A5. Marketing Material

Confederation of Indian Industry

Confederation of Indian Industry
125 Years: 1895-2020

Roadmap for Digital Enterprise through Digital Factory

2020/07/30

Confederation of Indian Industry

About JICA

JICA : Japan International Cooperation Agency governmental agency

JICA coordinates Official Development Assistance (ODA) for the government of Japan. It is chartered with assisting economic and social growth in developing countries, and the promotion of international cooperation.

JICA & CII Experts

Dr Hiroshi Jogasaki
Mr Kiyoshi Yoshida
Mr Hiroki Omiya
Dr Sarita Nagpal
Mr Amit Kumar Vishnoi

Confederation of Indian Industry

Lecturer's Biography

Hiroshi Jogasaki E-mail: Hiroshi-Jogasaki@wba.co.jp JICA Expert
Director Senior Consultant, World Business Associates, Inc.
Certified Business Consultant by METI, Japan April, 2008
Ph.D. in Systems Information Science March, 2017

Doctoral Program, Future University Hakodate March, 2017
Department of Electrical Engineering, Faculty of Science and Engineering, Waseda University March ,1987

Feb, 2020 In charge of "Digital KAIZEN" course lecturer sponsored by the Ministry of Foreign Affairs JAPAN in the 6 cities at Major States of Russia.
Nov, 2019 28 IT companies visiting and meeting with Japanese companies from Russia hosted by the Ministry of Foreign Affairs Japan. In charge of the chief lecturer of the training to Japan for the company.

June, 2019 JICA Engaged in the business of training pilot for indian manufacturing executives. (Continuing)

April, 2019 Project Manager for METI Grant Application Support to 17 Small and medium-sized manufacturing companies in Japan.

June,2018 In charge of "Project Management" course lecturer sponsored by the Ministry of Foreign Affairs JAPAN in the 6 cities at Major States of Russia.

Information Technology related corporate experience more than 30years. Most recently, From 2008 to 2011 at IBM Japan customer success team for automotive manufacturing companies's headquarters and affiliates throughout Japan, especially for IT Infrastructure pre-sales. From 2011 to 2013 at Tata Consultancy Services Japan, he was in charge of the construction of a global infrastructure for a general trading company and a pre-sales of a help desk construction support project. From Nov. 2013 to Sep 2016, at Harveynash, HQ in United Kingdom, worked as a Head of the Japanese business of Vietnam offshoring business. From Oct.2016 Current position.

Co-author: "Loyalty Marketing" and many others Doctoral thesis: Emotion-focused method for smart device sensing

Confederation of Indian Industry

Message to Senior Managers from Eiji Toyoda

"Senior management is simply a flag bearer when a business decision is made. It is of no use unless others follow the flag."

– Eiji Toyoda
(Former Chairman of Toyota)

Senior management should have a flag with follower.

Chapters

1.Digital revolution of automotive industry in the world

CASE (**C**onnectivity, **A**utonomous, **S**hared & **S**ervices, **E**lectric)

2.Data Science Revolution with using AI & IoT

What is AI & IoT Technologies for automotive industry?

3. Concept of Digital Factory & Roadmap

What is Digital Factory and how to make it happen?

Main Part

4.How you motivate employee?

KAIZEN Leadership and SDGs oriented approach for motivating employee for Digital Enterprise.

5. Executive Summary

6. Q & A time

1. Digital revolution of automotive industry in the world

Fact of Automotive Industry

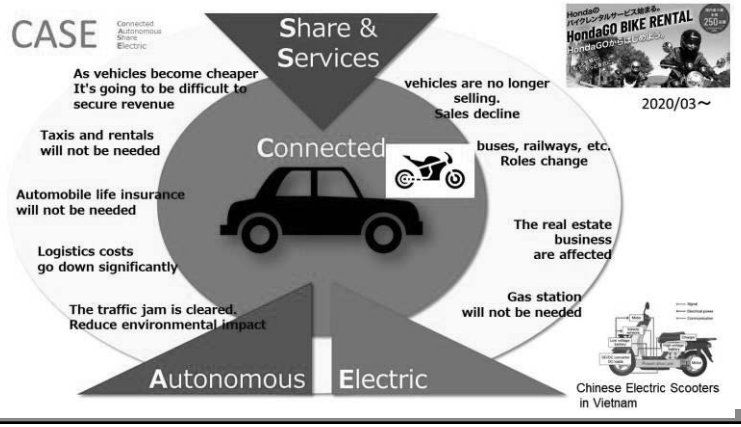
According to the researchers,

Among 7 Billion people, there is 800Million vehicles in the world 2015.
But riding only 15 days in a year and other days vehicles are staying in the Parking place

"The Automobile Revolution: Towards a New Electro-Mobility Paradigm"

Optimize the total utilization of the vehicles

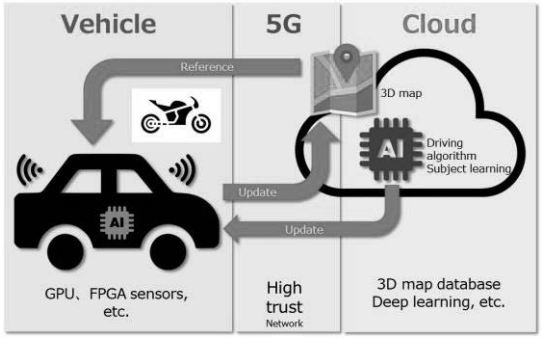
Digital transformation to drive change in a variety of industries



For autonomous driving Platform (Smartphone of automobile)

C

A



BMW AUTONOMOUS BIKE – BMW R 1200 GS

Vehicles that can drive autonomously

Level3 has started on the public road in Japan.

A

E

Level4-5 Fully automatic driving	The system performs all acceleration, steering, and braking, and the driver is not involved. * Level4 depending on the weather and road environment.		Accident liability
Level3 Associates Automatic Running	Acceleration, steering, and braking All the system by autonomous, but the driver responds if requested by the system.		
Level2 Associates Automatic driving	The system performs multiple operations of acceleration, steering, and braking.		
Level1 Safe driving support	The system accelerates, steers, or brakes.		
Level0 No support	The driver always performs all operations (acceleration, steering, braking).		

Concerning Point
Law
Insurance
Running together with Human manipulating car

List from 2019 Autonomous Millage reports in CA,USA

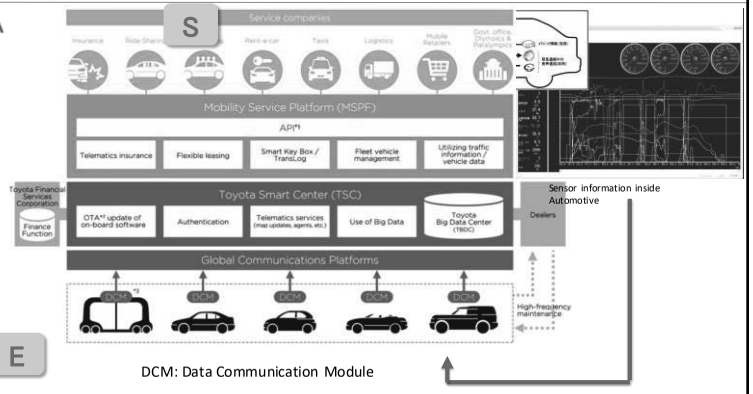
Waymo (Google)
GM Cruise
Apple
Uber
Lyft
Aurora (Amazon)
Nuro (Spin out of Waymo)
Baidu(Chinese IT company)
Zoox (Pure venture)
Tesla

CASE STUDY: TOYOTA Mobility Services Platform

TOYOTA

In 2020, Every Toyota car is having DCM inside.

S



C

A E

DCM: Data Communication Module

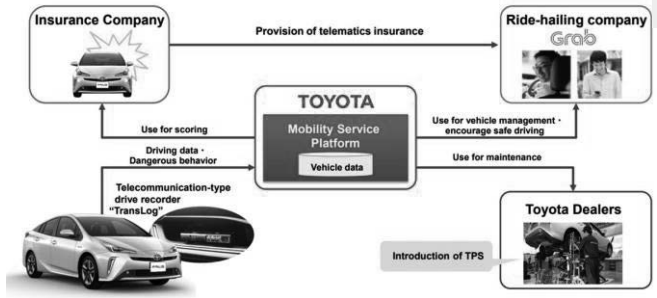
CASE STUDY: Toyota for CASE(1/2)

C

S

Collaboration with Grab: "Total-care Service"

- Provide support for safe, efficient operations by sharing vehicle/driving data via a Mobility Service Platform (MSPF)
- Provide insurance, vehicle management, and maintenance, all coordinated with data, by the Toyota Group



Singapore
Malaysia
Vietnam
Thailand
Cambodia
Myanmar
Indonesia
Philipines

CASE STUDY: Toyota for Autonomous and Electric(1/2)

MaaS-dedicated Vehicle Lineup

Develop multi-task vehicles that reflect the characteristics of MaaS (including capacity efficiency, ease of getting in/out, cleaning, and maintenance)

A

E

	e-Palette	MaaS Sienna	MaaS BEV
Purpose	Multi-task short distance transportation (people/cargo)	Medium-to-long distance ride-sharing	Short-to-medium distance ride-sharing
Launch	2021 Tokyo Olympic Games	2021	-
Power	BEV	HEV	BEV
Size	Large	Medium	Small

MaaS: Mobility as a Service, BEV: Battery Electric Vehicle, HEV: Hybrid Electric Vehicle

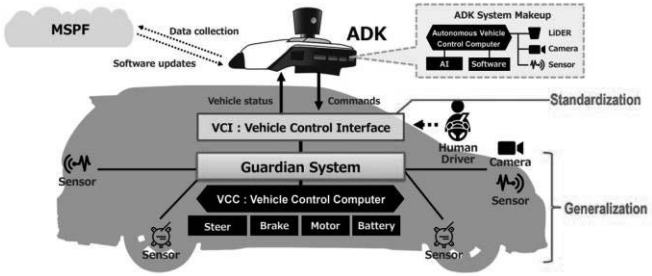
CASE STUDY: Toyota for Autonomous and Electric(2/2)

Autonomous Driving MaaS Vehicles

A

E

- Convert Level 2-3 mass-produced vehicles into Level 4 MaaS-dedicated vehicles through ADKs (Autonomous Driving Kit)
- Improve safety through dual-monitoring of the surrounding environment by the ADK software and the Guardian system on the vehicle
- Promote standardization of VCI (Vehicle Control Interface) and generalization of the vehicle control unit, including the Guardian system



Using Toyota's Real-World Technologyand Assets as Strengths

Mass-produce advanced vehicles equipped with AI at sufficient quality and appropriate cost, and conduct maintenance on those vehicles at appropriate intervals to popularize them as safe mobility services in society

CASE STUDY : Yamaha Autonomous Manipulating ROBOT(2015～2017)

Impressive driving experience by visualizing information

R&D

accelerator

front brake

shift pedal

rear brake

clutch

Experience

Output

Machine Learning

Input

High-precision GPS

speed

engine speed

posture

A

MOTOBOT himself determines the optimum line of the circuit course and the limit of machine performance, and improve the lap time by repeating the run. 200km/hr

MOTOBOT is driving without modifying the vehicle body.

Human style robots gives insights to R&D to improve the experience on the two wheeler.

CASE STUDY : Yamaha started new company with Autonomous Car Startup

Logistics inside the factory

R&D

Engineering

Yamaha's new Company (eve autonomy) is joint venture company together with Open Source based Autonomous Car solution start-up "Tier IV".

A

eve autonomy

+

Open Innovations is key for the success for Digital Factory solutions.

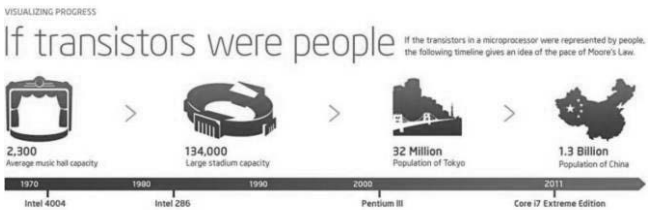
Chapter Conclusion

The automotive industry is under going a profound transformation with the arrival of new type of vehicles, services, and uses that break away from the traditional model of vehicles.

2. Data Science Revolution with using AI & IOT

Moore's Law-Accumulation rate of the Semiconductors doubles in 18 months

（インテル創業者の一人であるゴードン・ムーアが、1965年に自らの論文上で唱えた「半導体の集積率は18か月で2倍になる」という半導体業界の経験則です。）



Semiconductor improvement is so significant. It is changing the world.

History of Computer and Automotive

1940's
ENIAC (Electronic Numerical Integrator and Computer)

1960's
IBM System/360

1980's
IBM PC/AT

1940's
CADILLAC Fleetwood 60 special

1960's
Ford Thunderbird

Computers are downsizing every 20 years. And reducing cost dramatically.

1980's
Cadillac Fleetwood Sixty Special

History of Computer and Automotive

2000's (2007)
Apple i-phone

Everybody have more power than ENIAC in your hand.

2000's(2007)
Camaro

Significant Change from Hardware Keyboard to Software Keyboard

Looking back IT history IT Trends

At Cambrian age, every animal started to having eye and started explosion.
AI's eye can recognize better than Human from 2017.

IBM(2000 --> 2019)

IBM has established at 1911

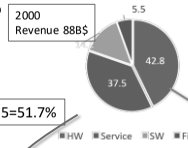
1993 Lewis Garsner CEO at Transition
2003 Samuel J Parsamino CEO
2012 Jeannie Rometti First Women CEO
2020 Arvind Krishna First Technical background CEO

2000
The structure of sales (summary) in the business of
Hardware 42.8%
Global Services 37.5%
Software 14.3%
Finance and others 5.5%

From HW business to Service business

2019
The structure of sales (summary) in the business of
Global Technology Services 38%
Cloud & Cognitive Solutions 30%
Global Business Services 24%
System hardware 8%

2000
Revenue 88B$

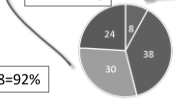


14.2+37.5=51.7%

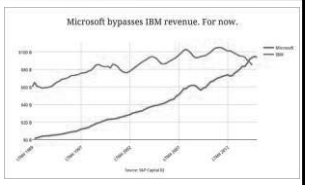
42.8%

2019
Revenue 78B$

8%



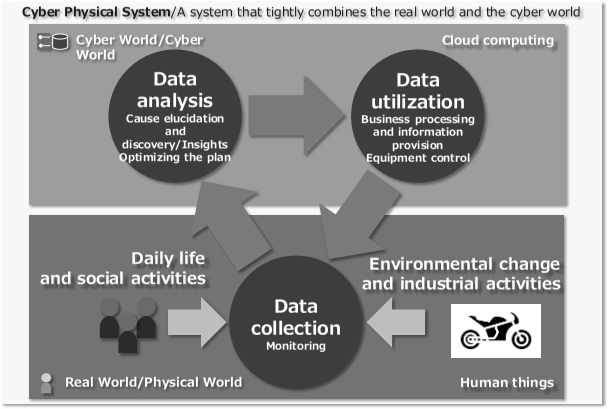
24+30+38=92%



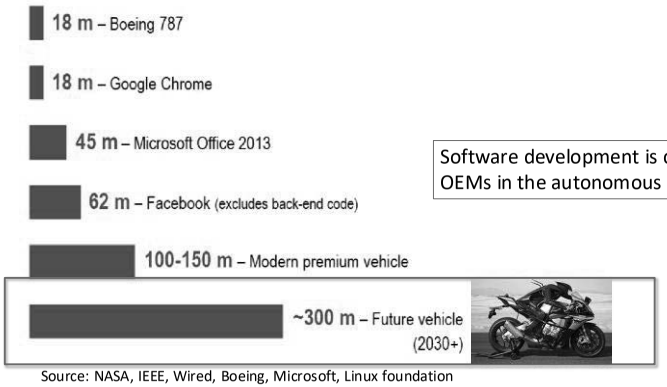
IBM acquires Opensource company **Red hat with 34B$ in 2018**.

From HW Company to Services Company

Latest IT Trend for Optimize Society



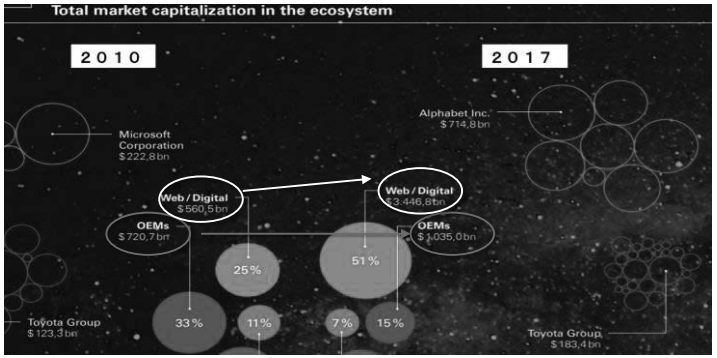
Things to software



Software development is critical factor of OEMs in the autonomous vehicle.

Source: NASA, IEEE, Wired, Boeing, Microsoft, Linux foundation

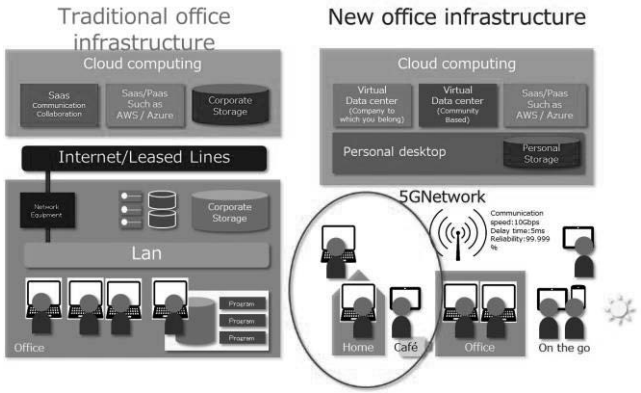
Things to software



Global Automotive Executive Survey 2018 – KPMG

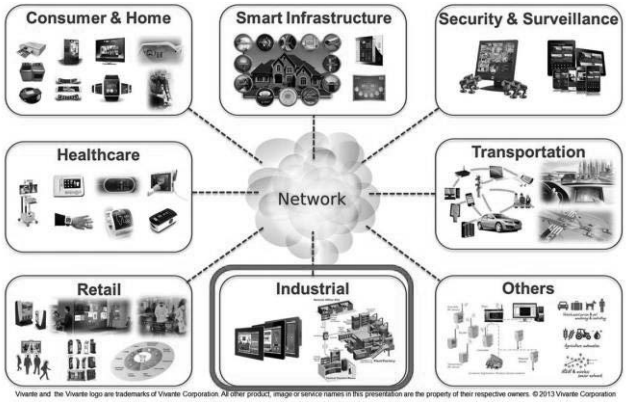
Web/Digital industry's Market Value is more than three times than OEMs after 2017.

Office infrastructure in the future (After CORONA)



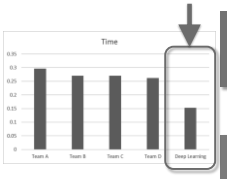
The scene where is utilized IoT / AI

Wide usage of the technology of IoT/AI enables cost reduction to enter this field .



Why is deep learning so much attention?

Because it has proven precision on Visual Recognition at **ILSVRC2012**(Large Scale Visual Recognition Challenge).



Rule

make rules for interpretation based on human experience or knowledge

Machine learning

By analyzing **the data**, Find out automatically the rules and Patterns in it

Traditional machine learning
Point of interest when finding a pattern
(Feature Value)

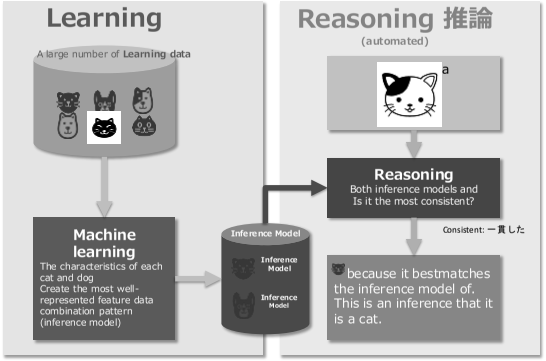
Data

Human beings teach the quantity of features and Machine find patterns, organize patterns in the data

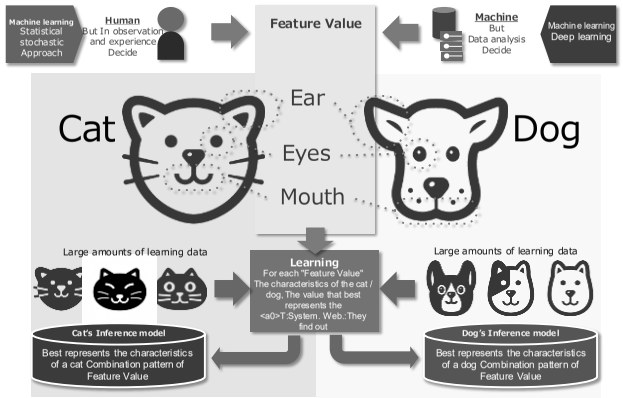
Deep learning
(based on Neural Network)
Point of interest when finding a pattern
(Feature Value)

Even if humans don't teach, they find patterns among all things. Classify and organize the world

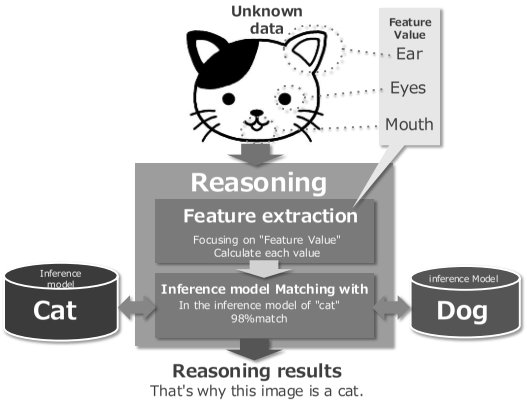
Machine Learning and Reasoning (1/3)



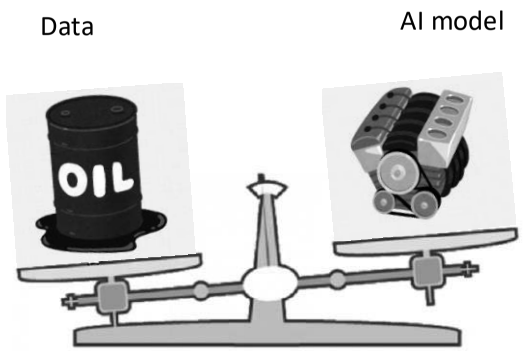
Machine learning and reasoning (2/3)



Machine Learning and Reasoning (3/3)



Data is Oil, AI model is Engine



What is for automotive factory by AI technologies? (1/2)

Bevel gear supplier
realize dramatic cost down
3M$ Cost Down / 2379M$ Revenue

NVIDIA Jetson NANO

- For example, in the production line of the assembly manufacturing industry, AI is seeming to fit an visual inspection. What was initially expected to AI was to be perfectly distinguished OK products and NG products. And if you know it's impossible, this time you're going to say, "If 100% accuracy is not guaranteed, it cannot be used on the production line."
- However, such confusion seems to have settled down considerably, too. By doing PoC (Proof of Concept) and element development, the essence of AI has come to be recognized.
- "In the first place, even a human inspector cannot distinguish 100% with precision.
- "Even if it is not possible to automate appearance inspection suddenly, reduction of the number of inspector is meaningful"
- "Even if AI continue to work for a long time, AI won't get tired, and AI won't lose his concentration. "AI is useful for pokayoke, etc., " face-to-face reality, There is a growing need for utilization such as at shop floor"

What is for automotive factory by AI technologies? (2/2)

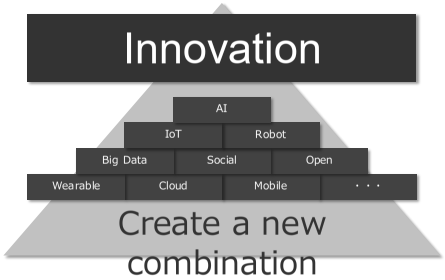
For example, such as the "color unevenness" judgment at the paint shop is difficult job for AI. AI needs to perform a subtle distinction that considerable build-in and tuning will be required to achieve more than a certain level of accuracy.

