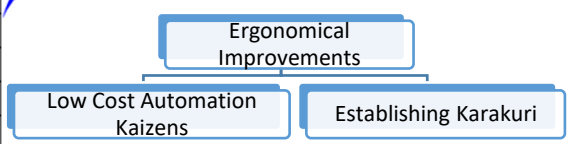
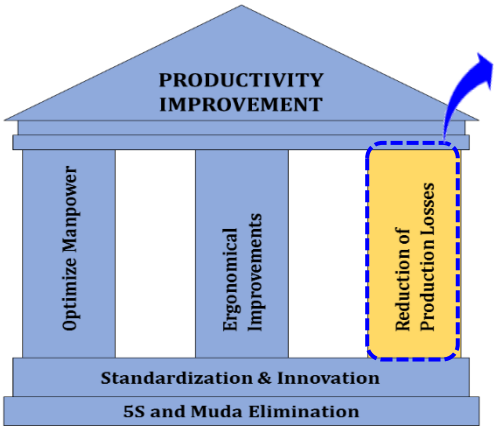


Figure: 3.2 (e) REBA Score Summary Stage wise

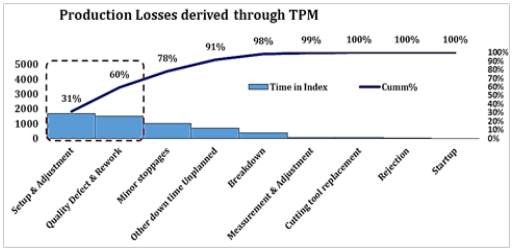
3.3 Reduction of Production Losses:



Productivity Improvement House

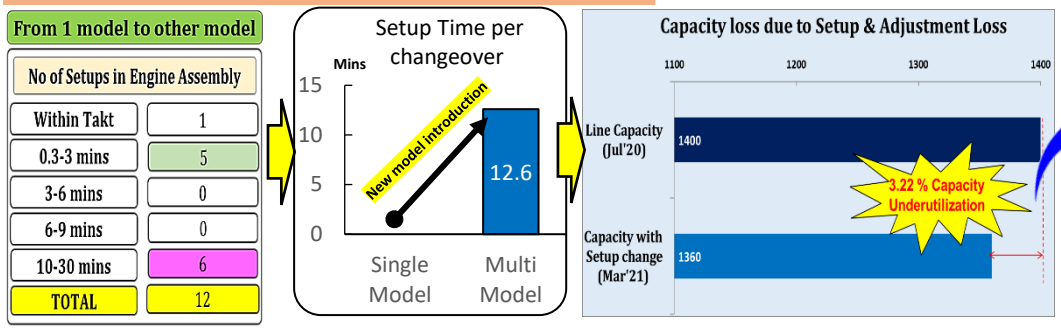
Losses are inevitable in the production and to enhance the Productivity, reduction in losses play a very important role. We as an organization committed to reduce the production losses with ***TPM (Total Productive Maintenance)*** as a ***holistic approach.***

Based on the Pareto analysis, it found that Setup & adjustment loss and Quality defect & rework loss were the major loss contribution out of the TPM's 16 Major losses.



Data Collection & Analysis:

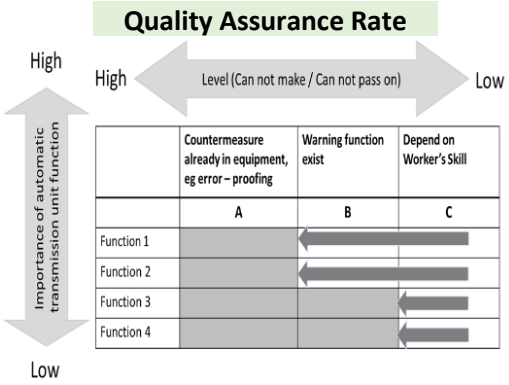
Setup & adjustment Loss



Inferences:

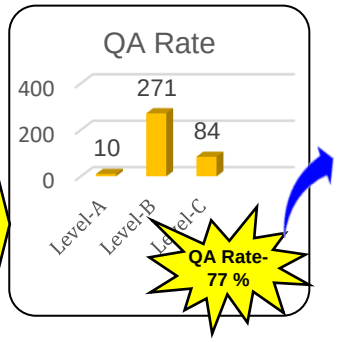
- No of setup change/ shift found to be 4.
- 3.2 % underutilization of capacity.
- Internal activities are more.