On the other hand, it is relatively easy to determine that the parts in the box are out of stock or that the connector is off.

"First of all, from the easy part of such an effort, among various manufacturing approaches AI can start implementing and achieve results such as labor shortage measures and productivity improvement
in a short period of time."

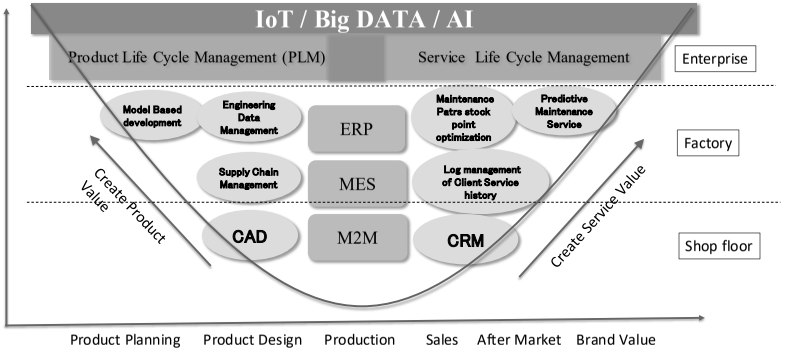
Where are you going?

Business value

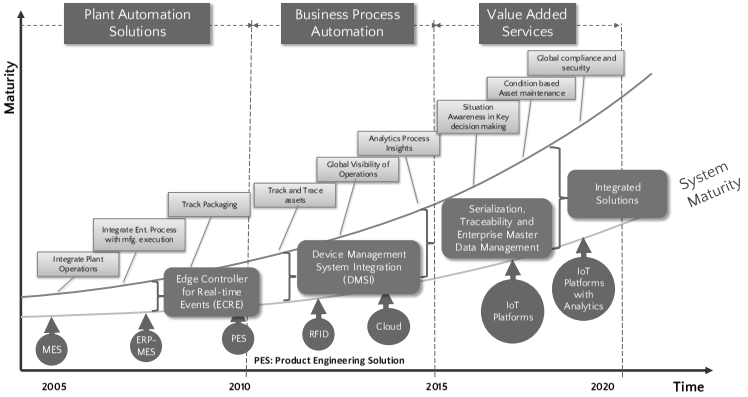


3. What is Digital Factory and how to make it happen?

Smart Manufacturing Platform defined by METI
(Ministry of Economy , trade and investment in Japan)



Overview of how IT Solutions address Digital Factory Needs

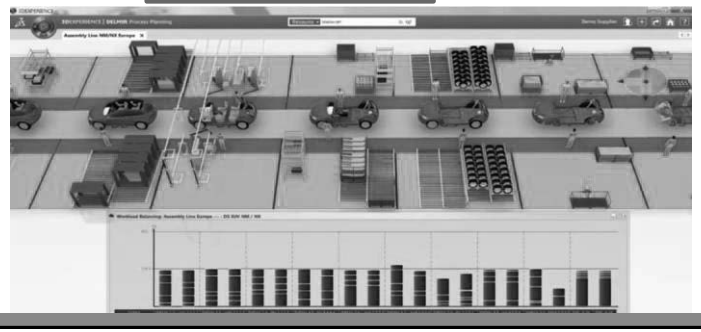


Digital Planning tool for the Automotive Assembly Line

Factory Layout Planning & Maintenance

Example : "DELMIA Final Assembly Planning" Dassault Systems

Improve planning quality
Deliver manufacturing planning efficiency



Digital Product cost Planning and Management

Example : "Teamcenter" by Siemens

Product Lifecycle management
BOM management
Change Management & Workflow
Documentation Management & Publishing
etc

Kinaxis Supply chain optimization software

Get an at-a-glance view of the health of your supply chain with geo-mapping.

Digital Tracking the global Supply Chain

Challenges: Under the COVID-19,
Lack of Visibility and High Fixed and Variable Costs Impacts Profitability for the company

Solution: Insist on Deep Visibility and Accurate Cost Controls Throughout the Global Supply Chain

CASE STUDY : Harley-Davidson York Factory

PAIN POINTS

Harley Davidson's new younger buyers wanted a different type of motorcycle. It needed to get agile, to be able to respond to the changes fast, and to be more efficient and productive. It needed to lower the hours per unit to build motorcycle.

SOLUTIONS

In 2010, Harley-Davidson began a massive restructuring of its manufacturing plant and deployed an IoT system that collects data from manufacturing equipment to look for early sign of mechanical problems. Hundreds of machines were connected with IoT sensors to help plant managers track such metrics as temperature and vibrations to keep machinery operation at peak efficiency and alert managers to problems that could slow production.

The data from the machines powers analytics systems that can predict problems long before they are likely to occur.

Recent story about Harley-Davidson

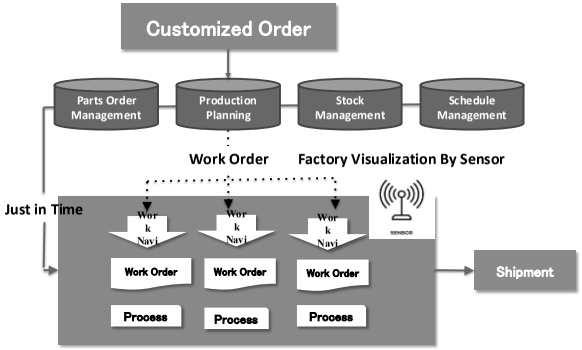
BUSINESS VALUE

- Ten to 25 times improvement in build-to-order(BTO) cycle times (18 months reduced to two weeks)
- Seven to 12 percent increase in IoT automation-driven equipment utilization.
- A profitability increase between 3 to 4 percent in one factory.

In 2016, **Harley-Davidson leveraged IoT to change its York** (Pennsylvania, USA) **manufacturing facility and deployed smart sensors and edge analytics. They could reduce the time it takes to produce a motorbike** from a 21-day cycle to six hours.

Now, one motorcycle comes off the assembly line every 89 seconds. – while simultaneously reducing operating costs by $200 million.

Mass-customization based Factory in Harley Davidson in York Factory



Overviews of the Factory

https://www.youtube.com/watch?v=3IUoF488ic4

Main LCD Board for Visualization

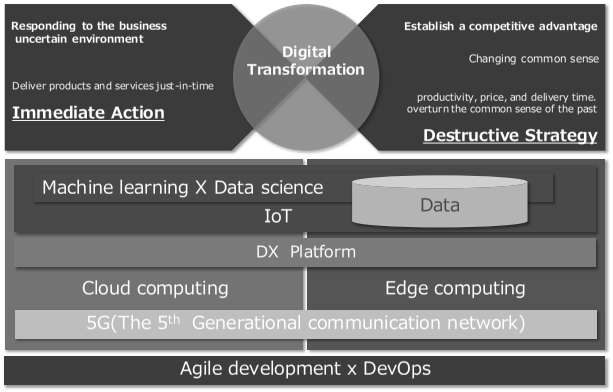
LCD Displays for Digital Andon in Assembly Line

Robot Painting

Pilot Project Proposal in Hero MotoCorp Neemrana plant,

Adopted New Approach : Digital Transformation and Andon System

Digital Transformation (Supporting Technology)



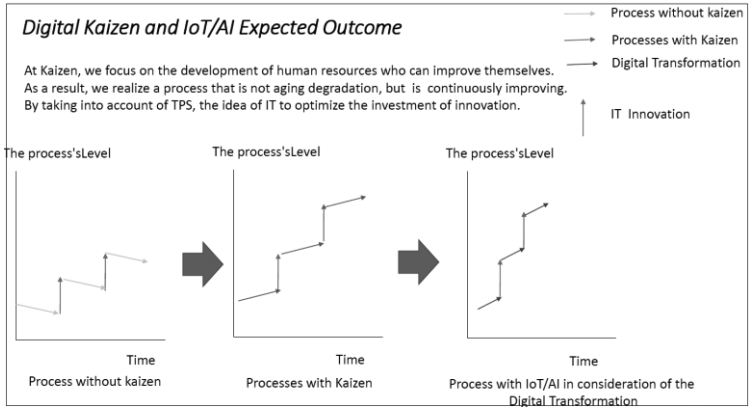
What is good for Company

- 【Environment】 Get Agility for competitiveness
  - Improve the speed of the response against the market demand.
- 【Operation】 Improve the speed of KAIZEN
  - Improve productivity
  - Improve the First-time-Right
  - Improve the reducing the stock from the factory
- 【Outcome】 Get agility for the company sustainability
  - Profitability
  - Supply Capacity
  - Revenue

What is good for Employees

- 【Environment】 Clear objectives
  - Accurate object driven daily activities
- 【Operation】 Organized Operation
  - Shorten the working time
  - Focusing on more value adding job
  - Shifting from non-intelligent work to intelligent work
- 【Outcome】 Employer's happiness
  - Data driven culture
  - Efficient working style
  - Good return on money

Digital Kaizen

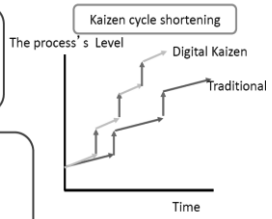


Digital Kaizen and IoT/AI Expected Outcome

1. Iot Visualization
- 1.1.Equipment uptime
- 1.2.Operating conditions of the equipment (Time, temperature, humidity etc)
- 1.3.Detection of abnormalities (sound, vibration, light etc)

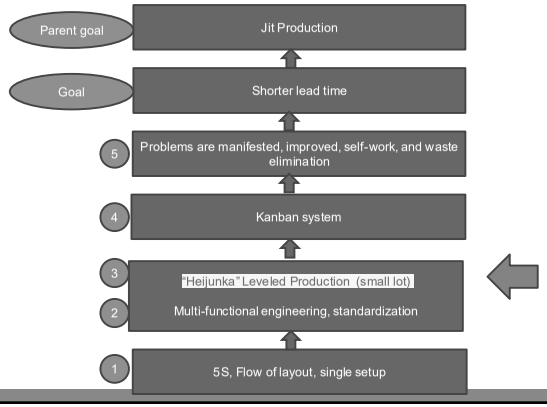
2. Kaizen:
- 2.1.Discovery and standardization of waste (Leveling, layout)
- 2.2.Optimization of production conditions (yield improvement, variation reduction)
- 2.3.Prediction of failure

3. Management Improvement: Cost Reduction
- 3.1.Reduce lead time and increase productivity
- 3.2.Quality improvement and productivity improvement
- 3.3.Preventive maintenance and productivity improvement



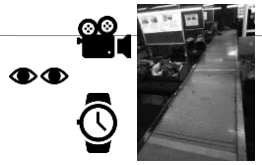
What has been realized In Kaizen?

Toyota production system (TPS) Relationship between methodologies

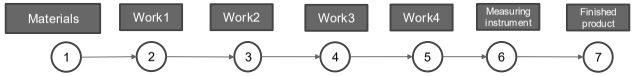


(CASE Study) Helmet assembly process "Hejunka"

ProductNumber:123-456 ProductName:Sakura
Monthly Target Production 18,400 ➡ Per day required:920
Number of days of operation of the factory per month 20 Days
Scheduled working hours:460 Minutes (7HRs40minutes)



(1) Equipment layout diagram



(2) Processing order and processing time

Material	Work1	Work2	Work3	Work4	Measuring instrument	Finished product

Processed contents		Processing 1	Processing 2	Processing 3	Processing 4	Inspection	
Manual time (seconds)	2	22	15	14	32	16	2
Auto feed time (seconds)				25			

Production capacity table by process

Process order	Process name	Work hours(Seconds)	Completion time (seconds)	Note
Process1	They take the material	2		
Process2	Operation 1	22	32	On a conveyor
Process3	Operation 2	15	32	On a conveyor
Process4	Operation 3	14	32	On a conveyor
Process5	Operation 4	32	32	On a conveyor
Process6	Inspection	16	32	On a conveyor
Process7	Put the finished product	2		
Total			104	

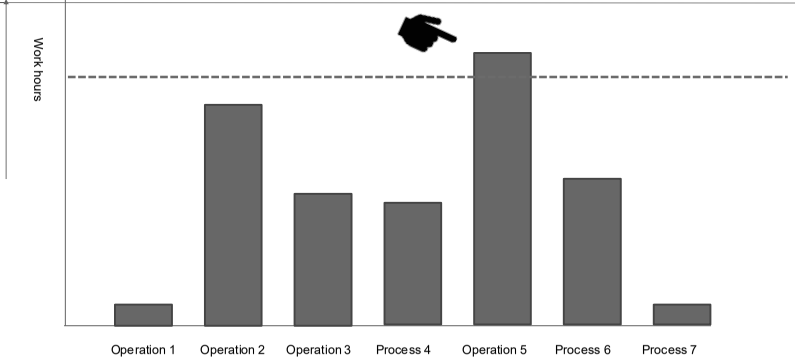
Production capacity= $\frac{Working\ hours}{Comletion\ time\ per\ one\ product} = \frac{460x60}{32} = \frac{27,600}{32}$ =862.5

→ less than 920
Shortage of pieces : 58

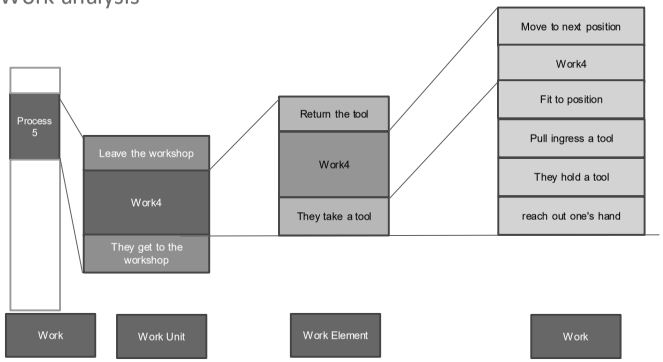
TAKT TIME= $\frac{Working\ hours}{Per\ day\ Required\ numner} = \frac{460x60}{920} = \frac{27,600}{920}$=30 (Seconds)

→ Need to investigate the work contents

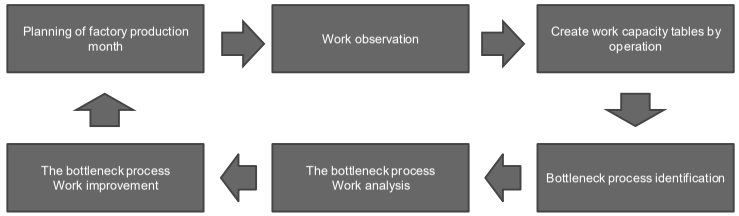
Bottleneck analysis



Work analysis



Kaizen cycle, work observation cycle

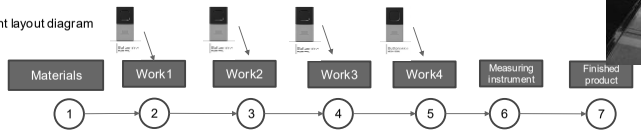


What can be done in new In Digital Kaizen?

(CASE STUDY) Helmet assembly process "Hejunka"

ProductNumber:123-456 ProductName:Sakura
Monthly Target Production 18,400 ➡ Per day required:920
Number of days of operation of the factory per month 20 Day s
Scheduled working hours:460 Minutes (7HRs 40minutes)

(1) Equipment layout diagram

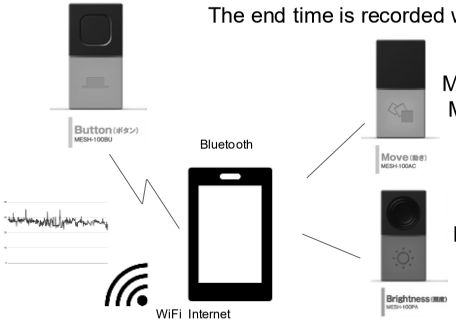


(2) Processing order and processing time

Processed contents		Processing 1	Processing 2	Processing 3	Processing 4	Inspection	
Manual time (seconds)	2	22	15	14	32	16	2
Auto feed time (seconds)				25			

Manual or automatic measurement by sensor input

Button sensor: The start time is recorded when pressed once,
The end time is recorded when pressed twice.



Motion sensor:
Measure the strength of the acceleration

Light Sensor:
Measure the Light intensity

Production capacity table by process

Process order	Process name	Work hours(Seconds)	Completion time (seconds)	Note
Process1	They take the material	2		
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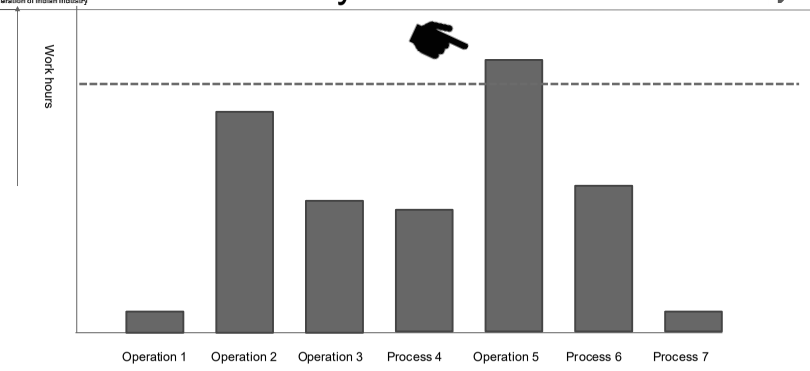
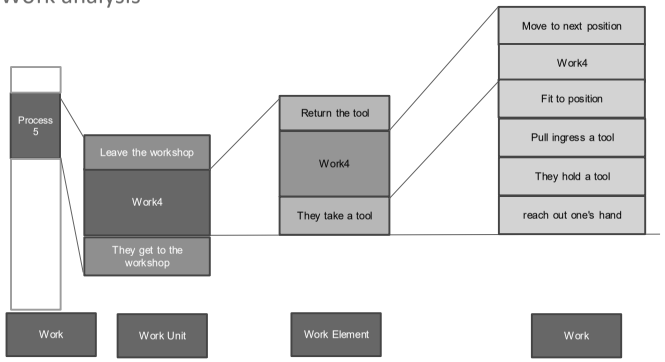
Shortage of pieces : 58

TAKT TIME= $\frac{Working\ hours}{Per\ day\ Required\ nummer} = \frac{460x60}{920} = \frac{27,600}{920}$ ≒30 (Seconds) ➡ Need to investigate the work contents

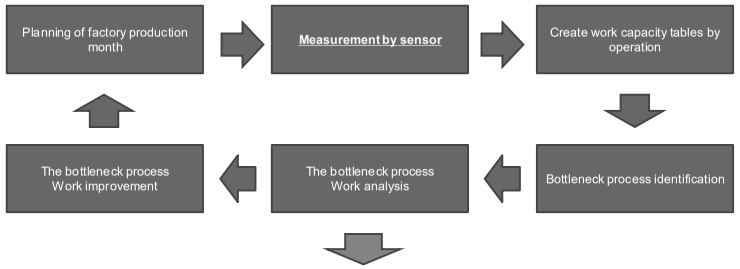
Bottleneck analysis



Work analysis

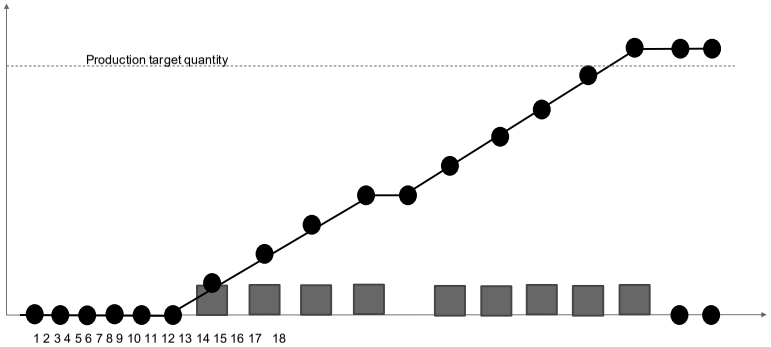


Kaizen cycle is monthly, weekly, daily and real-time

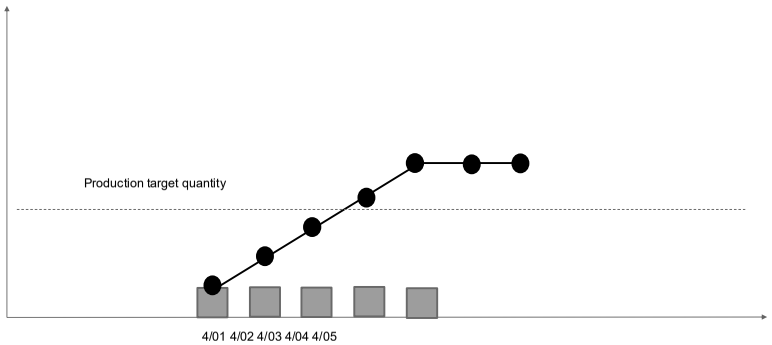


Kaizen cycle can be realized in an short time.
It is possible to focus on the needs, when necessary, and the tasks needed.

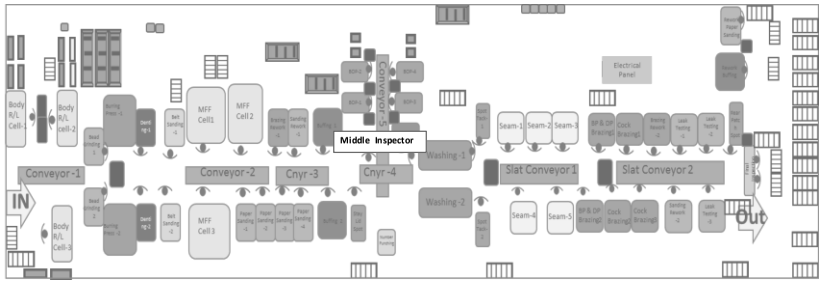
IotProduction Line Analysis (Daily)



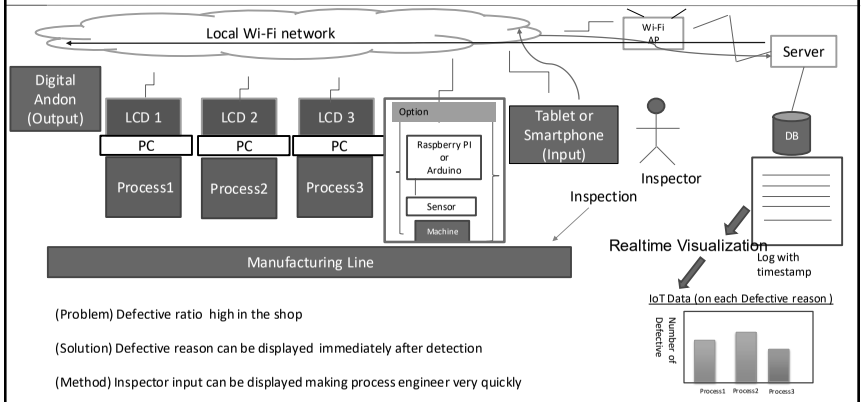
IotProduction line analysis (weekly)



(CASE Study):Fuel Tank Weld Assembly Line



Holistic View of Total System of Digital Kaizen in Pilot proposal



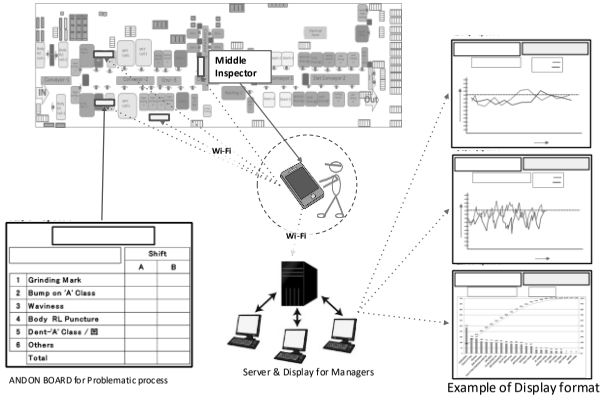
(Problem) Defective ratio high in the shop

(Solution) Defective reason can be displayed immediately after detection

(Method) Inspector input can be displayed making process engineer very quickly

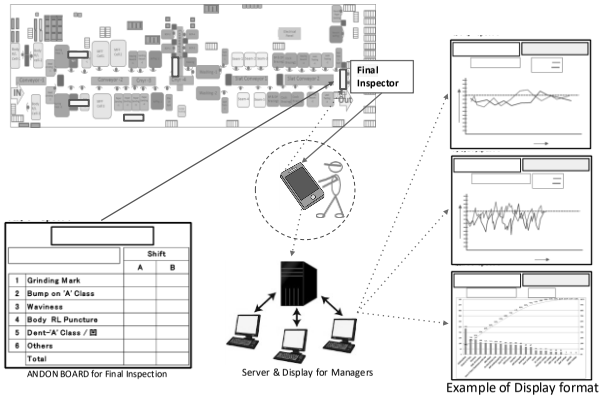
Step-1 Proposal in Pilot project

Construction of ANDON system for interim inspection ... Provisional goal: End of Dec, 2020



Step-2 Proposal in Pilot project

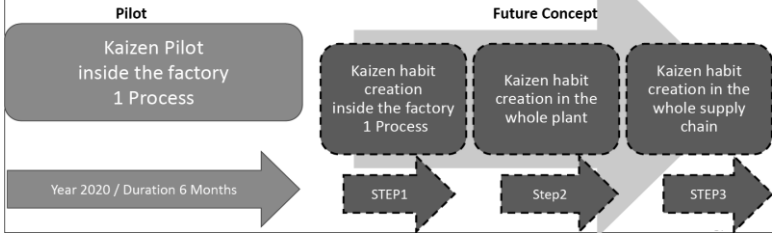
Construction of ANDON system for final inspection: System for intermediate inspection



Future Concept of Kaizen

Future Concept related to Kaizen

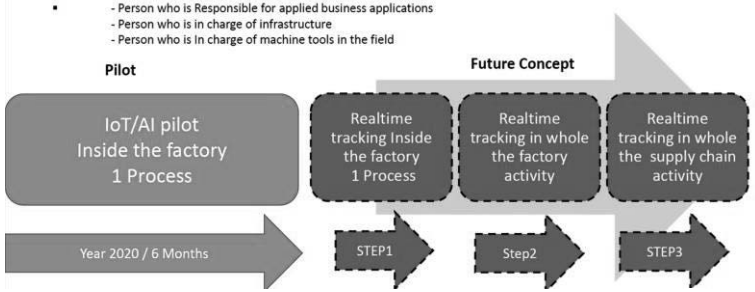
- Focus on the development of human resources who can improve themselves. The pilot will only educate them on the spot.
- From a small success experience, employees improve themselves that have been nurtured become an asset to the company.
- Employees who improve themselves become teams that improve themselves, and become companies that improve themselves.
- In order to achieve this, we will emphasize the following three basic ideas.
- The top management decision to step down
  - -Organizational culture for sustainable improvement and learning & unlearning
  - -Understanding kaizen techniques
- Pilots try to establish an organizational culture through small group activities with the cooperation of top management.



Future Concept of IoT/AI

Future Concept related to IoT / AI

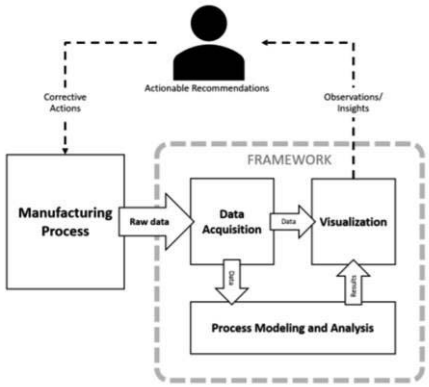
- IoT / AI apply for the process that the site has advanced improvement with Kaizen
- Agile methods as for the way of the TPS will apply to form a synchronization with Kaizen
- IoT / AI to realize the system of IT departments and sites work together.
- In order to achieve this, the following 3 persons must do cooperation in the field.
- - Person who is Responsible for applied business applications
  - Person who is in charge of infrastructure
  - Person who is In charge of machine tools in the field



Little bit advanced

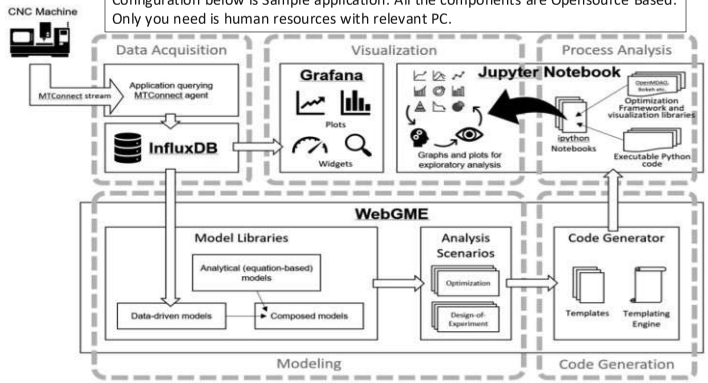
Advanced Approach : Data Gathering from existing Machines

Typical configuration for Visualization

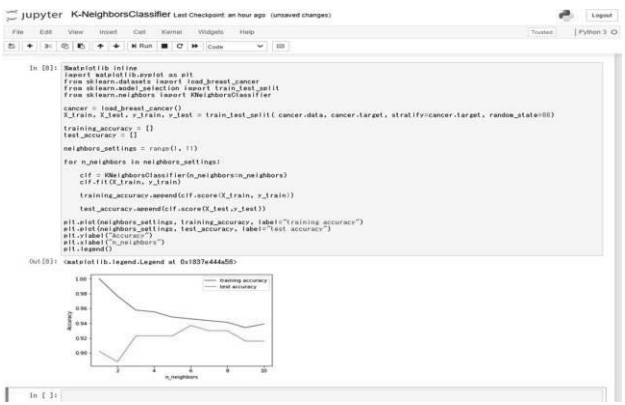


Typical configuration for Real-Time Visualization

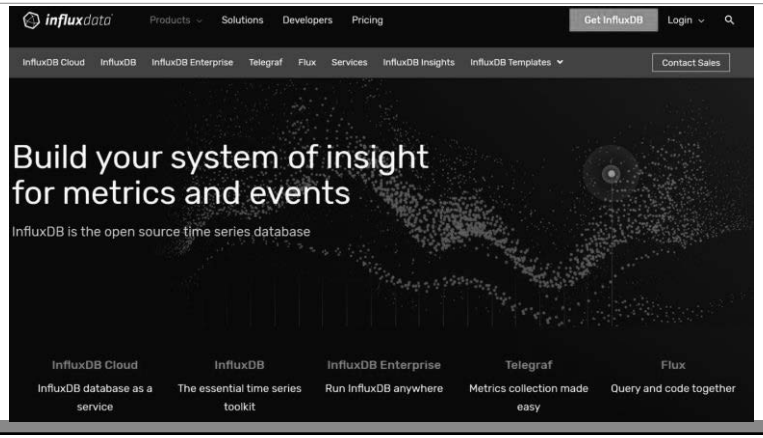
Configuration below is Sample application. All the components are Opensource Based. Only you need is human resources with relevant PC.



Jupiter notebook : Python interpreter

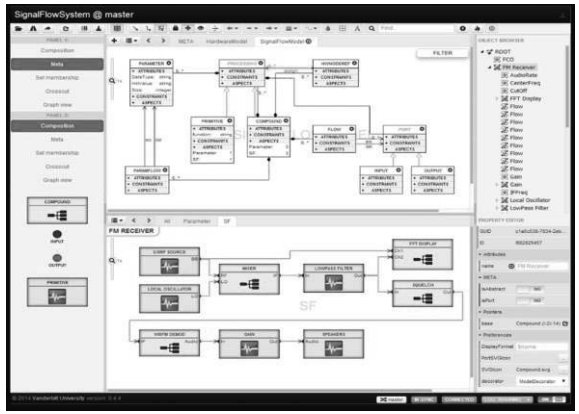


influx data : influx DB - time series database

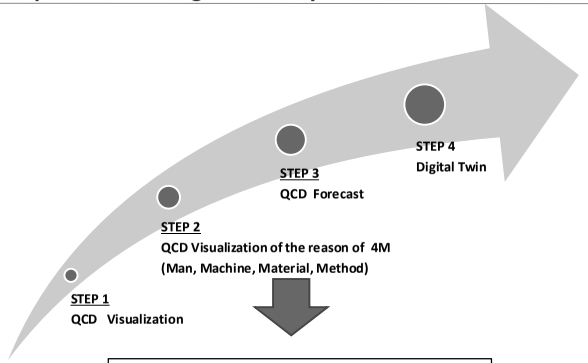


Grafana - Visualization

Web GME – Modeling for CPS (Cyber Physical System)

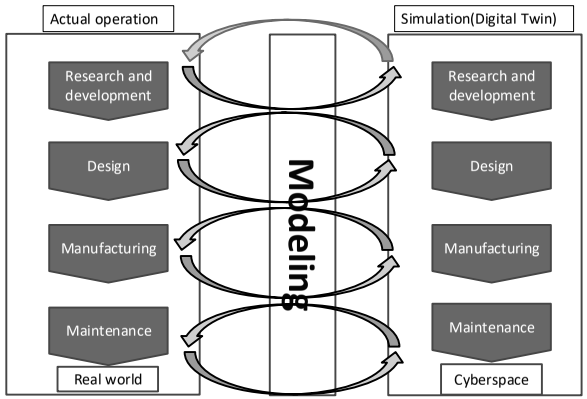


Step s towards Digital Factory

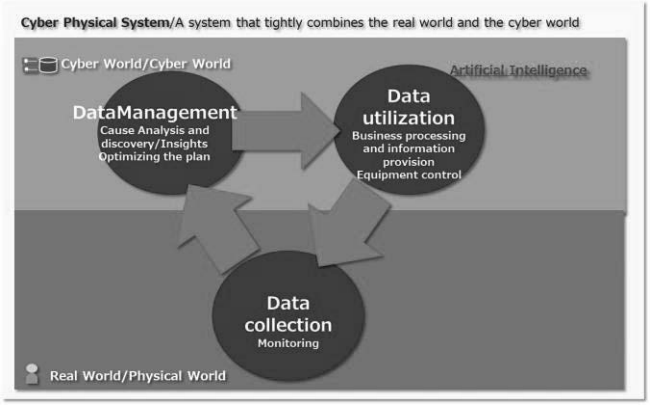


The first important step is data collection.

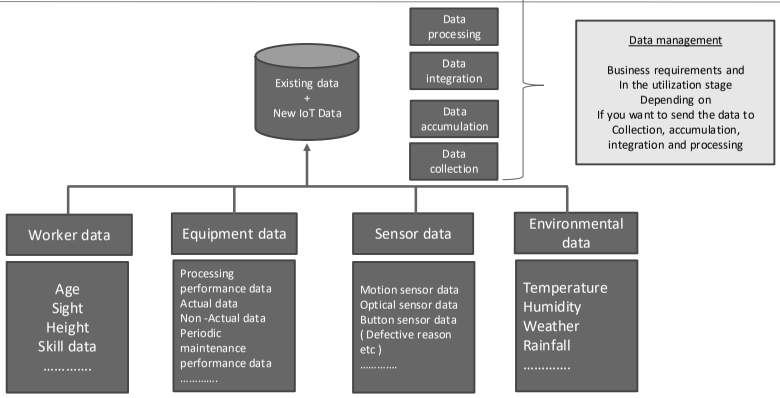
Digital Twin



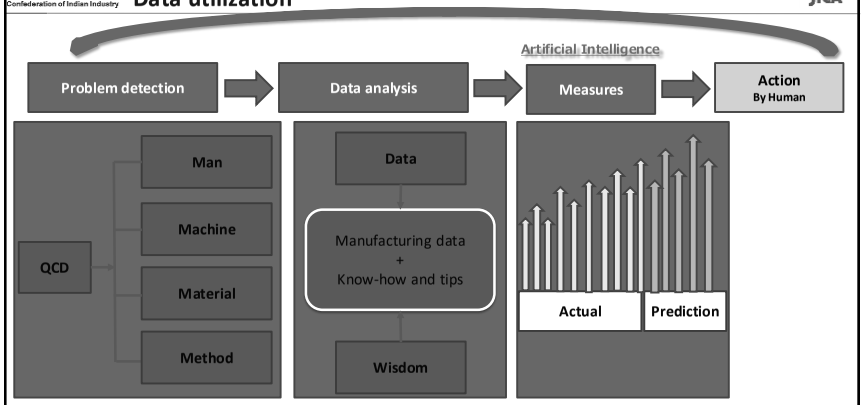
Cloud Computing



Data collection & Data management



Data utilization



Human Resource Development

1. CEO Level Executive Education Program
2. Senior Manager Level Executive Education Program
3. Self-learning Online-Course Sample for ML/DL for Middle Management and Engineers

Education architecture on different Level(1/2)

CEO Level Executive Education Program (Sample from Berkley)

Topic 1 | Introduction – AI and Business
Topic 2 | Machine Learning Basics
Topic 3 | Neural Networks and Deep Learning
Topic 4 | Key Applications: Computer Vision & Natural Language Processing
Topic 5 |Robotics
Topic 6 |AI Strategy
Topic 7 |AI and Organizations: Building Your AI Team
Topic 8 |The Future of AI in Business
Topic 9 |Capstone Business Challenge Project

Senior Manager Level Executive Education Program (Sample from MIT)

MODULE 1 - AN INTRODUCTION TO ARTIFICIAL INTELLIGENCE
MODULE 2 - MACHINE LEARNING IN BUSINESS
MODULE 3 - NATURAL LANGUAGE PROCESSING IN BUSINESS
MODULE 4 - ROBOTICS IN BUSINESS
MODULE 5 - ARTIFICIAL INTELLIGENCE IN BUSINESS AND SOCIETY
MODULE 6 - THE FUTURE OF ARTIFICIAL INTELLIGENCE

Education architecture on different Level(2/2)

Self-learning Online-Course Sample for ML/DL for Middle Management and Engineers

edx : online
https://courses.edx.org/courses/course-v1:UCSanDiegoX+DSE220x+1T2020a/course/

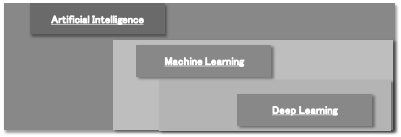
Machine Learning Fundamentals.
10 Weeks

- Introduction and Course Information
- Week 1: Prediction Problems
- Week 2: Generative Modeling I
- Week 3: Generative Modeling II
- Week 4: Linear Regression and Probability Estimation
- Week 5: Optimization and Geometry
- Week 6: Linear Classification
- Week 7: Combining Simple Classifiers
- Week 8: Representation Learning I
- Week 9: Representation Learning II
- Week 10: Deep Learning
- Final Exam

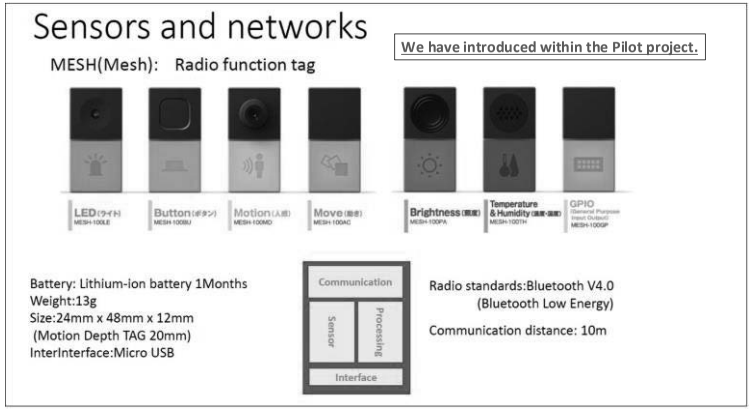
Courcera
https://www.coursera.org/specializations/deep-learning?action=enroll

Deep Learning Specialization
10 Weeks

1.Neural networks and Deep Learning
Week1: Introduction to Deep Learning
Week2:Neural Network Basics
Week3.Shallow neural networks
Week4.Deep Neural Networks
2.Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization
Week5.Practical aspects of Deep Learning
Week6. Optimization Algorithms
Week7.Hyperparameter tuning. Batch Normalization and Programing Frameworks
3.Structuring Machine Learning Projects
Week8. ML Strategy(1)
Week9. ML Strategy(2)
4.Convolutional Neural Networks Week10. CNN



IoT Data Gathering – Self Learning Kit for Blue workers and Operators



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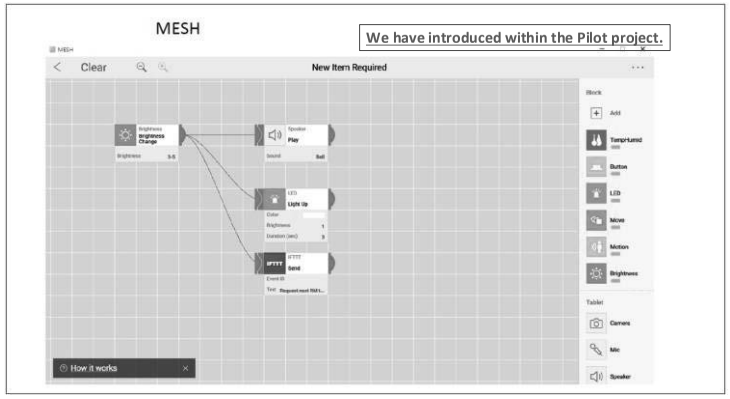
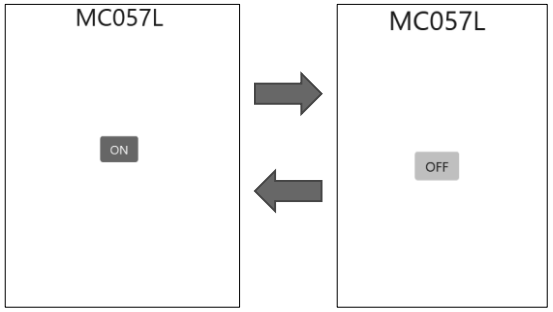


IoT Visualization & Web APPs for Digital Andon 8-10 Weeks

We have introduced with in the Pilot project.

Lecture : Demo Web app for Digital Andon		
S. No.	Lecture Inputs	System Output
1	Ruby :your code	Hello
2	Def. & Gems	Gems Installation
3	Selenium web driver	Browser Automation
4	Rail New	Hello Rail
5	DB – Data Bases	Data storing
6	MVC: Model View & Controller	Modification
7	Online data collection	Software development
8	Digital Andon	Real time data visualization

Real Time Demo for Audience (1/2)



Real Time Demo for Audience (2/2)

New Machine Register

MC046	MC047	MC051L	MC051R	MC056	MC057L
MC057R	MC058L	MC058R	MC059L	MC059R	MC033
MC034	MC035	MC036	MC037	MC038	MC007
MC013	MC014	MC015	MC022	MC023	MC001
MC041	MC026	MC027	MC050	MC042	MC005
MC006	MC008	MC009	MC040	GR002	GR004
GR008	GR009	HN001	HN002	HN004	HN005
LP001	MP	MC046	MC047	MC051L	MC051R
MC056	MC057L	MC057R	MC058L	MC058R	MC059L
MC059R	MC033	MC034	MC035	MC036	MC037
MC038	MC007	MC013	MC014	MC015	MC022
MC023	MC001	MC041	MC026	MC027	MC050
MC042	MC005	MC006	MC008	MC009	MC040

4. How you motivate employee?

Motivate employee using long term strategies with

TPS(Toyota Production System) and
SDG(Sustainable Development Goals)

Why long-term strategies impacts motivation?