Quality defect & Rework Loss



QA Rate = (A+B)/ (A+B+C)*100

A Level= Defect can't be Generated,
B Level= Defect can't be Outflow,
C Level= Manual control on Defect Mode

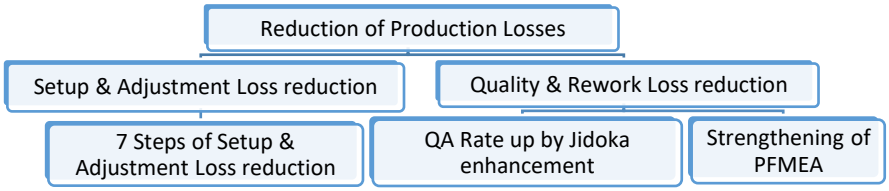


Inferences:

- Poor countermeasures for defect generation.
- Weak Failure mode analysis.

Solutions/ Ideas generation:

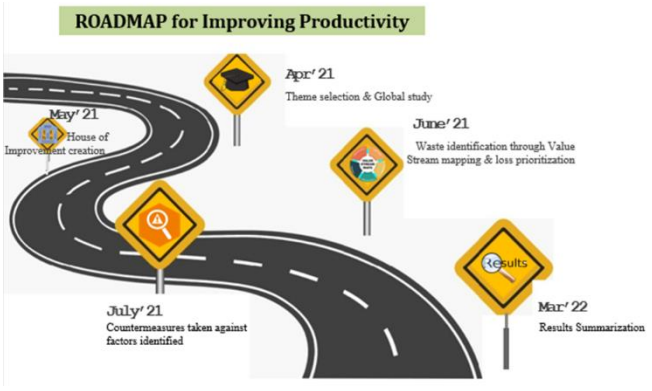
Solutions decided based on ICE tool.



4. Implementation:

Based on the alternate solutions identified, relevant countermeasures taken for Optimizing Manpower, Ergonomical improvements and Reduction in losses according to **Road map** developed within the project timeline.

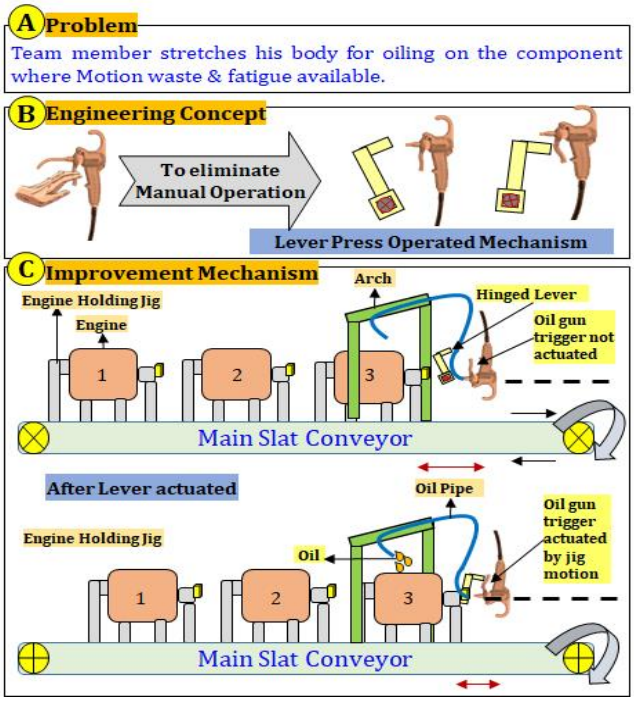
Some of the **Challenges** include medium level of Innovation culture, partially skilled labour, and high cost of Automation.

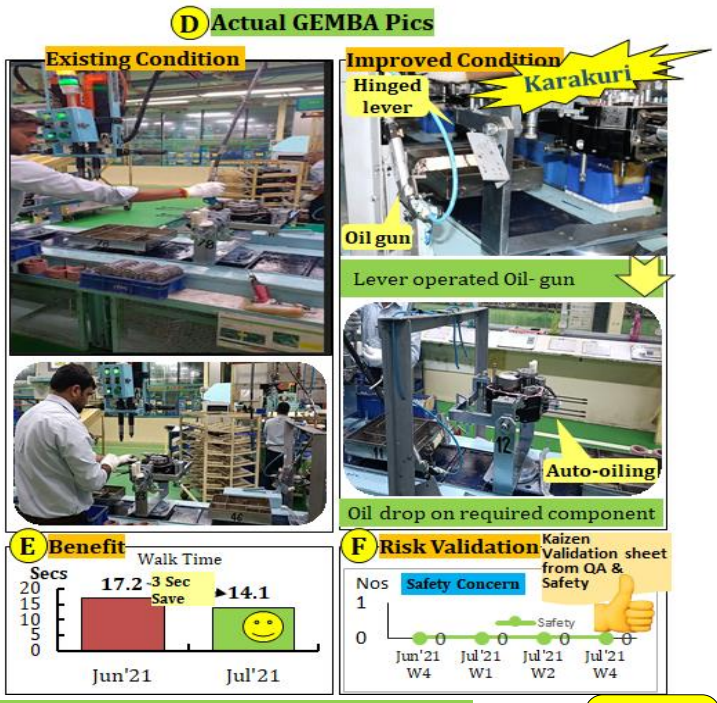


1 Optimizing Manpower Improvements:

1.1 Elimination of Motion waste through Mechanical Automation – Auto oiling

Manual to Auto Oiling by establishing Karakuri on the line.



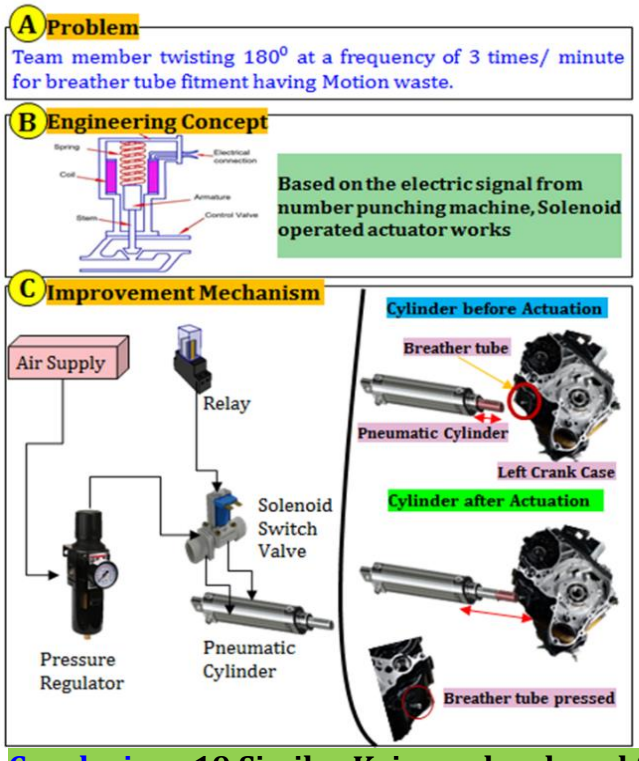


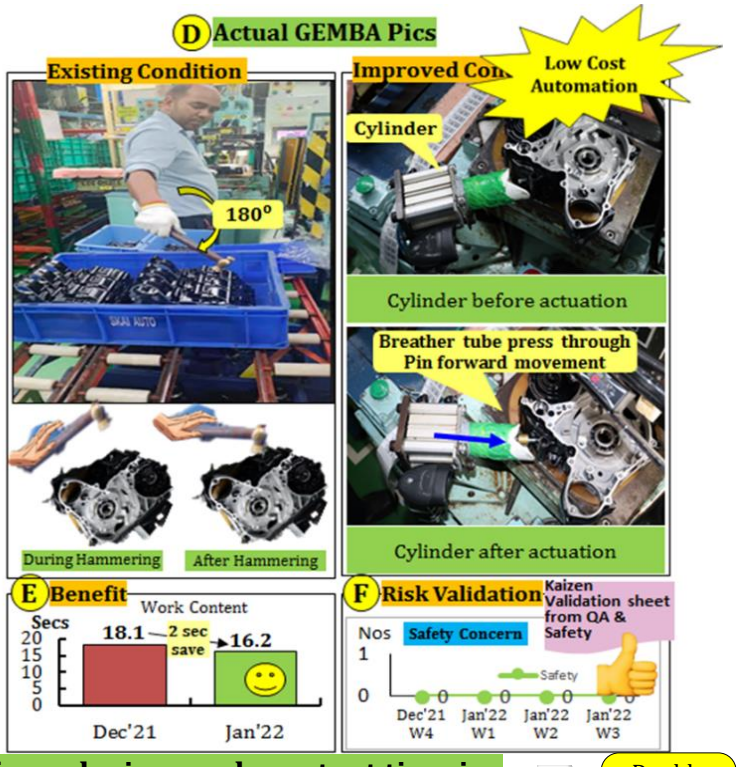
Conclusion: 28 Similar Kaizens developed for reducing work-content time in Assembly area using Karakuri concepts.