Long-Term commitment to Continuous improvement & SDGs activities gives opportunity to maintain Human motivating cycle such as below:

1. **Set goals to create meaning**
2. **Celebrate milestones big and small**
3. **Provide meaningful feedback**
4. **Empower problem solving and learning**
5. **Follow through on promises**
6. **Experiment and learn**

What is SDGs?

What is SDGs?

- Action plan adopted by all the 193 countries ,United Nations Member States in 2015
- 17 Goals and 169 Targets to be achieved until 2030

The REASON for targeting Digital Enterprise is that addressing Global Social issues are crucial for sustainable entity.

How to implement to the Corporate activities

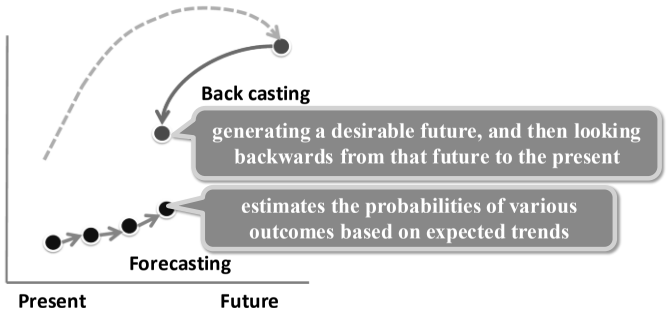
How to implement ?

①Think from Future back to Current
Back casting

②Problem solving in inclusive way
⇒ My Problem
Outside in

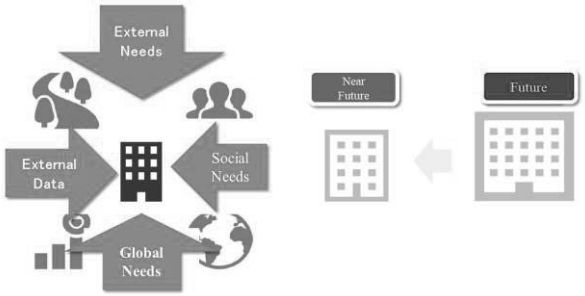
What is Back casting?

Back casting

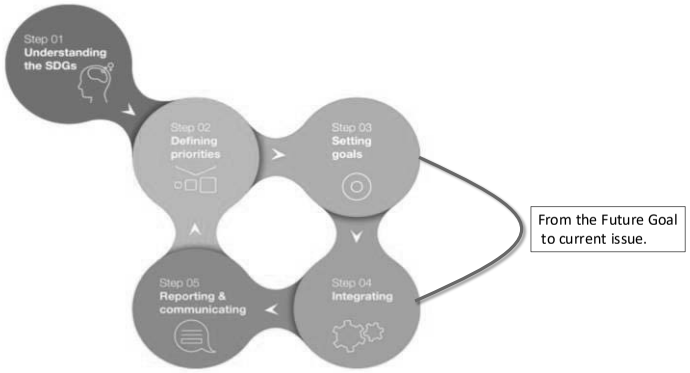


What is Outside-In?

② Problem solving in **inclusive way**



How to implement?



5. Executive Summary

Executive Summary (1/2)

Chapter 1. Digital revolution of automotive industry in the world

The automotive industry is under going a profound transformation.

Connectivity : Every Toyota car is having Data Communication Module.
Autonomous : BMW introduced autonomous bike.
Shared & Services : HONDA started BIKE rental services in Japan.
Electric : Chinese scooter company is exporting Electric scooter for Vietnamese students.

Chapter 2. Data Science Revolution with using AI & IoT

Software is eating the world.

Increase of Degree of integration for Semiconductor is so significant.
Computers are downsizing every 20 years and reducing cost dramatically.
Automotive company needs to become a software company.
Data is more important than AI model.
AI technology will grow up with your accurate and appropriate data.

Executive Summary (2/2)

Chapter 3. Concept of Digital Factory & Roadmap

Critical Success Factor of Digital Factory is collecting the useful Real Time accurate Data.

Smart Manufacturing Platform is IoT/ BIGDATA/ AI.
Digital tools can help improving productivity and reducing the cost through visualization.
Harley Davidson has started IoT implementation at the factory in 2010 with success.
Hero has got the proposal of pilot project Digital Kaizen with IoT/AI with CII/JICA.
Pilot project is having a potential to become the source for making fire.

Chapter 4. How you motivate employee?

Recommendation for using TPS and SDGs related long-term strategies to motivate employee.

TPS is not only a group of tools but respecting for each employee's abilities.
If senior management is committing to the long-term KAIZEN, people will follow.
SDGs should link to the daily operation of the enterprises.
My plan related SDGs can be created with the "backcasting" and "outside-in" methodologies.

6. Q & A Time

Other useful link for your reference.

Connected Bikes with IoT | Smart two wheeler | Bosch mySPIN (1minute)
https://youtu.be/XD6-g_aatmg

CASE: Digital Innovation and Mobility | Mercedes-Benz Talk | CES 2019 (27minutes)
https://youtu.be/dGb333lvK6w

Software is eating the world. (4minutes)
https://youtu.be/UW5ktbit2s0

Harley-Davidson York Manufacturing Facility- United States of America (3minutes)
https://www.youtube.com/watch?v=3IUoF488ic4

Why digital twins will be the backbone of industry in the future (3minutes)
https://www.youtube.com/watch?v=ObGhB9CCHP8

Sustainability Strategy: Backcasting from Success (5minutes)
https://www.youtube.com/watch?v=DeDm-HTFuiY

Thank you very much for Listening!!

Let’s start Digital Transformation from Digital Factory!!

Thank you

A6. Suggestions from the viewpoint of TPS

Hero MotoCorp Ltd.

Fuel tank welding shop

To increase “First Time Right”
ZERO DEFECT PROJECT

Suggestions from the viewpoint of TPS

JICA K. Yoshida

2020.01.07

Hero MotoCorp Ltd.

Fuel tank welding shop

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TPS KEY WORDS

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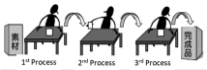
Production



Production flow must be entirely smooth.
生産の流れは完全にスムーズでなければならない

One-piece-flow manufacturing easily finds problems in the production line.
一個流生産は、生産ラインの問題を容易に見つけることができる

One-piece-flow manufacturing is the best method to eliminate waste.
一個流しは、ムダを排除する最も良い方法である

Quality

Quality should be ensured in each production process.
品質は、それぞれの生産工程で保障されるべきである

You must only send fine quality products to the next process.
後工程には、よい品質のものだけを送らなくてならない

We need to find the root cause when defective products are made.
私たちは、不良品ができた時には、その真意を見つけなくてはならない

We must be careful not to let these defects occur again.
私たちは、これらの不良を再び生じさせないように注意しなくてはならない

It is costly to keep making defects.
不良を作り続けるのは損失が大きい

100% defect-free goods. The later process shouldn't accept any defects from the earlier process.
“Zone Control”

Visualization

Production process that can be find out immediately when a problem occurs
Process where the problem process can be seen visually
問題が発生したときにすぐに見つけることができる生産工程
問題のプロセスを視覚的に確認できるプロセス

The spirit of TPS

First, “bring up a human being” then manage them.
The term “bring up a human being” encompasses the spirit of TPS.
まず「人間をつくれ」、そして経営せよ。
「人間をつくれ」という言葉には、トヨタ生産方式の全てが集約されている。

Many people think that TPS is just a manufacturing method.
トヨタ生産方式は単なるモノづくりの手法と考えている人が多が実は違う。
“To Human resource development” is the most important thing, and TPS is where people who grow up are making things while continues KAIZEN/improvements every day.
「人間をつくる」ことが最重要であり、トヨタ生産方式は、人が成長しながらカイゼンを続けるモノづくりである。
That's why there are no rebounds and you can always make the strongest manufacturing.
トヨタ生産方式だ。だからこそ、リバウンドもないし、いつまでも最強のモノづくりでいられる。

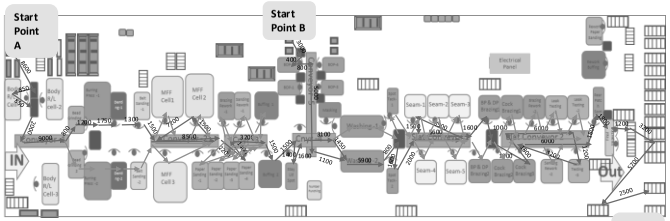
Manufacturing is not something that can be done with machines and methods.
モノづくりは、機械や手法によってできるものではない。
The main constituent is just workers, and workers at the site can think better for themselves and solve for themselves.
「人は成長する」だからよりよいモノづくりができる。モノづくりは人づくり
“Human resource development”

Fuel tank welding shop

Current status survey

Scaled layout of tank body welding line with operators and Flow of Material

(Flow represents only one MIG WELDING machine)



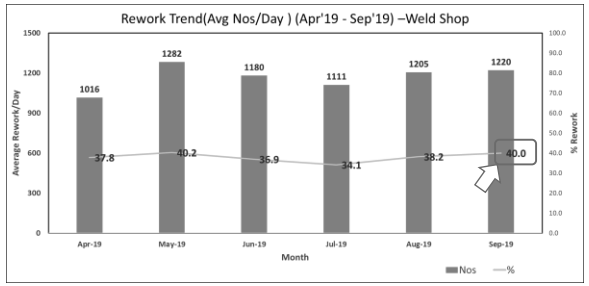
全フローを書くのは不可能⇒不具合発生工程の特定が難しい

It is impossible to write the entire flow ⇒ It is difficult to identify the process where the problem occurred

View:

- **Worker density is very high and workers interfere with each other**
- **Very complicated (congested enough to write the flow of all machines & workers)**
- **Difficulty in quality control (unable to identify workers for defects)**
- **No space for intermediate inspection and rework**

Weld Shop Rework Trend (Last 6 months)



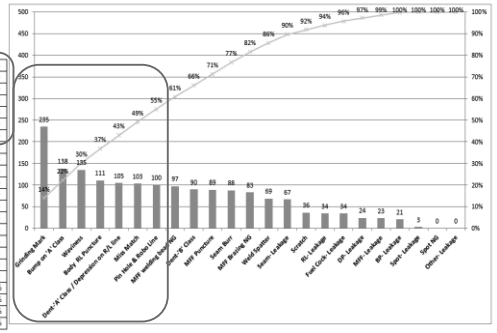
View:

- **Too many in-line reworks (Even if there are multiple problems in one tank, the number of repairs is counted as one)**
- **Defects are sent to the next process (10% of defects are returned from Paint Shop)**

Collect quality data

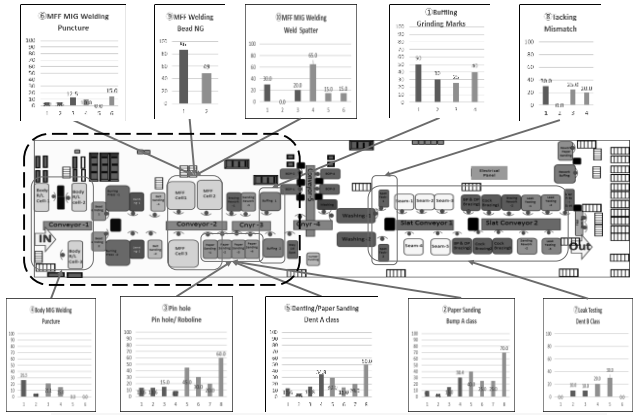
Defect Pareto – Avg defects of Group 1 & Group 2

	Defect	Total		
1	Grinding	235	235	14%
2	Bump on 'A'	138	373	22%
3	Waviness	135	508	30%
4	Body RL	111	619	37%
5	Dent-'A'	105	724	43%
6	Miss Match	103	827	49%
7	Pin Hole &	100	927	55%
8	MFF welding	97	1024	61%
9	Dent-'B'	90	1114	66%
10	MFF	89	1203	71%
11	Seam Burr	88	1291	77%
12	MFF Brazing	83	1374	82%
13	Weld Spatter	69	1443	86%
14	Seam-	67	1510	90%
15	Scratch	36	1546	92%
16	RL- Leakage	34	1580	94%
17	Fuel Cock-	34	1614	96%
18	DP- Leakage	24	1638	97%
19	MFF-	23	1661	99%
20	BP- Leakage	21	1682	100%
21	Spot-	3	1685	100%
22	Spot NG	0	1685	100%
23	Other-	0	1685	100%



To increase "First Time Right"
ZERO DEFECT PROJECT

Investigate individual differences among workers



View: Defects are concentrated in the first half of the process
Do not bring defects into this area (→Receiving inspection)
There is a possibility that defects in the previous process are

Investigation of defect occurrence process and defect occurrence degree by workers

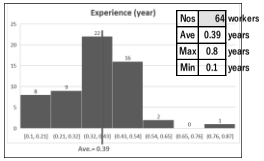
Contribution rate	
A	80-100%
B	60-80%
C	20-60%

NO.	Defect	Number	%	No.	OP-1	OP-2	OP-3	OP-4	OP-5	OP-6	OP-7	OP-8	OP-9	OP-10	OP-11	OP-12	OP-13	OP-14	OP-15	OP-16	OP-17	OP-18	OP-19
				Process	MIG WELD	BEAD GRIND	HYDRAULIC PRESS	DENTING	BELT SANDING	MFF MIG WELD	BRAZING REWORK	PAPER SAND	BUFFING	BOP s/w	WASHING	WASHING	TACKING	SEAM WELD	COOL PIPE BRAZING	LEAK TESTING	NUMBER PUNCHING	PATCH s/w	FINAL INSPEC.
				Work place	3	2	2	2	2	3	1	4	2	4	1	2	2	5	5	3	1	1	1
				No. of worker	3	2	2	2	2	3	1	4	2	4	1	2	2	5	5	3	0	1	2
1	Grinding Mark	210	14%						C			A	A										
2	Bumpon 'A' Class	138	9%		C			A															
3	Waviness	105	8%		A																		
4	Body RL Puncture	111	7%		A																		
5	Dent-'A' Class / 凹	105	6%		C			A															
6	Miss Match	90	6%														A						
7	Leak Test	90	6%		A																		
8	MFF weld. bead NG	87	6%							A													
9	Dent-'B' Class	90	6%		C												C	C		C			
10	MFF Puncture	80	5%			B				C													
11	Seam Burr	80	5%															C					
12	MFF Brazing NG	60	5%								C												
13	Weld Spatter	60	4%							C													
14	Seam- Leakage	57	4%															C					
15	Others	170	11%																				
Total		1,503	100%	A		0	0	2	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0
				B	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				C	2	0	0	0	0	2	1	3	0	0	0	0	1	3	0	1	0	0	0

View:
Critical reworks due to body R/L MIG welding

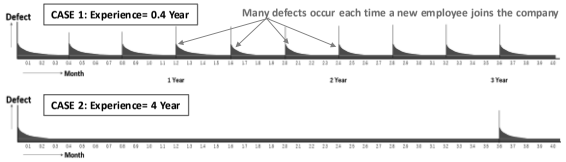
View:
Many critical reworks due to workers

Workers' experience



View:
- Very short work experience (0.39 months on average: By calculation, a fresh worker joints in every 2.3 days)
- Workers with only 4 months experience for jobs that require advanced skills
- In particular, Denting process gives secondary problems if there is little skill

Comparison of Nos of defects when a newcomer enters every 4 months vs. every 3 years(Image)



Result: Frequent change of workers may cause many defects

Suggestions from the viewpoint of TPS

To increase "First Time Right"
ZERO DEFECT PROJECT

I. Change to proper production layout

タンクの流れが交差しない
作業者同士の干渉がない
不具合の発生工程＆作業者がわかる
中間検査＆手直しが可能なこと（特に新製品、不具合発生時）

<Layout concept>

1. Quality assurance can be ensured 品質保証が確実にできる
   - Tank flows do not intersect
   - No interference between workers
   - Easy to find the process where the problem occurred & the operator
   - Create an intermediate inspection & rework process (Especially when producing new products or adjusting equipment)

Develop 2 (or 3) production lines

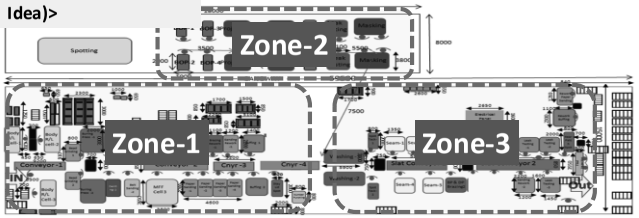
Improve quality / productivity while competing for each production lines

2. Be flexible with production fluctuations 生産量の変動に対しフレキシブルなこと
   - Multiple models can be produced simultaneously 複数のモデルを同時に生産可能
   - Easy relocation of machines and workers 機械・作業者の配置換えが容易
3. Low running cost ランニングコストが安いこと
4. Safe and good working environment 安全で作業環境が良いこと

II. Introduce "Zone Control System"

1. Never pass-on defects parts to the following process
   - Implementation of interim inspection (& rework)
   - Accept only 100% good products → Creating pallets that can guarantee 100% quality
   - Only 100% good products are sent to Paint Shop

<Suggestion (One Idea)>



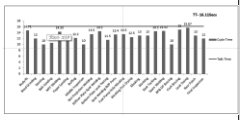
Implement Intermediate inspection (& rework)
Do not bring any defects into each zone
Do not leave any defects outside each

III. Produce parts according to takt time

タクトタイムに従って生産する

<Current problem>

- The current production line cannot keep tact time
  → Tact Time is influenced by the cycle time of three MIG welding process
  → Tact time varies. It may cause workers get Muri(overloaded)/MURA(uneven)



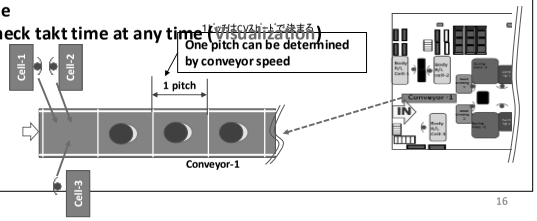
<Suggestion (One Idea)>No visualization of takt time

- Not visualization of takt time
- Operators place only one part in the conveyor-1 belt
- Operators place only one part in the frame on the CV.

<Expected effects>

- Tact time can be accurately controlled according to production volume
- Can check takt time at any time (visualization)

1ピッチはCVスピードで決まる

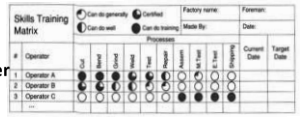


IV. Develop human resource

1. Contract employee ⇒ Long-term employment (permanent employee) → "To Human resource development"

2. Develop human resource → Enhancement of employee training (including Moral)
   - Practical training for new employees (Develop "Training room")
   - Review the morning meeting (including education, discipline, etc.)
   - QC activity
   - Multiple-skilled worker

Motivation: Multiple-skilled worker
→ rotation
→ leader
→ leader (promotion)



Develop "Robust production line"

TPS is where people who grow up are making things while continues KAIZEN/improvements every day.

「人を育てる」のが最も重要で、そうして育った人が、日々改善を重ねながらモノづくりをしているのがトヨタ生産方式だ

V. Others

Items below were proposed at the meeting on December 18, 2019

- Inspection of BOP to be Done Properly
- Elimination of denting process by changing of Jig
- Defect Wise, Stage Wise and Operator Wise Analysis to be continued
- Stage wise skill attributes to be finalized, specific levels to be defined
- Stage wise training material to be prepared
- Ensure Trained and Competent Person Deployed in Stage
- No Reward System and Less Motivation/Moral of Workers
- Improve work environment, dust, noise level and welding light containment
- Team Member Involvement in Defect Reduction
- Practical Training Machines to be provide for Training of Denting, Bead Grinding, Paper Sanding and Buffing
- Training Program must be followed before deployment on critical specific stages
- PQCT Adherence Level to Improve

Thank you

Excellence through Values

SAI GROUP

A7.Final Report (Aerostar Helmets)

(CII-JICA Project)

VSME 2.0
Productivity Improvement through Integration of TPS & IOT/AI

January 2021

Aerostar Helmets and Accessories

Contents

1. Outline of target factory (Unit 2)

Unit 1: Shree Amba Industries, Roorkee (Uttrakhand) - Manufacturing facility [approx. 250 kms from New Delhi]

Target factory for this KAIZEN project

Unit 2: Aerostar Helmets & Acessories, Bhiwadi (Rajasthan) - Manufacturing facility [approx. 75 kms from New Delhi]

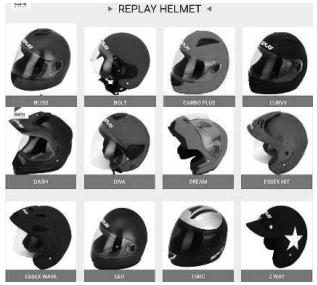
Unit 3: Shree Amba Industries, Jindpur, New Delhi – Spare part division

Corporate: Heart of New Delhi Office

Group website: **www.saigroupglobal.com**

PLANT - II
BHIWADI (RAJASTHAN)

Total land area : 261360 square feet
Covered area : 100000 square feet
Manpower : 600 Trained work force
Automatic hard coating and machining capacity : 15000 Pcs.Per day
Production capacity : 15000 Pcs.Per day



Team member

Project Facilitator
Sumit Doseja

Project Coordinator
Rajeev Tomar

JICA expert
Mr. Kiyoshi Yoshida
Dr. Hiroshi Jogasaki
Mr. Hiroki Omiya

CII
Mr. Amit Vishnoi
Dr. Sarita Nagpal
(Principal Adviser)

TPS Team

Leader	Member	Member	Member	Member	Member
					Photo
ARPIT MATHUR	RISHABH GUPTA	SURENDER YADAV	RAVINDER	RAVI GAUR	ADESH KUMAR
BUSSINESS EXCELLENCE	ASSEMBLY	QUALITY	MOULDING	MAINTEANCE	PAINT SHOP

IOT /AI Team

IOT /AI Team:
1. Jitesh
2. Ravi Gaur
3. Din Dayal
4. Naveen
5. Rishabh

Kick-off meeting

2. Theme of KAIZEN

To increase "First Time Right" & achieve ZERO DEFECT

I. Productivity improvement
II. Quality improvement (Reduce rework)
III. Introduce a simply ANDON system (IoT)
IV. 5S activities (5S, safety, environment, moral)

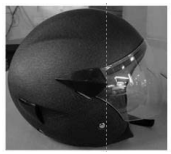
Project duration : 1st Oct,2019 ~ June,2020

Note: The factory burned down in June 2020 and the Kaizen activities ended halfway .