Double Click to See the Video

1.2 Elimination of Motion waste through Mechanical Low cost Automation

Manual to Auto fitment by establishing Low Cost Automation on the line.





Conclusion: 19 Similar Kaizens developed for reducing work-content time in Assembly area using Low Cost Automation Concepts.

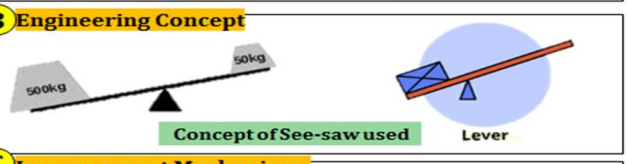
Double Click to See the Video

1.3 Karakuri Developed indigenously by using the motion of dead weight & see-saw concept

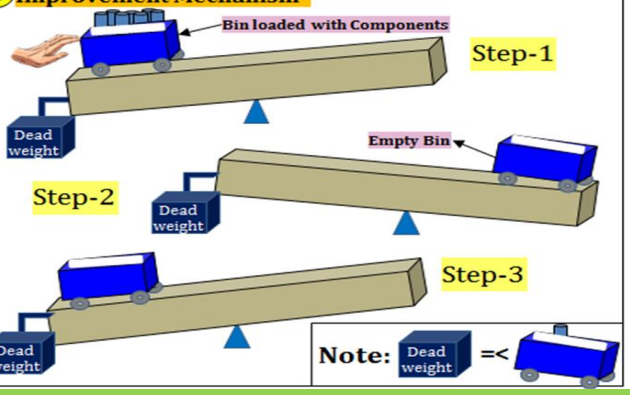
A Problem

Team member travel distance of 3 meters for a frequency of 6 times per shift causing Motion waste & fatigue.

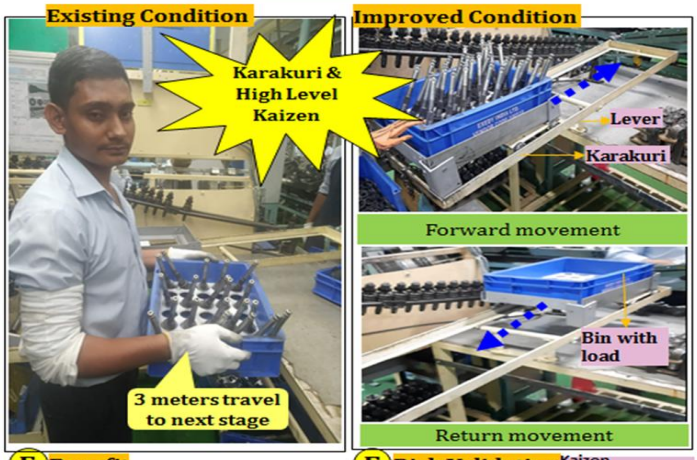
B Engineering Concept



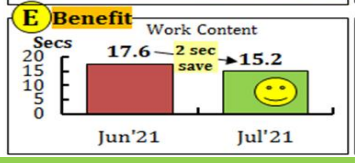
C Improvement Mechanism



D Actual GEMBA Pics



E Benefit



F Risk Validation

Conclusion: 17 Similar Kaizens developed for reducing work-content time in Assembly area using Karakuri & High level kaizen.

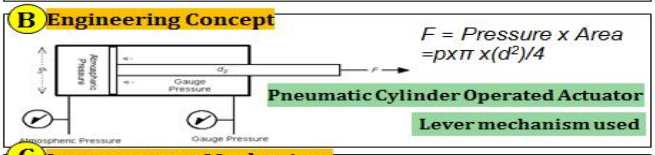
2 Ergonomical Improvements:

2.1 Low cost Automation developed to eliminate the heavy lifting.

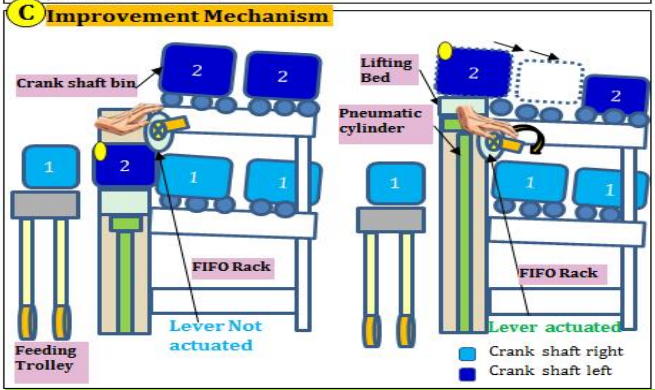
A Problem

Team member lifting bin weighing 18 Kg about 3 feet height and a frequency of 20 times/shift.

B Engineering Concept

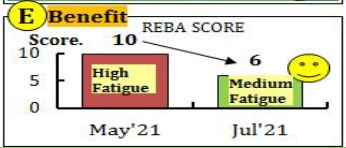


C Improvement Mechanism



D Actual GEMBA Pics

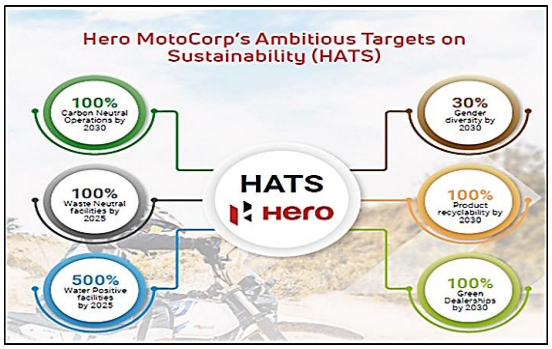
E Benefit



F Risk Validation

Conclusion: All the high fatigue stages (26) converted into medium & low fatigue stages and improved the Team Member Performance.

4b. Green as a management Concept:



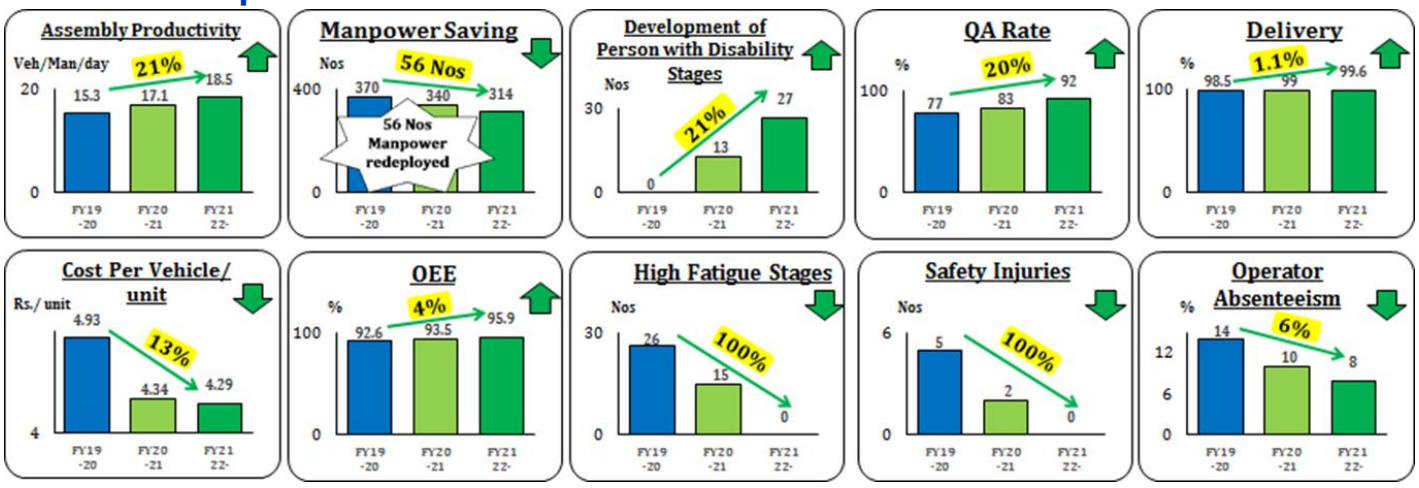
Inline to Hero MotoCorp's Ambitious targets on **sustainability (HATS),** Our Project promoted **3R** strategy.

Reduce: Reducing the trolley size, working table & Consumables.