3. Target process & Target parts

Target process: Assembly shop Line-NO.3

Target Parts: AEROSTER (HONDA)

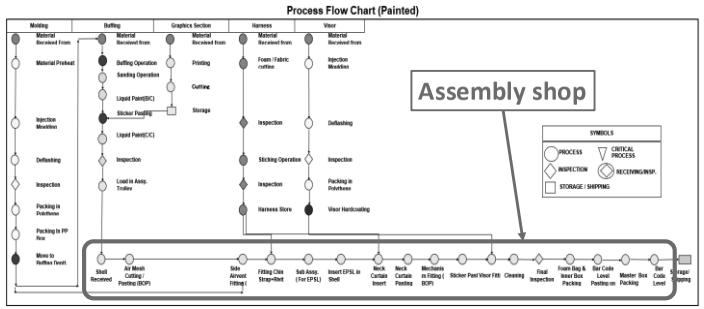


5,000 units/m (1 type, Color)

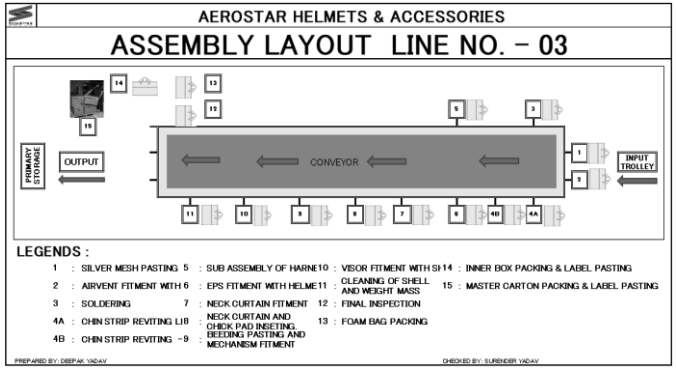
Reason for choosing (parts)

- **Big deference between plan and actual production**
- **Conveyor is not managed appropriate**
- **Many reworking occurred**

Process Flow Chart (Painted Helmets)



LAYOUT (Line-NO.3)



4. Current status survey results and improvement plans

- Analysis and proposal by Yoshida -

Major Reasons of Production Loss @ Helmet Assembly

Observation	Root Cause	Analysis/Action	Document
1. Gap between material & production planning, assembly line facing shortage problem day to day basis 計画と実績のｷﾞｬｯﾌﾟ	Parts cannot flow on the belt conveyor according to the takt time	**Conveyor control system** ➢ Whether the conveyor speed matches the takt time? ➢ Parts cannot flow on the belt conveyor according to the takt time ➢ Only supervisor should change conveyor speed ➢ Introduction of Bell System ➢ Introduction of Call System	①
2. Approx. 50% Rework material generation over assembly line, which is being reworked at line by sending it back to stage 50%が手直し	Unbalanced line	Study line balancing	
3. Tampering with conveyor speed, any person can easily change conveyor speed at any point of time 誰でもCV速度変更	Is the number of units suitable for production capacity?	Analysis quality data and take countermeasures	②
4. Manpower skill gap against requirement of assembly process 技能力ｷﾞｬｯﾌﾟ	Raw material shortage?	Grasp the capabilities of workers. Skill training	③
5. No alarming system at line in case of generation of any single defect 警報システムなし	**Workers are not in the process at the start of work ?**	Working standing posture	④
6. Increase in inspection time during quality issue creating bottleneck for line ◇時間の増加	There is no operational rule for conveyors ?	5S activities	
7. Lack of identified place to keep it separately, incase of rejection/Rework material 手直置場無	Huge amount of rework	Introduction of morning meeting	⑤
8. Startup loss between 08:00 AM to 08:30 AM, absence of all manpower seen during this time period 8時スタート時人手不足	Worker skills are low	Introduction of vacation reservation system	⑥
9. Communication of production plan to line supervisor at least 1 day before so that all materials to be arranged accordingly 生産計画	Working posture is poor (sitting posture)	Communicate production plan to parts supplier the day before. Parts supply the day before	
10. Break down Riveting M/C (2019/8/27—3.8 hrs)	No visualization, no alarm system	Create and carry out daily/ periodically checklist	⑦
	Low moral	Create equipment / machine list	⑧
	Employee vacations overlap ?	Purchase a backup machine as soon as possible	
	?		
	Equipment check is not done		
	No backup machine		

① Conveyor control system

- **Whether the conveyor speed matches the takt time?**
- **Parts cannot flow on the belt conveyor according to the takt time**
- **Only supervisor should change conveyor speed**
- **Introduction of Bell System**
- **Introduction of Call System**

Conditions for single piece flow on the belt conveyor

- All workers start work at the same time and finish work at the same time
- Is the tact time(19.8sec) correct?
- Run only good products (no faults in the raw material)
- Do not throw defects into the next process (If you find a defect, call the sub-leader/supervisor to fix / reject on the spot)
- If a defect is found at the final inspection, correct it outside the process. (if you bring it in the process and correct it, the flow does not flow normally)
- Basically, when a problem occurs and a repair is necessary, the worker who made defect works overtime and repairs.
- Must be well line balancing
- Create a management system so that there is no hindrance to the operation of the line even if there are workers on holidays

a. Production efficiency (current status: end of June, 2019)

b. The concept of single-rolling on a belt conveyor

c. Introduction of a system that stops when the conveyor is full of parts

d. Install a switch to stop the conveyor and stop the conveyor in case of emergency

e. Introduce parts call system

f. Introduce Production control board

g. Ideal production line management system (draft)

a. Production efficiency (current status: June 2019)

Working days:	26 day/mth
Working hours:	11hrs/day
Takt time	19.8 sec

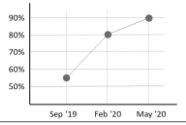
Calculated production volume

Efficiency	Formula	unit/day	unit/mth
100%	=11*3600/19.8*1.0	2,000	52,000
90%	=11*3600/19.8*0.9	1,800	46,800
80%	=11*3600/19.8*0.8	1,600	41,600
70%	=11*3600/19.8*0.7	1,400	36,400
60%	=11*3600/19.8*0.6	1,200	31,200
50%	=11*3600/19.8*0.5	1,000	26,000

DATE	TOTAL REWORK	OK QTY	unit/day	Production Efficiency
2019/6/25	426	990	1,416	71%
2019/6/26	287	1,062	1,349	67%
2019/6/27	195	924	1,119	56%

Problem

- Low production efficiency (56% to 71%)
- Very large variation from day to day
- The main cause of low production efficiency is defects, and it is essential to reduce defects in the process



Target (Tentative)

Production efficiency:
90% or more (1,800 unit / day, 46,800 unit / mth)

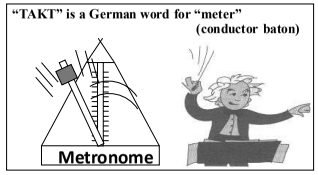
<Reference> Takt time

Exact time required to process one product

Takt time is the pace of production determined by the rate of customer demand

$$\text{Takt Time} = \frac{\text{Monthly Operating Time}}{\text{Monthly Production Quantity}} = \frac{\overset{8hrs\ x\ 25days}{200\ hrs/month}}{8{,}000\ pcs/month} \quad 1.5\ min$$

"TAKT" is a German word for "meter" (conductor baton)



Takt time = Time available seconds per working day / Volume daily production requirement

Cycle Time = Actual time required for a worker to complete one cycle of his job process including walking distance.

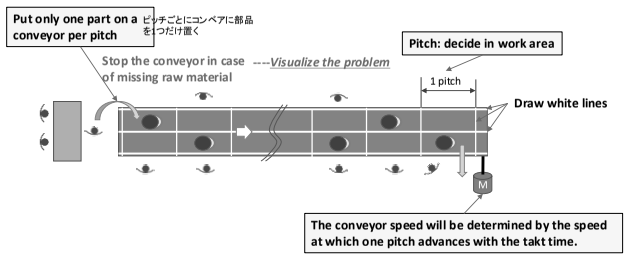
NOTE:
Adjust takt time according to production volume (increase/ decrease)

b. The concept of single-rolling on a belt conveyor

Purpose: To produce as planned with the set takt time

Basically, there must be one workpiece per pitch.

基本的に、ピッチごとに1つのワークピースが必要

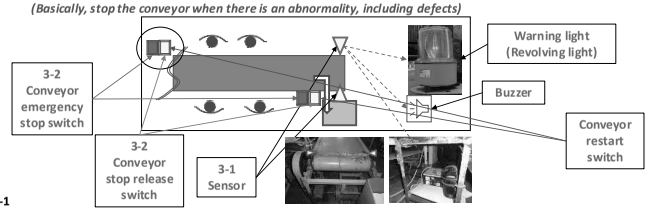


コンベアの速度は、タクトタイムで1ピッチが進む速度によって決まる

c. Introduction of a system that stops when the conveyor is full of parts

d. Install a switch to stop the conveyor and stop the conveyor in case of emergency

Purpose: Operate the belt conveyor correctly
(Basically, stop the conveyor when there is an abnormality, including defects)



3-1

When the part on the conveyor reach the conveyor end, the sensor detects this and automatically stops the conveyor and sound buzzer

If you take parts, the conveyor will automatically restart and buzzer will stop sound

3-2 (Draft)

When a danger or abnormality occurs, press the switch to emergency stop the conveyor.

In both cases(3-1, 3-2), the buzzer sounds and the mini-Andon lights up to indicate the reason for the stop

By pressing the emergency stop release switch, the line will restarts the conveyor

The conveyor stop time is automatically recorded

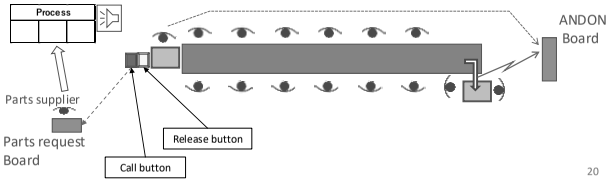
The reason for conveyor stoppage is recorded by the sub-leader in the record book

e. Introduce parts call system (when supply is delayed and there are no parts to work on)

Purpose: Call parts supplier before material runs out to prevent production line from shutting down

When parts are about to run out, the process person press a button to inform the parts supplier

If the button is pressed, the requested part name is displayed on an mini-Andon board and at the same time a buzzer/melody is sounded to inform the parts supplier.



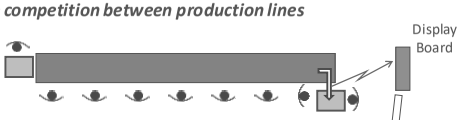
f. Introduce Production control board

Planned vs actual output

Consider whether it will help or not

Purpose: Display production plan and actual output on the display board so that all workers can see

- *Increasing worker awareness of production*
- *Inspire competition between production lines*



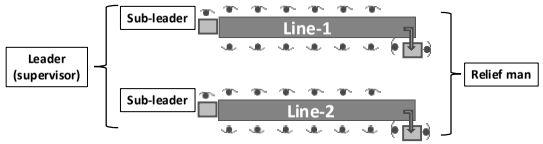
	7:00 ~8:00	8:00 ~9:00	9:00 ~10:00	10:00 ~12:00	12:00 ~13:00		
Plan					(Input manual)		
Actual					(Conveyor sensor)		
Line Stop					(Conveyor sensor)		

g. Ideal production line management system (draft)

Purpose: Build a stronger production line (high production efficiency with no defects)

Even if workers take leave or leave the line (e.g. go to the toilet) the production line operates normally

Production line member	Number of people	role
Leader (supervisor)	1	Manage the entire HONDA line
Sub-leader (Person who can work in any process)	2	Respond to production line abnormalities (especially quality assurance) Moming meeting Line stop record Training KAIZEN/5S activity Corresponding when workers take leave,etc
Relief man (Person who can work in any process)	1	Corresponding when workers take leave Rework work KAIZEN/5S activity,etc



② Analysis quality data and take countermeasures

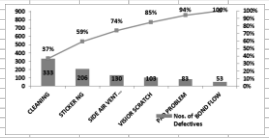
A lot of rework
First, reduce rework
To do so, investigate and analyze the cause of rework

Current status

REWORK AT LINE NO -7 HONDA FLOW (NON/PAINTED SHELL)

REWORK DEFECT / BREAK DOWN

DATE	BOND FLOW	PAD PROBLEM	STICKER NG	SIDE AIR VENT MECHANISM FITMENT	CLEANING	VISIOR SCRATCH	TOTAL REWORK	OK QTY	Rework %	BREAK DOWN RIVITING M/C	Total
2019/6/25	20	31	100	56	183	36	426	990	43%		1,416
2019/6/26	17	30	84	41	101	34	287	1,062	27%		1,349
2019/6/27	16	22	42	33	49	33	195	924	21%	225 Min	1,119
Total	53	83	206	130	333	103	908	2,976	31%		



Why does the rework rate vary from day to day?
(The difference between workers?)

Receiving inspection

Objective: Investigate the quality at the time of acceptance and investigate whether it is the cause of rework

Survey method: Inspect raw materials for 4 hours a day for 3 days

Sample of check list

	Date	Nos. of inspection	OK QTY	Nos. of defectives	Defective %	Failure phenomenon					Possible cause
						Scratch	Dent	color			
Helmet											
	Total										

	Date	Nos. of inspection	OK QTY	Nos. of defectives	Defective %	Failure phenomenon					Possible cause
						Scratch	Dirt				
Visor											
	Total										

	Date	Nos. of inspection	OK QTY	Nos. of defectives	Defective %	Failure phenomenon					Possible cause
						Scratch	Dent				
	Total										

③ Grasp the capabilities of workers Skill training

Porpouse:
Promote multi-skilled workers
The work time is measured and evaluated for each worker, and the ability at each time point can be grasped.
And it helps to raise the overall work proficiency by supplementing those who are late in work proficiency and items lacking in training.

Work skill level evaluation table

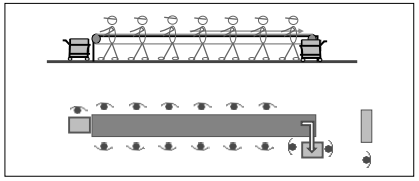
Item / Skill level	Safety	Quality	Procedure	Vital part	Speed
100%	Safety work is always protected.	Acceptance can be carried out certainly.	Work is repeated rhythmically.	There is certainty.	It ends within a takt time.
75%	Work is possible with the impossible posture of operation which is not.	It is on the level which can pass an inspection.	Repetition work can be performed in the same procedure each time.	There is no rework	It ends within a takt time.
50%	Understands the point of a safe matter and work is possible.	Not less than 75% of a ratio of successful applicants	Although it is scattering, work stops.	It can complete, although there is rework	Less than 125% of T.T
15%	Understands the point of a safe matter.	Not less than 50% of a ratio of successful applicants	A procedure is mistaken although it is scattering.	Work is possible although cautions are received.	Less than 150% of T.T

④ Working standing posture

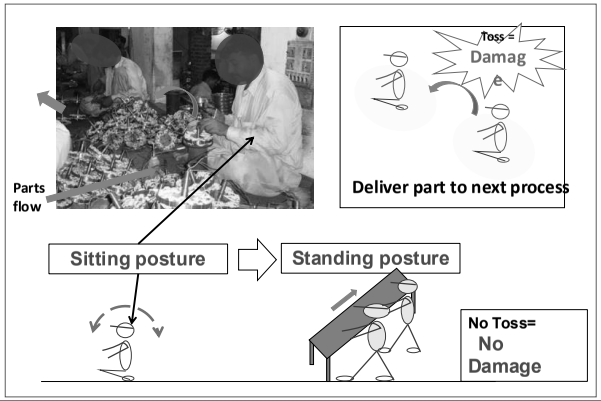
Purpose: Improve productivity and quality by working standing up

Current Assembly Line (Work in sitting position)

Ideal Assembly Line (Work in Standing position)

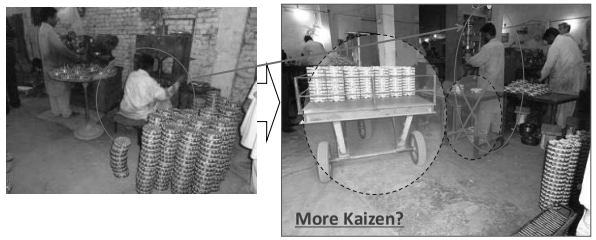


<Reference> Quality falls down in sitting position



<Reference> Productivity increase in standing position (1)

Before Kaizen **After Kaizen**



After KAIZEN
- Reduced cost (No helper)
- Reduce defects (Less handling = Less damage)
  (Not put parts on the flower directory)

<Reference> Productivity increase in standing position (2)

Sitting posture → Standing posture

What are the problems?

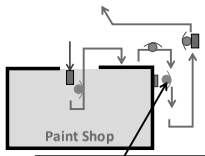
1) Waste of Transportation
2) Waste of Waiting
3) He can't work without helper

Why?

He is sitting

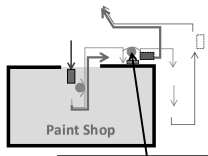
<Reference> Productivity increase in standing position (2)

Before Kaizen



Sitting posture

After Kaizen



Standing posture

Reduced cost (No helper)

⑤ Introduction of morning meeting

Morning meeting

The idea of TPS:
- **Manufacturing is not something that can be done with machines or techniques.**
- **The subject is just a person, and people on the ground can "think for themselves and solve for themselves" to make better things.**
- **First, "make a human being" and manage them.**
- **The word "make a human being" is the essence of TPS**

"make people", Educate/train and create human beings

Purpose:

Checking workers, checking work for the day, sharing and checking information, and improving work efficiency

In addition, the morning meeting is meaningful as a place for education and training.

Specifically:

- *confirmation of the worker's absence / health status for the day*
- *internal communication report*
- *confirmation of the progress of the target*
- *confirmation of work for the day*
- *The rule which workers should follow(As part of education)*

<Reference> Morning meeting

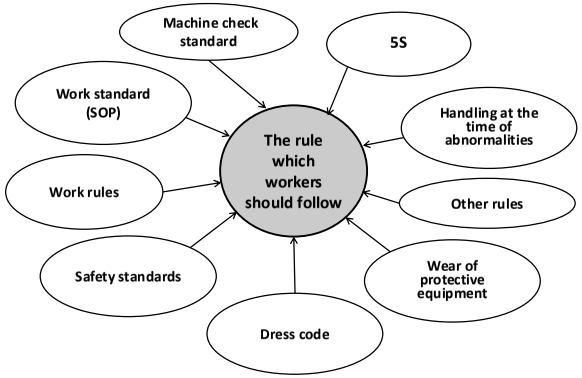
Gymnastics before the start of work

Enter your spirit before the start of work

More than 90% of companies in Japan conduct morning meetings

<Reference> lecture at morning gather(1)

The rule which workers should follow



To cultivate culture that follow rules

Make understanding of the necessity of rules

↓

Minimize the creation of rules

↓

Clarify reasons why it can not be follow

↓

If it is decisions that can not be followed, make it a rule that is easy to follow

↓

Cultivate spiritual features that always follow what we have decided

5. Realization of Kaizen

5-1. Productivity improvement

① Conveyor control system
② Analysis quality data and take countermeasures
③ Grasp the capabilities of workers Skill training
④ Working standing posture

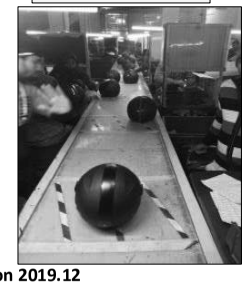
① Conveyor control system

Establishing one-piece flow production

Put only one part on a conveyor per pitch
Pitch: decide in work area

BEFORE

AFTER



Conducted on 2019.12

① Conveyor control system

Establishing one-piece flow production

The conveyor speed will be determined by the speed at which one pitch advances with the takt time.

BEFORE

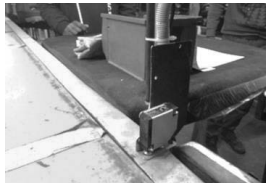
AFTER

① Conveyor control system

Establishing one-piece flow production

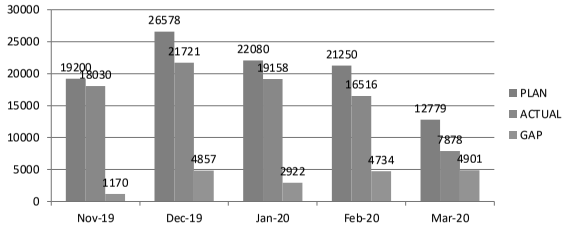
- **Introduction of a system that stops when the conveyor is full of parts**
- **Install a switch to stop the conveyor and stop the conveyor in case of emergency**

AFTER



② Analysis quality data and take countermeasures

1. Production PLAN VS ACTUAL



Note: The factory burned down in June 2020 and the Kaizen activities ended halfway
Continue to improve at the new factory (Shree Amba)

④ Working standing posture

BEFORE **Working sitting posture**

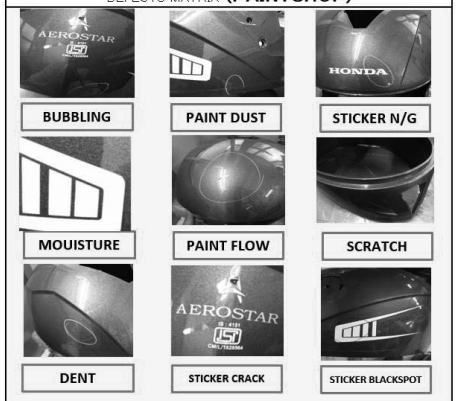
AFTER **Working standing posture**

Realization of Kaizen

5-2. Quality improvement (Reduce rework)

Defect status-1

DEFECTS MATRIX **(PAINTSHOP)**



PREPAIRED BY :- DEEPAK YADAV | APPROVED BY :- MR.SURENDER YADAV

AHA/QA/F-12:00

Defect status-2

DEFECT MATRIX (ASSEMBLY)

PREPAIRED BY:- DEEPAK YADAV | APPROVED BY:- MR. SURENDER YADAV

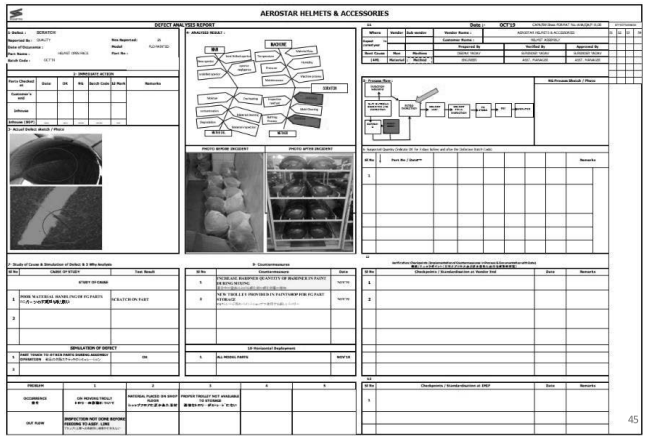
AHA/QA/F-12:00

DEFECT MATRIX (PRE-DISPATCH INSPECTION)

PREPAIRED BY:- DEEPAK YADAV | APPROVED BY:- MR.SURENDER YADAV

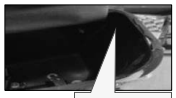
AHA/QA/F-12:00

REJEECTED ANALYSIS SHEET (Sample)



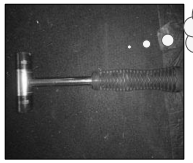
- **Problem :-** CRACK
- **ROOT CAUSE** :- USING METAL HAMMER FOR BUSH FITMENT OR DRILLING MANUALLY

BEFORE



MATERIAL CRACK AT ASSEMBLY STAGE

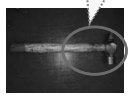
AFTER



USE RUBBER HAMMER

REJECTED MATERIAL REPLACED WITH OK MATERIAL

Root Cause: USED METAL HAMMER FOR REVITING OPERATION



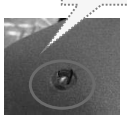
CRACK

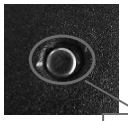
- **Problem :-** REVITING NG
- **ROOT CAUSE** :- REVITING DONE MANUALLY

BEFORE

AFTER

Root Cause: MANUAL OPERATION DONE FOR REVITING



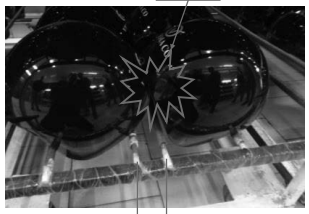


REVITIN G NG

ACTION : CHINA REVITING M/C IMPLIMENTED FOR REVITING OPERATION

Problem: No trolley standards
(Trolley dimensions vary)

hitting



A

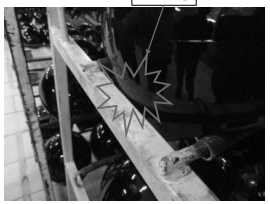
A ≠ B

B

Suggestion: Standardized trolley dimensions

Problem: Very low quality awareness of both supervisor/leader and wor

hitting



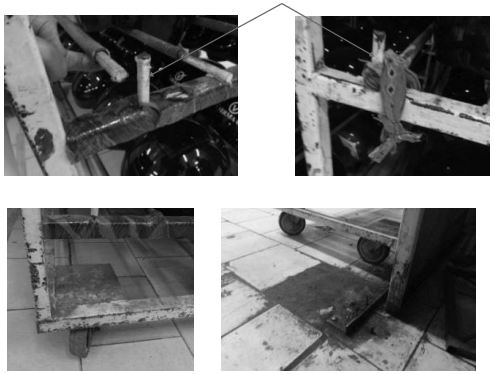
Insufficient cover

Suggestion:
1. Renew all scratch protection covers
2. Installation of Rubber Cover on all iron rods and iron square pipe
3. Paint the iron part with white paint
4. Number the trolleys and clean and manage all trolleys regularly

The purpose is not only to prevent scratches caused by trolleys, but also to raise workers' awareness of quality

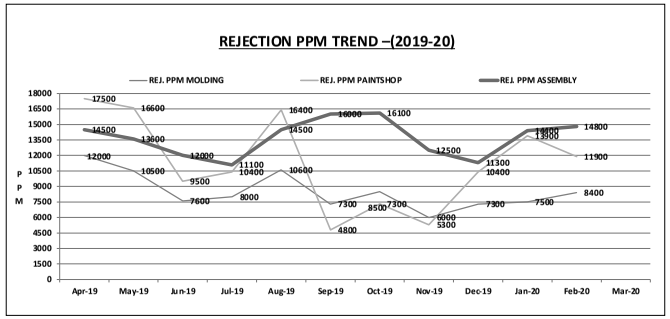
Problem: Very low quality awareness of both supervisor/leader and wor

No maintenance even broken!



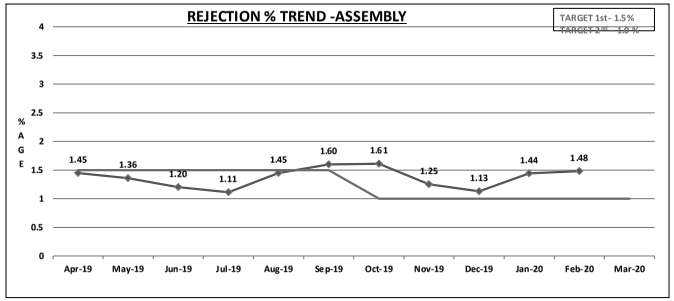
The purpose is not only to prevent put dust in the paint shop, but also to raise workers' awareness of quality (Dress is important)

Rejection status (Molding, Paint, Assembly)

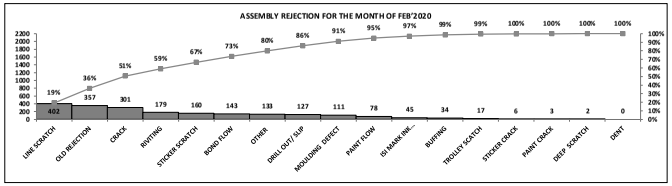


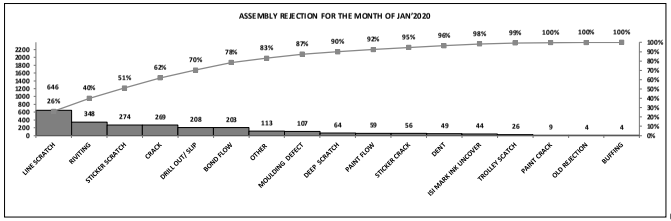
Note: The factory burned down in June 2020 and the Kaizen activities ended halfway
Continue to improve at the new factory (Shree Amba)

Rejection Trend (Assembly line)

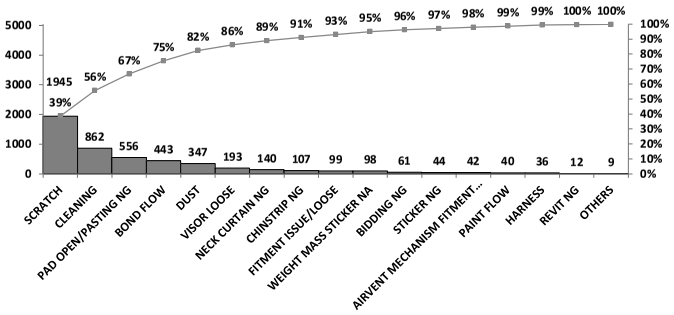


Contents of the defect item





REWORK DETAIL – FEB'20



Realization of Kaizen

5-3. Introduce a simply ANDON system (IoT)

Initial suggestions

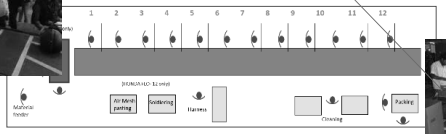
LINE-3 Model: HONDA FLO- 20
Model: GTS- 20

Production Analysis Board				
Line:		Date:		Time:
Time	Production			Conveyer stop time
	plan	Actual	Deference	
08:00 – 09:00				
09:00 – 10:00				
10:15 – 11:00				
12:30 – 13:00				
13:00 – 14:00				
14:00 – 15:00				
15:15 – 16:00				
16:00 – 17:00				
17:15 – 18:00				
Total				

① **Planed volume** = A

② A-B= Rework

B



Initial suggestions

ANDON Board at the site (Draft)

Manual Input (for the beginning)
Every morning

Server (Automatically)

Production Analysis Board				
Line:		Date:		Time:
Time	Production			Conveyer stop time
	plan	Actual	Deference	
08:00 ~ 09:00				
09:00 ~ 10:00				
10:15 ~ 11:00				
12:30 ~ 13:00				
13:00 ~ 14:00				
14:00 ~ 15:00				
15:15 ~ 16:00				
16:00 ~ 17:00				
17:15 ~ 18:00				
Total				

Signal: Motor sensor

Signal: Packing person press the Button (Manual)

Reason the CV down time : Record manually by team leader

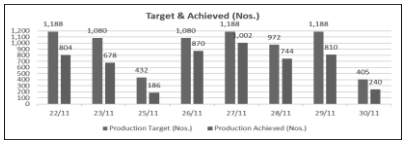
Manager's office / Smart phone (Sample)

Initial suggestions

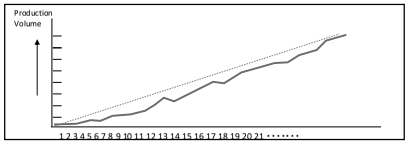
Display-1

Production Analysis Board				
Line:		Date:		Time:
Time	Production			Conveyer stop time
	plan	Actual	Deference	
08:00 – 09:00				
09:00 – 10:00				
10:15 – 11:00				
12:30 – 13:00				
13:00 – 14:00				
14:00 – 15:00				
15:15 – 16:00				
16:00 – 17:00				
17:15 – 18:00				
Total				

Display-2

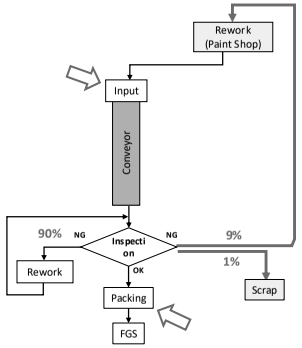


Display-3

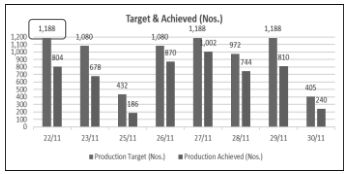


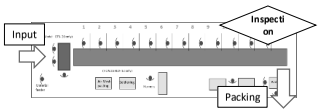
Reconfirm the flow of rework

Initial suggestions



Are reworked Helmets included in the planned production volume? -→Yes.





Management point?

ANDON Board at the site (Draft)

Initial suggestions

Signal:
Inspector press the Button (Manual)

Server:
(Automatically cumulate)

Rework situation

Defect	Number	cumulat
MOLDING DEFECT	120	120
SCRATCH	90	210
BUFFING DEFECT	50	260
LINE CONVEYOR SCRATCH		---
---	---	---
---	---	---
---	---	---
---	---	---
Total	---	---

Manual Input
By final inspection

Manager's office / Smart phone (Sample)

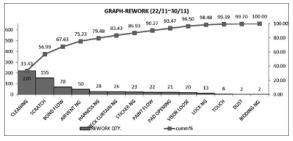
Initial suggestions

Display-1

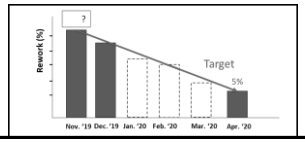
Rework situation

Defect	Number	cumulat
MOLDING DEFECT	120	120
SCRATCH	90	210
BUFFING DEFECT	50	260
LINE CONVEYOR SCRATCH		---
---	---	---
---	---	---
---	---	---
---	---	---
Total	---	---

Display-2



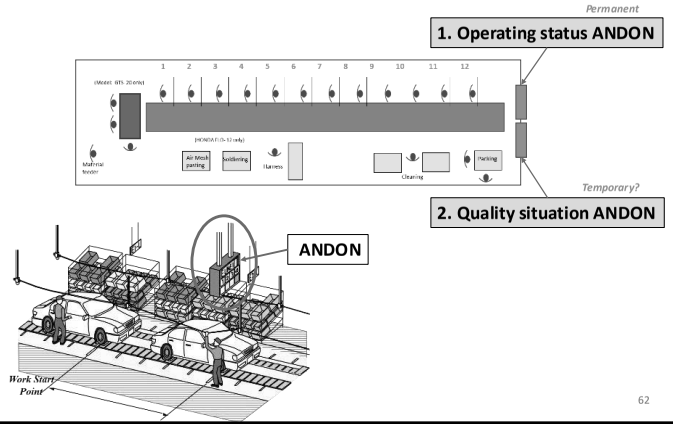
Display-3



Andon installation location

Initial suggestions

Install where all related workers can see at a glance



SHREE AMBA INDUSTRIES ROORKEE

Iot PROJECT DEVELOPMENT PROGRESS STATUS

GTS HELMET LINE

SHREE AMBA INDUSTRIES ROORKEE

Iot Task & Target

SR. NO	TASK	TARGET DATE	STATUS
1	Ruby & Rails Installation on Server	05-NOV-2020	DONE
2	Run Demo Application on Server – Developed by Omiya San	05-NOV-2020	DONE
3	Development – As Per Scope Discussed	20-JAN-2021	In Process

SHREE AMBA INDUSTRIES ROORKEE

Iot Development Content & Target

SR. NO.	CONTENT	TARGET DATE	STATUS
1	Home Page	24-NOV-2020	Done
2	Login Screen & Authentication 認証	05-DEC-2020	In Process
3	Production Plan Screen	20-DEC-2020	Pending
4	Production / Rejection / Rework Entry Update	05-JAN-2021	Pending
5	Production Report Auto Mail	05-JAN-2021	Pending
6	Reports – Andon Dashboard Display	20-JAN-2021	Pending

Production Plan – Elements Of This Screen

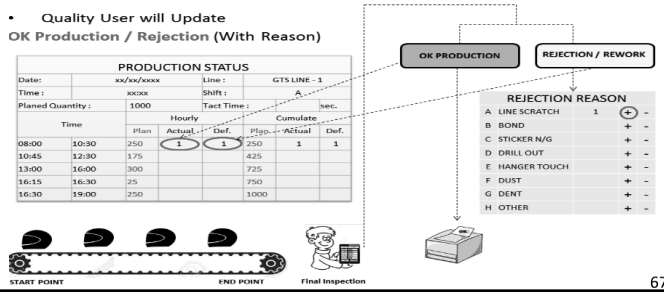
PRODUCTION PLAN							
Date:	xx/xx/xxxx			Line :	GTS LINE - 1		
Time :	xx:xx			Shift :	A		
Planed Quantity :		1000		Tact Time :			sec.
Time		Hourly			Cumulate		
		Plan	Actual	Def.	Plan	Actual	Def.
08:00	10:30	250			250		
10:45	12:30	175			425		
13:00	16:00	300			725		
16:15	16:30	25			750		
16:30	19:00	250			1000		

- User will login into the application and select the line to update shift wise hourly production plan

Production / Rejection / Rework Entry – **Elements Of This Screen**

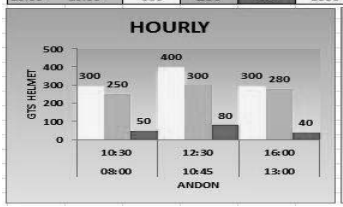
- **When user will select the Line, production plan will be automatically populate.**

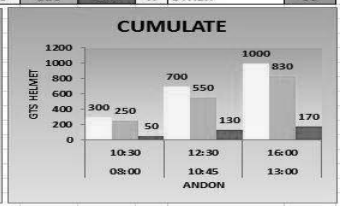
- Quality User will Update
OK Production / Rejection (With Reason)



Andon Dashboard Report / Display

PRODUCTION STATUS								REJECTION STATUS		
Date:	07-10-2020			Line :	GTS LINE -1			REJECTION QTY		170
Time :	15:24:00			Shift :	A			A	LINE SCRATCH	10
Planed Quantity :	1000			Actual Quantity :	830			B	BOND	18
								C	STICKER N/G	50
Time		Hourly			Cumulate			D	DRILL OUT	10
		Plan	Actual	Def.	Plan	Actual	Def.	E	HANGER TOUCH	15
08:00	10:30	300	250	50	300	250	50	F	DUST	19
10:45	12:30	400	300	80	700	550	130	G	DENT	13
13:00	16:00	300	280	40	1000	830	170	H	OTHER	35





Note: The factory burned down in June 2020 and the Kaizen activities ended halfway

Realization of Kaizen

5-4. 5S activities (5S, safety, environment, moral)

Assembly shop

	SHOP : STORE DEPARTMENT LOCATION : STORE	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 9-12-19	FINISHED ON : 9-12-19	
	BEFORE IMPROVEMENT	AFTER IMPROVEMENT	

OBSERVATION :- Material is grounded.	IMPLEMENT : Material is placed in blue bin.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) 5's Maintained. BENEFITS : 1) Safety increased	FACILITATOR: Mr. Depain Mr. Sagar	

Assembly shop

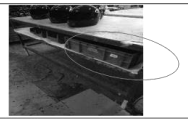
	SHOP : LOCATION :	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :	FINISHED ON :	
	BEFORE IMPROVEMENT	AFTER IMPROVEMENT	

OBSERVATION :- Chin strap material is on the ground.	IMPLEMENT : Chin strap material is removed on the ground.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) 5's Maintained. BENEFITS : 1) Safety increased	FACILITATOR: Mr. Mr.	

Assembly shop

	SHOP : ASSEMBLY DEPARTMENT LOCATION : ASSEMBLY	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 9-12-19	FINISHED ON : 9-12-19	
	BEFORE IMPROVEMENT	AFTER IMPROVEMENT	



OBSERVATION :- Beading is placed under the working table without a blue bin.	IMPLEMENT : The beading is placed in the blue bin below the working table so that it is maintained in 5's.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) 5's Maintained. BENEFITS : 1) Safety increased	FACILITATOR: Mr. Rishabh Mr. Dinesh	

Assembly shop

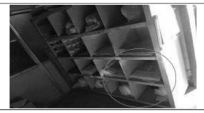
	SHOP : HR DEPARTMENT LOCATION : PHERIPERAL AREA	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :11-12-19	FINISHED ON : 11-12-19	
	BEFORE IMPROVEMENT	AFTER IMPROVEMENT	

OBSERVATION :- The empty master carton is placed below the material conveyor in the dispatch area.	IMPLEMENT : The empty master carton below the material conveyor in the dispatch area was removed from there.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) 5's Maintained. BENEFITS : 1) Safety increased	FACILITATOR: Mr. Naresh Mr. Vipin	

Assembly shop

	SHOP : STORE DEPARTMENT LOCATION : STORE	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :8-12-19	FINISHED ON : 8-12-19	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- The quality inspection rack does not have Thermocol, harness,sticker properly and the Visor box is not in proper place.	**IMPLEMENT : The thermocol, harness, sticker is correctly placed in the quality inspection rack and the Visor box is removed from it.**

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – 1) 5's Maintained.

BENEFITS : 1) Material Easy Check from Quality Inspection Rack.

FACILITATOR:
Mr. Depain
Mr. Sagar

Assembly shop

	SHOP : STORE DEPARTMENT LOCATION : STORE	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :8-12-19	FINISHED ON : 8-12-19	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- The material has been on the gangway due to the material rack becoming full.	**IMPLEMENT :The frame material placed on the gangway is placed in the second rack and the gangway is clean.**

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – 1) 5's Maintained.

BENEFITS : 1) Safety increased

FACILITATOR:
Mr. Depain
Mr. Sagar

Assembly shop

	SHOP : STORE DEPARTMENT LOCATION : STORE	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 9-12-19	FINISHED ON : 9-12-19	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- There is no identification tag on the master carton.	**IMPLEMENT : Identification tags have been placed on the master carton.**

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – 1) 5's Maintained.

BENEFITS : 1) Safety increased

FACILITATOR:
Mr. Depain
Mr. Sagar

Assembly shop

	SHOP : ASSEMBLY DEPARTMENT LOCATION : ASSEMBLY	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 8-12-19	FINISHED ON : 8-12-19	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- The back side of the Line-8 has placed Empty Master Carton, Blue Bin and Rejected Thermocol.	**IMPLEMENT : The back side of the Line-8 has removed Empty Master Carton, Blue Bin and Rejected Thermocol.**

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – 1) Space is found to keep material.

BENEFITS : 1) 5's Maintained

FACILITATOR:
Mr. Rishabh.
Mr. Naveer.

Assembly shop

	SHOP : ASSEMBLY DEPARTMENT LOCATION : ASSEMBLY	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :9-12-19	FINISHED ON : 9-12-19	
	BEFORE IMPROVEMENT	AFTER IMPROVEMENT	
			
	OBSERVATION :- Assembly ok material placed on gangway.	IMPLEMENT : Assembly ok material placed on dispatch area material remove from gangway.	

P	Productivity Increase	RESULT – 1) 5's Maintained.	FACILITATOR: Mr. Rishabh Mr. Naveer
Q	Quality Improved		
C	Cost Saving	BENEFITS : 1) Safety increased	
D	Delivery Fast		
S	Safety		
M	Moral Increase		

Assembly shop

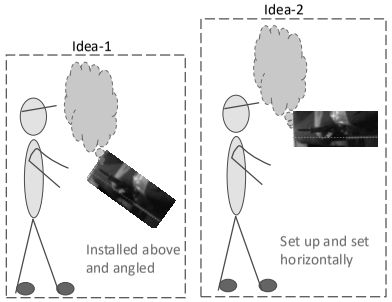
	SHOP : F.G.DEPARTMENT LOCATION : F.G. AREA	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 8-12-19	FINISHED ON : 8-12-19	
	BEFORE IMPROVEMENT	AFTER IMPROVEMENT	
			
	OBSERVATION :- Dispatch material was not properly placed.	IMPLEMENT : Dispatch material was properly placed.	