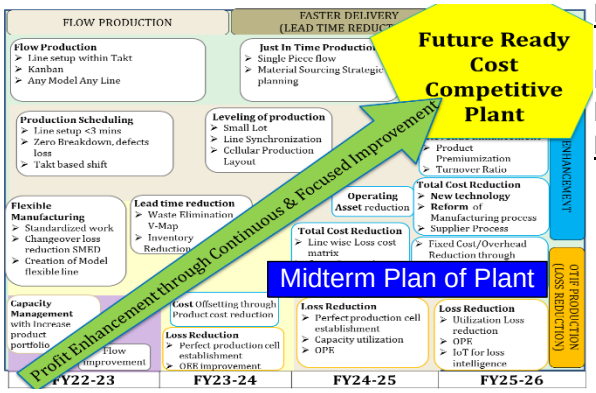
Reuse: Reusing the tools, & Sockets

Recycle: *Indigenously developed* all the Karakuri using scrap at various processes.

5. Results/ Impact:



6. Business Sustainability and Future Focus:



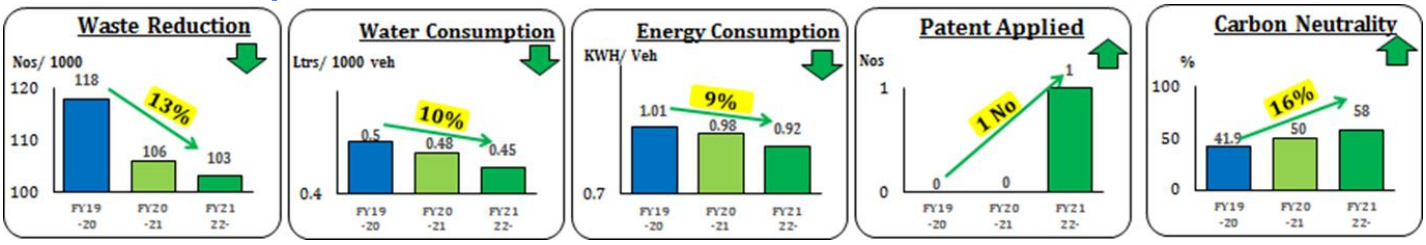
Business Sustainability:

In-line with the **Midterm plan** to be **"Future ready cost competitive Plant"**, we focus on continual improvement of Productivity through benchmarking our practices with respect to the competitors.

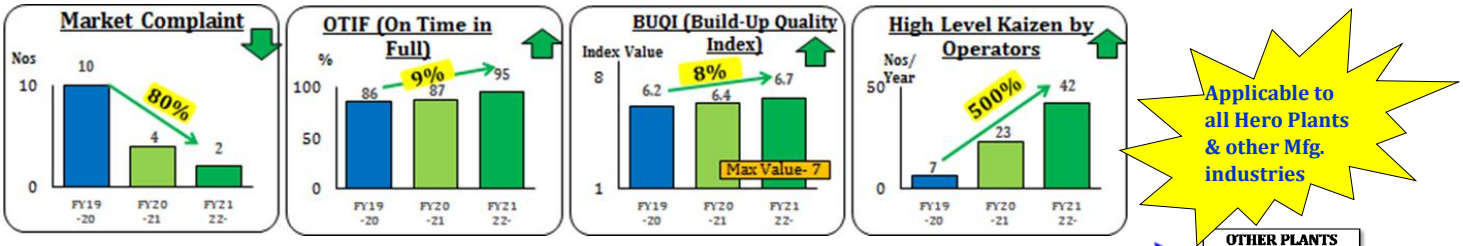
Future Focus to be in competition:

- Increase **Innovation & Automation Culture.**
- Create **"Any Model- Any Line"** concept through establishing Flexible Manufacturing lines.
- Creating **Flow Production** through developing Heijunka and Kanban Concepts.
- Improve the setup time reduction from **SMED to No touch concept.**
- Create **Gender Neutrality** & **Person with Disability** working stages and focus on ***"Design of Assembly".***

7. Resource Impact:



8. Business Metrics:



9. Scope of Horizontal deployment:

We have implemented World-renowned concepts like **TPM, JIT, Ergonomics improvement** which can be implemented in **"any labor intensive industry"** for productivity improvement and ultimately improve the operational efficiency.

10. Laurels of the Project:

Awarded TPM Special Award 2022 from the JIPM Assessors.

Case Studies of this Project appreciated in TPM Special Award Assessment

Gold Award for CII - Best Low Cost Automation

Silver Award from Hero Next Global Kaizen Conclave