P	Productivity Increase	RESULT – 1) 5's Maintained.	FACILITATOR: Mr. ABHISHEK Mr. ASWANI
Q	Quality Improved		
C	Cost Saving	BENEFITS : 1) Safety increased	
D	Delivery Fast		
S	Safety		
M	Moral Increase		

Harmful smoke rises worker's face

Assembly shop

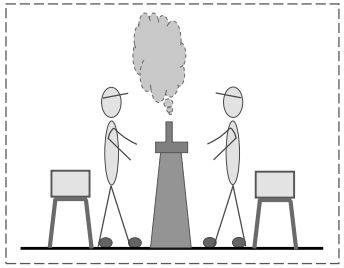
This ventilation fan is not working well



Assembly shop

- ✓ Harmful smoke rises worker's face
- ✓ Working on sitting position (Poor work efficiency)

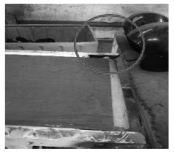
Idea



- Set the jig high so that smoke does not hit workers face
- Working on standing position (Improve work efficiency)

Buffing Department

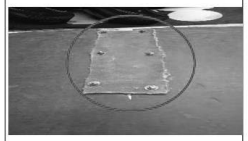
SHOP : Buffing Area LOCATION : All Shop Floors	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
STARTED ON : 30/01/2020	FINISHED ON : 1/02/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
Observation:-Sensor required on conveyor	IDEA : Sensor installed on conveyor

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) Quality improve BENEFITS : 1) Parts are not falling at the end of conveyor	FACILITATOR: Mr. SARJIT SINGH Mr. Bineet

Buffing Department

SHOP : Buffing Area LOCATION : All Shop Floors	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
STARTED ON : 4/02/2020	FINISHED ON : 4/02/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
KAIZEN THEME :- Due to the conveyor belt packing, there can be a problem of scratches and dent in the part.	IDEA : We have removed the conveyor belt packing, so that the problem of scratch and dent will not come.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) OK buffing parts are running on the conveyor. BENEFITS : 1) Quality Improved 2) Safety	FACILITATOR: Mr. SARJIT SINGH Mr. Bineet

Buffing Department

SHOP : Buffing Area LOCATION : All Shop Floors	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
STARTED ON : 28/01/2020	FINISHED ON : 28/01/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
KAIZEN THEME :- face mask not used by operator.	IDEA : face mask used properly.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) Moral increase BENEFITS : 1) safety	FACILITATOR: Mr. SARJIT SINGH Mr. Bineet

Buffing Department

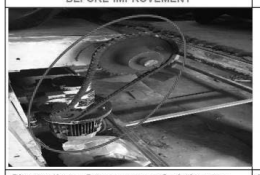
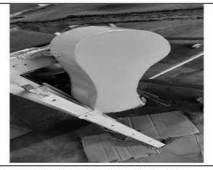
SHOP : Buffing Area LOCATION : All Shop Floors	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
STARTED ON : 1/02/2020	FINISHED ON : 3/02/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
Observation :- Dust collector are not working condition	IDEA : Dust collector working properly

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) Production smooth BENEFITS : 1) Productivity increase	FACILITATOR: Mr. SARJIT SINGH Mr. Bineet

Buffing Department

	SHOP : Bufffing Area LOCATION : All Shop Floors	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 27/01/2020	FINISHED ON : 29/01/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
Observation :- Conveyor gear & chain open	IDEA : Conveyor gear & chain cover by box

P	Productivity Increase	RESULT – 1) Moral increase	FACILITATOR: Mr. SARJIT SINGH Mr. Bineet
Q	Quality Improved		
C	Cost Saving	BENEFITS : 1) Safety	
D	Delivery Fast		
S	Safety		
M	Moral Increase		

F.G. Department

	SHOP :: FG Area (1st Floor) LOCATION : FG Area	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :3/02/2020	FINISHED ON :4/02/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- Fire Extinguisher cylinder not avaiable in FG Area (1ST Floor).	IDEA : :- Fire Extinguisher Cylinder available in FG Area (1ST Floor).

P	Productivity Increase	RESULT – 1) SAFETY PURPOSE	FACILITATOR: Mr. Abhishek Mr. Ashwani
Q	Quality Improved		
C	Cost Saving	BENEFITS : 1) SAFETY	
D	Delivery Fast		
S	Safety		
M	Moral Increase		

F.G. Department

	SHOP : FG Area (1st Floor) LOCATION : FG AREA	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 21/01/2020	FINISHED ON : 27/02/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :-Material is placed on the gangway in the FG first floor, which causes trouble in the movement.	IDEA : We have put the material behind the yellow line from the gangway so that movement can be appropriate in the gangway.

P	Productivity Increase	RESULT – 1) 5's Maintain	FACILITATOR: 1) ASWANI 2) ABHISHEK
Q	Quality Improved		
C	Cost Saving	BENEFITS : 1) Easy material movement.	
D	Delivery Fast		
S	Safety		
M	Moral Increase		

Hard Coating Department

	SHOP : Hard Coating Area LOCATION : Hard Coating Deptt.	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 4/02/2020	FINISHED ON :4/02/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- The checker plate is not used in the hard coating area for plastic pipes on the floor.	IDEA : Checker plate is used in hard coating area for plastic pipes on the floor.

P	Productivity Increase	RESULT – 1) MaintainSafety	FACILITATOR: Mr. Ravendra Mohan
Q	Quality Improved		
C	Cost Saving	BENEFITS : 1) Putting a checker plate on a plastic pie will not damage.	
D	Delivery Fast		
S	Safety		
M	Moral Increase		

Hard Coating Department

	SHOP : : Hard Coating Area LOCATION : Hard Coating Deptt	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :3/02/2020	FINISHED ON : 4/02/2020	

BEFORE IMPROVEMENT

AFTER IMPROVEMENT

OBSERVATION :-Suction Pipe open & dent present in suction pipe.

IDEA : Suction Pipe cover with iron mesh and dent to be remove a suction pipe.

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – 1) Morale Increase.

BENEFITS : 1) Safety a suction pipe.

FACILITATOR:

Mr. Ravendra Mohan

Hard Coating Department

	SHOP : Hard Coating Area LOCATION : Hard Coating Deptt.	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :30/01/2020	FINISHED ON : 31/01/2020	

BEFORE IMPROVEMENT

AFTER IMPROVEMENT

OBSERVATION :- Lux Light is not available in hard coating department.

IDEA : Lux Light has been installed in hard coating department.

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – 1) The use of lux light makes visior flim pasting easier.

BENEFITS : 1) It is easy to work.

FACILITATOR:

Mr. Ravendra Mohan

Hard Coating Department

	SHOP : Hard Coating Area LOCATION : Hard Coating Deptt	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 28/01/2020	FINISHED ON : 31/01/2020	

BEFORE IMPROVEMENT

AFTER IMPROVEMENT

OBSERVATION :- The master carton and the blue bin are not in the right place in the gangway.

IDEA : All material placing in Blue Bin... Material identification is on the blue bin.

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – Maintain 5's

BENEFITS : There is a lot of space in the gangway

FACILITATOR:

Mr. Ravendra

STITCHING Department

	SHOP : STITCHING AREA LOCATION : Replay HARNESS DEPTT	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :28/01/2020	FINISHED ON :30/01/2020	

BEFORE IMPROVEMENT

NA

AFTER IMPROVEMENT

OBSERVATION :-The replay Harness department is not connected to the gangway.

IDEA : The replay Harness department is connected to the gangway.

P	Productivity Increase
Q	Quality Improved
C	Cost Saving
D	Delivery Fast
S	Safety
M	Moral Increase

RESULT – 1) 5's Maintain

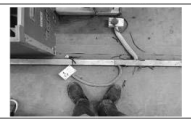
BENEFITS : 1) Easy material movement.

FACILITATOR:

Mr. Prasant
Mr. Anshu

STITCHING Department

	SHOP : AEROSTAR HARNESS AERA LOCATION : HARNESS DEPTT	KAIZEN IDEA SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :30/01/2020	FINISHED ON : 31/01/2020	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- Electrical wire is not piping On floor.	IDEA : Electrical wire is piping On floor.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1)) It has become safety. BENEFITS : 1) Safety	FACILITATOR: Mr. Prasant Mr. Anshu.	

Others

	SHOP : HR DEPARTMENT LOCATION : PHERIPERAL AREA	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :10-12-19	FINISHED ON : 12-12-19	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :-There are pipes in the garden area.	IMPLEMENT : Pipes have been removed from the garden area.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) 5's Maintained. BENEFITS : 1) Safety increased	FACILITATOR: Mr. Naresh Mr. Rupesh	

Others

	SHOP : HR DEPARTMENT LOCATION : PHERIPERAL AREA	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON : 10-12-19	FINISHED ON : 11-12-19	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :-The cylinder is not in its proper place	IMPLEMENT : The area of iron mesh has been defined to keep the cylinder.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) 5's Maintained. BENEFITS : 1) Safety increased	FACILITATOR: Mr. Naresh Mr. Rupesh	

Others

	SHOP : HR DEPARTMENT LOCATION : PHERIPERAL AREA	5's SHEET	DOC. No. : Rev. No. : Eff Date :
	STARTED ON :11-12-19	FINISHED ON : 11-12-19	

BEFORE IMPROVEMENT	AFTER IMPROVEMENT
	
OBSERVATION :- The empty box is placed on the gangway.	IMPLEMENT : The empty box is removed on the gangway.

P Productivity Increase Q Quality Improved C Cost Saving D Delivery Fast S Safety M Moral Increase	RESULT – 1) 5's Maintained. BENEFITS : 1) Safety	FACILITATOR: Mr. Naresh Mr. Vipin	

Comments

Add comments to the last page, something like---

- *Impressions of KAIZEN activities with JICA & CII*
- *Future plans*
- *Etc.*

Thank you

A8.Final Report (SONA BLW)

(CII-JICA Project)

VSME 2.0
Productivity Improvement through Integration of TPS & IOT/AI

January 2021

SONA BLW PRECISION FORGINGS LTD.
GURGAON PLANT

SONA BLW
MORE TORQUE PER GRAM

Contents

CII Confederation of Indian Industry

JICA

PART- I

KAIZEN – Based on TPS

OBJECTIVE

- Implementation of **Make One Bin---Inspect One Bin---Pack One Bin**
  Horizontal deployment of Unit#2' best learnings
- Mapping of Plant on micro level and identifying the **MUDA , NVA's**.
- Eliminate the unnecessary **transportation of material flow**.
- Implementation No. of Kaizen 10/man related to eliminates the **MUDA & NVA'S activities.**

Plant: Unit II & III

Project Organization Structure

SONA TEAM

Project Facilitator : R. Balaji
Project Coordinator: Ratan Singh
Project Leader : unit head name

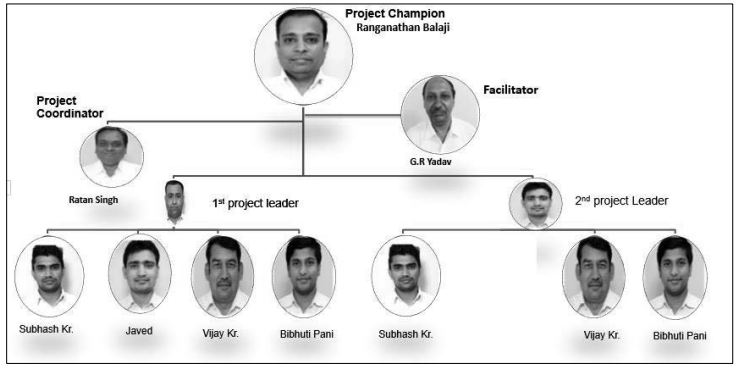
TPS Team:
1. Sanjay Khanna
2. Subhash
3. Javed
4. Vijay
5. Bibhuti

IOT /AI Team:
1. Ranjeet
2. Bhagat Singh
3. Roshan
4. Ashish
5. Rishabh

JICA TEAM(Experts)
1. Dr. Hiroshi Jogasaki (Overseer)
2. Mr. Kiyoshi Yoshida (TPS)
3. Mr. Hiroki Omiya (IoT/AI)

CII
Mr. Amit Vishnoi (Expert)
Dr. Sarita Nagpal (Principal Adviser)

CII: The Confederation of Indian Industry



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Ceremony at Kick-off meeting

Mr. Jogasaki presenting at the Kick-off meeting

Mr. Yoshida speaking in the Kaizen lecture

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Activities time line plan

Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status		April-20				July-20				Aug-20				Sept-20				Oct-20			
						W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Micro level study of Unit-3 Plant	Create the Space	Area save143.36 sq meter.	Done	Plan																				
					Actual																				
2	Prepare 2~3 Proposal to change layout & eliminate the Muda, NVA's	Create the Space	Material movement reduce to 16.14 meter	Done	Plan																				
					Actual																				
3	Reduce the chute length	Create the space	Space saved 7.14 Sq. Meter	Done	Plan																				
					Actual																				
4	Operator Movement reduced for inspection on Muratec	Reduce inspection movement	Operator Movement reduce 2.4 Meter/part check on 04 spindles.	Done	Plan																				
					Actual																				
5	Create the Gangway to reduce the transportation movement of Material feeder and lifter movement	Reduce the transportation of Material	83% transportation reduced	Done	Plan																				
					Actual																				
6	Machine shifting for create space & reduce transportation movement of material.	Space saving & reduced material movements.	86% transportation reduce	Done	Plan																				
					Actual																				
7	Line Balancing	Make one ,Inspect one, Pack one	Quality improve by one Piece flow.	Done	Plan																				
					Actual																				
8	Bin Qty. fixed for input material on Muratec Cell-1	Reduce the inventory	Inventory reduce 8 hrs. to 3 hrs.	Done	Plan																				
					Actual																				
9	Andon for material call	System for Material assurance	Eliminate the No load	Done	Plan																				
					Actual																				
10	M85 & M86 muratec machine shifted in front of each other to reduce operator movement	Reduce operator travel and increase productivity	Walking distance reduced in feet from 24.96 feet to 2 feet	Done	Plan																				
					Actual																				
11	To start on line inspection 2 machine shifted in cell 2 M62 & M60	One part flow concept	Material movement reduced 270 meters	Done	Plan																				
					Actual																				
12	Inspection chuted added with online inspection on M62 & M60	Create the Space	Material movement reduced 279 meters	Done	Plan																				
					Actual																				
13	To start online inspection 2 machine shifted in cell 2 M59,M58	One part flow concept	Material movement reduced 268 meters	Done	Plan																				
					Actual																				
14	Inspection chut added with online inspection on machine M59 & M58	Create the Space	Material movement reduced 281 meters	Done	Plan																				
					Actual																				
15	To start on line inspection 3 machine shifted in cell 3 M45, M46 & M47	One part flow concept	Material movement reduced 284 Meter	Done	Plan																				
					Actual																				

Plan
Actual
Rescheduled

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SONA COMSTAR Precision Forgings Limited
VSME 2.0 Project activities time line plan

Sr. No.	MUDA, NVA's & suggestion implementation	Purpose	Actual Benefits	Status		Nov-20				Dec-20				Jan-21				Feb-21				Mar ~April-2021			
						W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
16	Inspection chute added with online inspection on machine M45,M46 & M47	Create the Space	Material movement reduced 301 meter	Done	Plan																				
					Actual																				
17	Inspection chut added with online inspection on machine M48 & M49	Create the Space	Material movement reduced 290 Meter	Done	Plan																				
					Actual																				
18	Operator Movement reduced for inspection on Muratec by shifting machine in front of each other	Reduce operator on auto loader machine	2 operators now can be utilized for other machine	Done	Plan																				
					Actual																				
19	M39 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space.	Material movement reduced 200 meter	Done	Plan																				
					Actual																				
20	M14 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space	Material movement reduced 220 meter	Done	Plan																				
					Actual																				
21	M42 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space	Material movement reduced 247 meter	Done	Plan																				
					Actual																				
22	M38 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space	Material movement reduced 224 meter	Done	Plan																				
					Actual																				
23	Increase lot/hr of phosphating line	Increase lot/hr	Improvement of 36% in lot/hr	Done	Plan																				
					Actual																				

Plan
Actual
Rescheduled

Prepared By:- Department Head

Approved By:- Plant Head

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	SONA COMSTAR Precision Forgings Limited VSME 2.0 Project activities time line plan																								
Sr. No.	MUDA, NVA's & suggestion implementation	Purpose	Actual Benefits	Status		Feb-21				Mar-21				Apr-21				May-21				June-21			
						W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
24	M81 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space.		Pending	Plan																				
					Actual																				
25	M05 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space		Pending	Plan																				
					Actual																				
26	M01 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space		Pending	Plan																				
					Actual																				
27	M40 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space.		Pending	Plan																				
					Actual																				
28	M65 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space		Pending	Plan																				
					Actual																				
29	M36 Machine shifted for create space & reduce transportation movement of material.	Space saving & create the space		Pending	Plan																				
					Actual																				

Plan
Actual
Rescheduled

Prepared By:- Department Head

Approved By:- Plant Head

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Kaizen activities and results (Individual)

Phase 1

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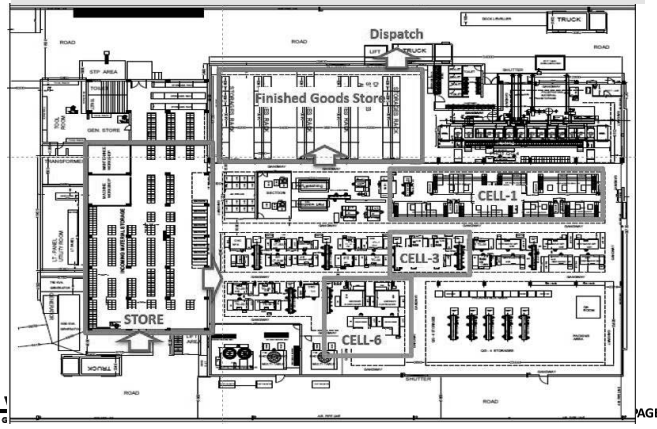
Unit-3 Master Layout for Model Project VSME 2.0



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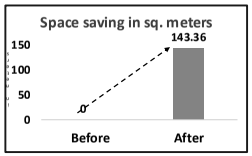
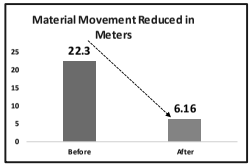
Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
1	Micro level study of Unit-3 Plant	Create the Space	Area saved 143.36 sq meter,	Implemented
2	Prepare 2~3 Proposal to change layout & eliminate the Muda, NVA's .	Create the Space	Material movement reduced from 22.3 meter to 6.16 meter	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**
Subject: Eliminate the MUDA and space savings		**Process:** QG4 Hard Turning	

Before	After		
		Productivity	
		Quality	
		Cost	
		Delivery	V
		Safety	V
		Morale	V
Comments: Earlier the material transportation from store to QG4 was 22.3 meters.	**Comments:** Now material transportation from material store to QG4 is 6.16 meters.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	16/10/2020
Benefits : Material transportation reduced 16.14 meter. **Area saved is 143.36 sq meter**		Suggested by	Avinash Jha
		Approved by	Vikas Verma





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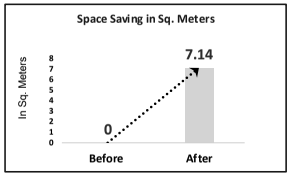
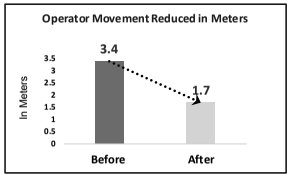
Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
3	Reduce the chute length of muratec machines (M85 & M86)	Create the space	Space saving of 7.14 sq meters and operator movement reduced 1.7 meters.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	Dept.: Machine Shop	Result: Space saved & material movement reduced	Month of Report	DEC' 2019
Subject: Length reduce of muratec chute		Process: Hard Turning		

Before	After		
		Productivity	
		Quality	
		Cost	
		Delivery	
		Safety	√
		Morale	√
Comments: Material chute length was long and needed extra space near muratec machine.	Comments: Now chute has been redesigned and kept under the muratec machine.	Environment	
		Others	.
Why-Why Analysis	Horizontal Deployment	Cost saving/Yr	
		Date of Implement	16/10/2020
Benefits : Operator movement reduced to 1.7 meter. Spaced saved is 7.14 sq meter		Suggested by	Avinash Jha
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma





Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
4	Operator Movement reduced for inspection on Muratec machine (M85 & M86)	Reduce inspection movement	Operator Movement reduce 2.4 Meter/ part check on 04 spindles	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	Dept.: Machine Shop	Result: Operater movement reduced by inspection chute placed under m/cine.	Month of Report	DEC' 2019
Subject: Length reduce of muratec chute		Process: Hard Turning		

Before	After		
		Productivity	
		Quality	
		Cost	
		Delivery	
		Safety	
		Morale	√
Comments:. Earlier operator had to travel a distance of 2.7 meter for part inspection	Comments: Now for part inspection operator had to travel only 0.3 meter.	Environment	
		Others	.
Why-Why Analysis	Horizontal Deployment	Cost saving/Yr	
	On all 4 spindles	Date of Implement	16/10/2020
Benefits : Operator movement reduced to 2.4 meter for each part check.		Suggested by	Avinash Jha
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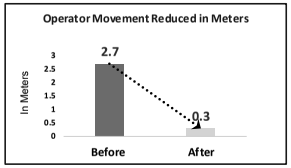
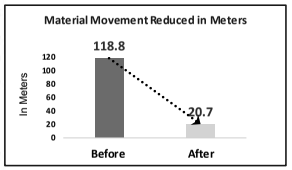


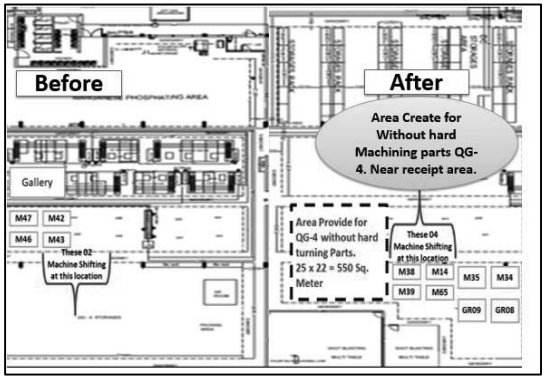
Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
5	Create the Gangway to reduce the transportation movement of Material feeder and lifter movement	Reduce the transportation of Material	Lifter & Material feeder movements reduced 83% .	Implemented

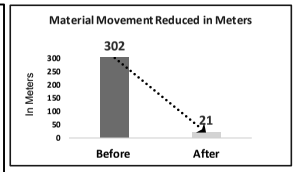
Company: Sona Comstar Unit-3	Deptt.: M/Shop	Result: Implemented	Month of Report	Dec-2019
Subject: Reduce the distance for material transportation.		Process: Hard Machining/Phosphating & FGS movement		

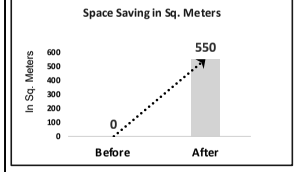
Before	After		
		Productivity	√
		Quality	
		Cost	√
		Delivery	√
		Safety	
		Morale	√
Comments: Gangway NA & Material transportation distance was QG-4 to DC 118.8 meters	Comments: Gangway Provided & Material transportation distance reduced 83%. After Kaizen QG-4 to DC distance 20.7 meters	Environment	
		Others	
Why-Why Analysis	Horizontal Deployment	Cost saving/Year	
Material transportation was long route , No Gangway was available	Same route follow for Hard Material, Packing & phosphate coating.	Suggestion by	S. Khanna
Benefits: Material transportation movement 83% reduced by implementing new Gangway.		Approved by	Mr. Ratan Mani



Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
6	Machine shifting for create space & reduce transportation movement of material.	Space saving & reduced material movements.	Receipt to QG-4 86% transportation reduced. Space saved 550 Sq. Meters	Implemented



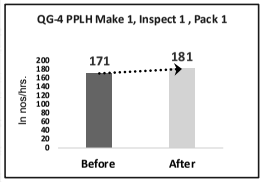




Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
7	Line Balancing	Make one ,Inspect one, Pack one	Quality improve by one Piece flow. PPLH improved 7.3%.	Implemented

Company: Sona Comstar Unit-3	Deptt.: QG-4 / M/Shop	Result: Implemented	Month of Report	Feb-2020
Subject: Make one, Inspect one, Pack one		Process: QG-4 Hard Machining		

Before	After		
		Productivity	√
		Quality	√
		Cost	√
		Delivery	√
		Safety	
		Morale	√
Comments: 5 manpower for inspection & packing.	Comments: 1 Manpower for inspection & packing with on line production.	Environment	
		Others	
Why-Why Analysis	Horizontal Deployment	Cost saving/Year	
Idea Not in mind.	M72, M46, M47, M71	Suggestion by	Javed Kumar
Benefits: In terms of productivity:- 10170-6400=3770Nos., On time inspection and on time dispatch., Quick feedback mechanism for improve FTR 100%.,Reduce the rejection and rework., Improve quality. Saving of the space.		Approved by	Mr. Ratan Mani



1. In terms of productivity:- Increase 10170 instead of 6400 by individual 5 Man .
2. On time inspection and on time dispatch.
3. Quick feedback mechanism for improve FTR 100%.
4. Reduce the rejection and rework.
5. Improve quality.
6. Saving of the space.

Operator Movement reduced on Muratec-M/c

- Reduce the fatigue of operator as per social distancing.
- Reduce manual time of operator (walking & Inspection time)
- Improve PPLH 15%.
- Easy to handle 02 spindle by single manpower.

Muratec m/c existing layout with two o/p for understanding

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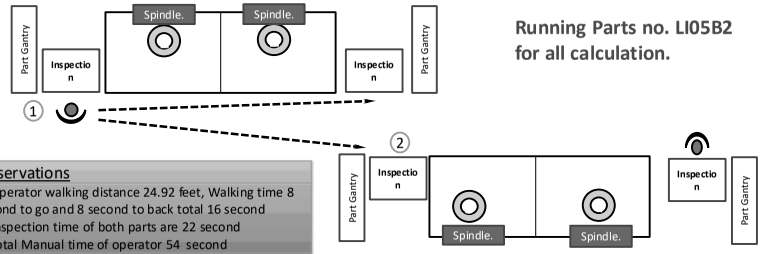
Present Layout of Muratec-M/c (M85 & M86)



Running Parts no. LI05B2 for all calculation.

Observations
1. Operator walking distance 24.92 feet, Walking time 8 second to go and 8 second to back total 16 second
2. Inspection time of both parts are 22 second
3. Total Manual time of operator 54 second
4. Auto time of one spindle 35.56 second
5. Part loading time in table 16 second . 1 parts loading time is 1.1 sec. (14 parts loading in rod).
6 . Every times 4 to 6 parts accumulate for inspection.
7. Chances of inspection missing by operator.
8. Production/Hrs. target - 101nos. from 01 spindle.

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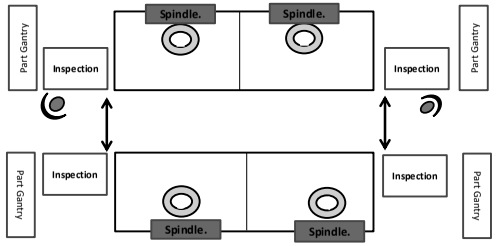
Proposed Layout Muratec-M/c (M85 & M86)

Running Parts no. LI05B2 for all calculation.



➢**Advantage**
1. Operator walking distance reduced from 16 sec. to 2 sec.
2. Walking distance reduced in feet from 24.96 feet to 2 feet.
3. Saved 02 extra manpower for operational both spindle of Machine as per layout.
4. Saved extra floor Space by New Layout Machine's **(20x25= 500 square feet / 46.452 Square meters)** .
5. Improved PPLH (685 nos. to 808 nos./Shift) , Because of 02 spindle operation feasible by single manpower

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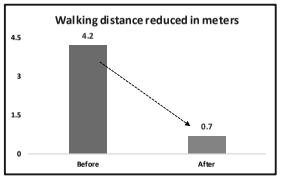
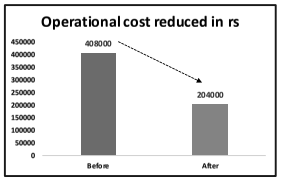
PAGE /////

Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
7	M85 & M86 in front of each other	Reduce walking distance of operator	Walking distance reduced from 4.2 meter to 0.7 meter.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Operator movement reduced by eliminating speed motion loss	**Month of Report**	NOV 2020
Subject: Reduce operator travel		**Process:** Hard Turning(Fanuc Controller)		

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	
		Safety	√
		Morale	√
Comments: Fatigue for operators and not easy to handle 2 spindles at same time	**Comments:** Now by machine shifting fatigue reduced and easy to operate 2 spindles at same time	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	204000 rs
		Date of Implement	26/08/2020
Benefits: Operator walking distance reduced from 16 sec. to 2 sec. Walking distance reduced in meter from 4.2 m to 0.7 meter. Saved 02 extra manpower for operational both spindle of Machine and cost saving 204000 rs/year.		Suggested by	Avinash Jha
		Approved by	Vikas Verma

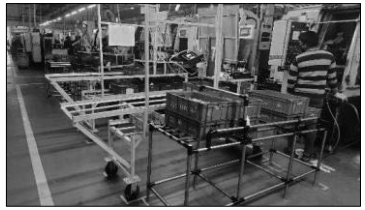




Phase 2

HD of Phase #1

BEFORE



AFTER

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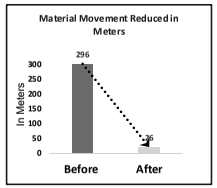
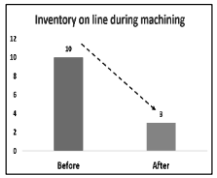
Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
11	Online inspection (M62 & M60)	One part flow concept	Material movement reduced 270 meter , Inventory decreased by 7 bins.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)		

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	√
		Safety	√
		Morale	√
Comments: Operation looks clumsy and difficult to understand and inspection and packing was done in batches	**Comments:** Now one part made, inspected and packed .	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	06/09/2020
Benefits: Quick feedback mechanismfor achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Avinash Jha
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

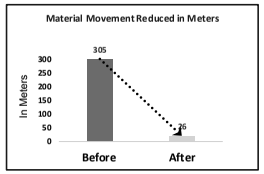


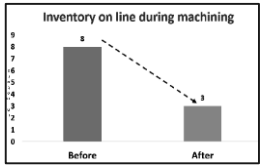


Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
12	Inspection Chute added (M62 & M60)	Create the Space	Material movement reduced 279 meter ,Inventory decreased by 5 bins.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)		

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	√
		Safety	√
		Morale	√
Comments: Earlier parts need to travel a distance for VI-PC	**Comments:** Now parts are checked on the same line and quick feedback we can obtain.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	13/09/2020
Benefits : Quick feedback mechanism for achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Avinash Jha
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

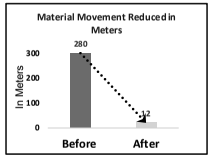


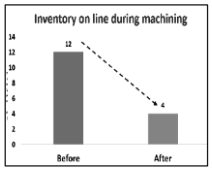


Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
13	Online inspection (M58 & M59)	One part flow concept	Material movement reduced 268 meter. Inventory reduced by 8 bins.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report** OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)	

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	√
		Safety	√
		Morale	√
Comments: Operation not easy to understand and space is also less for transportation.	**Comments:** Now one part made, inspected and packed , increasing over delivery rate.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	22/09/2020
Benefits: Quick feedback mechanism for achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Avinash Jha
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

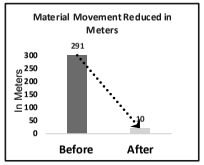


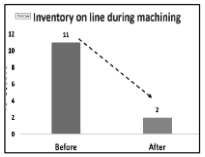


Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
14	Inspection chute added (M58 & M59)	Create the space	Material movement reduced 281 meter. Inventory reduced by 9 bins	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report** OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)	

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	√
		Safety	√
		Morale	√
Comments: Earlier parts were checked at different locations thus increasing the delivery time.	**Comments:** Now parts are inspected and packed at the same line thus decreasing the delivery time.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	29/09/2020
Benefits: Quick feedback mechanism for achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Jitender Ahuja
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

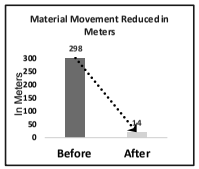


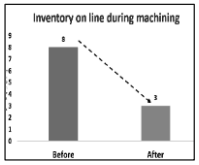


Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
15	Online inspection (M45,M46 & M47)	One part flow concept	Material movement reduced 284 meter. Inventory reduced by 5 bins	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report** OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)	

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	√
		Safety	√
		Morale	√
Comments: If part made wrong then we cannot do the analysis who has made it as parts moved to next stage on another line for inspection.	**Comments:** Now one part made, inspected and we can do analysis who made it and how it can be corrected.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	01/10/2020
Benefits: Quick feedback mechanism for achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Avinash Jha
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

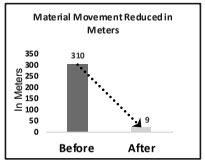


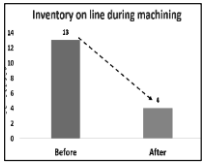


Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
16	Inspection chute added(M45,M46 & M47)	Create the space	Material movement reduced 301 meter. Inventory reduced by 9 bins.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report** OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)	

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	√
		Safety	√
		Morale	√
Comments: Earlier it is difficult to check the quality of parts and we can only check when it moved to next stage.	**Comments:** Now we can check hand by hand the quality of parts and can correct it immediately.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	06/10/2020
Benefits: Quick feedback mechanism for achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Jitender Ahuja
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

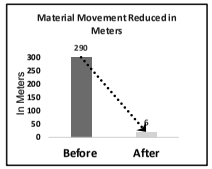


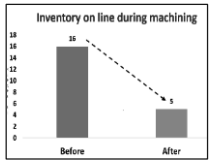


Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
17	Online inspection (M48 &M49)	One part flow concept	Material movement reduced 284 meter. Inventory reduced by 11 bins.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)		

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	√
		Safety	√
		Morale	√
Comments: Earlier the operation was diffcult to work upon and inventory was huge..	**Comments:** Now hassle free operation and inventory reduction has helped us to achieve our target.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	16/10/2020
Benefits: Quick feedback mechanism for achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Avinash Jha
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

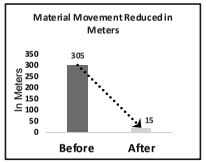


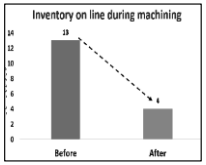


Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
18	Inspection chute added(M48,M49	Create the space	Material movement reduced 290 meter. Inventory reduced by 9 bins.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	OCT 2020
Subject: Make one ,Inspect one, Pack one		**Process:** Hard Turning(Fanuc Controller)		

Before	After		
		Productivity	
		Quality	√
		Cost	
		Delivery	
		Safety	√
		Morale	√
Comments: No inspection chute added so overall operation time was more as parts inspected at another station.	**Comments:** Now operation time is less and parts can be checked line to line with quick feedback.	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	25/10/2020
Benefits: Quick feedback mechanism for achieving 100% FTR. Quick feedback if any problem arise during any stage. One line inspection & one line dispatch		Suggested by	Jitender Ahuja
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma

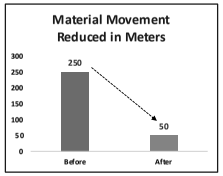




Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
19	M39 Machine shifted	Create the space	Material movement reduced from 250 meters to 50 meters.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	Jan2021
Subject: Machine shifted for space		**Process:** Hard Turning(Fanuc Controller)		

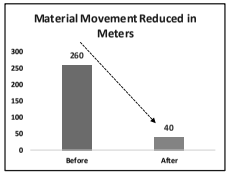
Before	After		
		Productivity	
		Quality	
		Cost	
		Delivery	√
		Safety	
		Morale	√
Comments: Transportation of material was long as material need to move to different location for checking	**Comments:** Now after machine shifting material movement is less	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	06/11/2020
Benefits: Material movement reduced 200 meters		Suggested by	Jitender Ahuja
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma



Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
20	M14 Machine shifted	Create the space	Material movement reduced from 260 meter to 40 meter	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	Jan2021
Subject: Machine shifted for space		**Process:** Hard Turning(Fanuc Controller)		

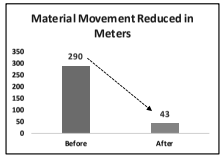
Before	After		
		Productivity	
		Quality	
		Cost	
		Delivery	√
		Safety	
		Morale	√
Comments: Transportation of material was long as material need to move to different location for checking	**Comments:** Now after machine shifting material movement is less	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	12/11/2020
Benefits: Material movement reduced 220 meters		Suggested by	Jitender Ahuja
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma



Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
21	M42 Machine shifted	Create the space	Material movement reduced from 290 meters to 43 meters	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	Jan2021
Subject: Machine shifted for space		**Process:** Hard Turning(Fanuc Controller)		

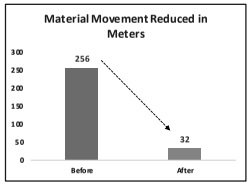
Before	After		
		Productivity	
		Quality	
		Cost	
		Delivery	√
		Safety	
		Morale	√
Comments: Transportation of material was long as material need to move to different location for checking	**Comments:** Now after machine shifting material movement is less	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	19/11/2020
Benefits: Material movement reduced 247 meters		Suggested by	Jitender Ahuja
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma



Sr. No.	Muda, NVA's & suggestion implementation	Purpose	Actual Benefits	Status
22	M38 Machine shifted	Create the space	Material movement reduced 256 meters to 32 meters.	Implemented

Company: Sona Blw Precision Forgings Ltd. (Unit -3)	**Dept.:** Machine Shop	**Result:** Space saved & material movement reduced	**Month of Report**	Jan2021
Subject: Machine shifted for space		**Process:** Hard Turning(Fanuc Controller)		

Before	After		
		Productivity	
		Quality	
		Cost	
		Delivery	√
		Safety	
		Morale	√
Comments: Transportation of material was long as material need to move to different location for checking	**Comments:** Now after machine shifting material movement is less	Environment	
		Others	.
Why-Why Analysis	**Horizontal Deployment**	Cost saving/Yr	
		Date of Implement	26/11/2020
Benefits: Material movement reduced 224 meters		Suggested by	Jitender Ahuja
SONA BLW MORE TORQUE PER GRAM		Approved by	Vikas Verma



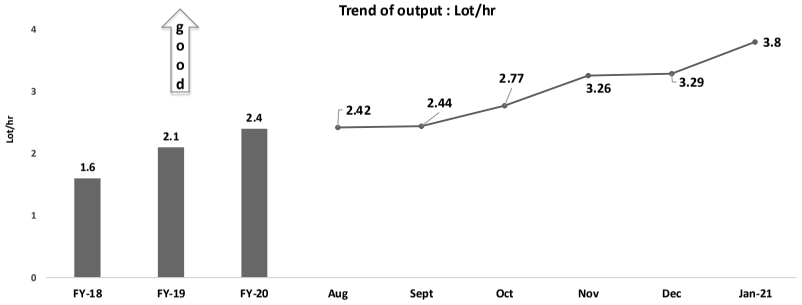
Muda Elimination in Phosphating Cell

Objective :

To improve 2.4 lots per hour to 4 lots per hour

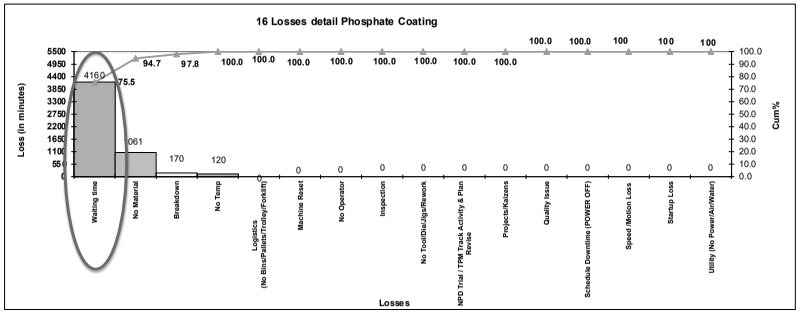
SONA BLW MORE TORQUE PER GRAM

Trend of output : Lot/hr



SONA BLW MORE TORQUE PER GRAM

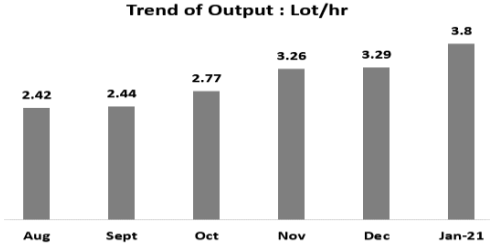
16 Losses in phosphating Sep'20



Action executed to achieve results

Sr #	Problem	Reason	Action to be taken	Prevent	Resp	When	Status
1	**Waiting time for empty trollies** was 75.5% to total loss time	Against standard requirement of 7 trollies, we were operating on 5 trollies	2 trollies need to procure	N/A	Jitender Ahuja	1st Nov	Completed
2	**Waiting time for empty trollies** was 19.2% to total loss time	hand to mount material from Hard machinig & OSP HT	Flexible timing of heater start-ups, Heaters to be start only once have opening stock of 4K for phosphating	Need to review on hourly basis	Rattan Singh	Immediately	Completed

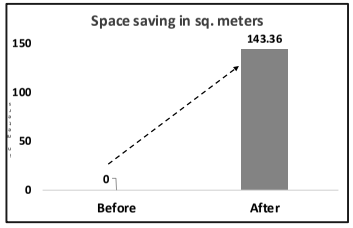
Results

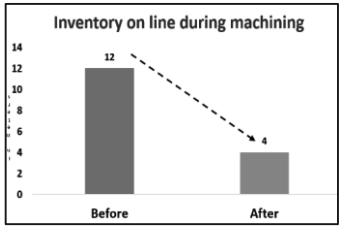


Improved by 36 %

Over all result

Tangible benefits-1

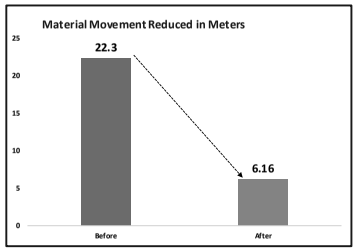


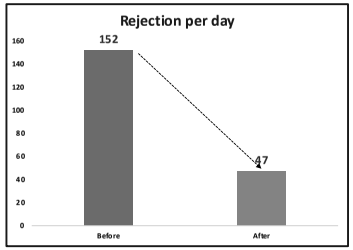


1. **Area saved - 143.36 meter**

2.Inventory reduced -12 bins to 4 bins

Tangible benefits-2

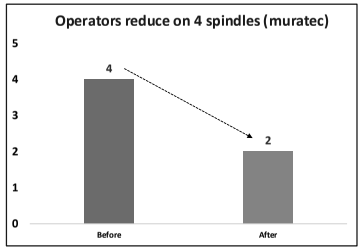


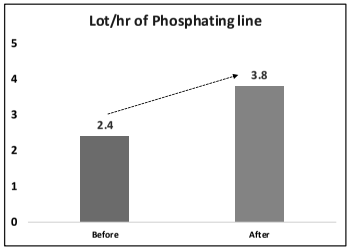


3. Material movement reduced - 22.3 meter to 6.16 meter

4. Rejection reduced from 152 parts to 47 parts per day

Tangible benefits-3





5. Manpower reduced from 4 to 2 nos on muratec machine

6. Lot/hr increased from 2.4 to 3.8

Intangible benefits

1. Team spirit of operators increased.
2. Fatigue has been reduced.
3. Key learnings on MUDA, NVA activites is enhanced.
4. Focus work environment has been created.
5. Recognition to employees for there good work.

CII Confederation of Indian Industry

JICA

PART- II

DIGITAL KAIZEN – RUBY ON RAILS LEARNING

Team Member
- Ranjeet Singh
- Bibhuti Pani
- Bhagat Singh
- Ashish Tiwari
- Rishabh Goel
- Raushan Kumar

Mr. Omiya during the IoT lecture

Topics Covered

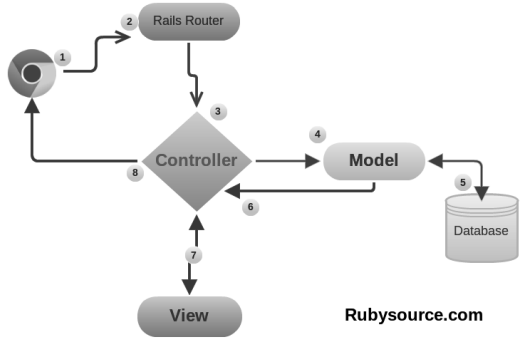
1. Introduction to Ruby on Rails
2. Understanding MCV diagram
3. Working with Numbers and Strings
4. Various Functions & Methods of Numbers & Strings
5. Assignment – Developing Rock Paper Scissor game.
6. Installation of Rails using Ruby Command prompt
7. Generating ROR Project
8. CRUD Functionality

1. Introduction to Ruby on Rails

- Ruby on Rails is a web application framework written in Ruby, a dynamic programming language.
- Ruby on Rails uses the Model-View-Controller (MVC) architecture pattern to organize application programming.

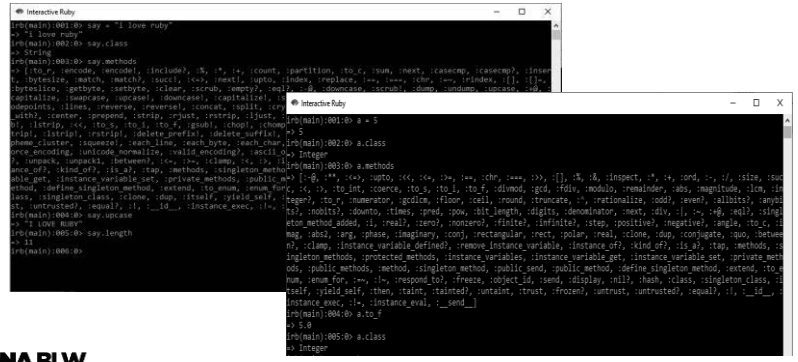
- A *Model* in a Ruby on Rails framework maps to a table in a database
- A *Controller* is the component of Rails that responds to external requests from the web server to the application, and responds to the external request by determining which view file to render
- A *View* in the default configuration of Rails is an erb file. It is typically converted to output html at run-time

2. Understanding MCV diagram



Rubysource.com

3. Working with Numbers and Strings



4. Various Functions & Methods of Numbers & Strings

- Methods
- Ruby methods are used to bundle one or more repeatable statements into a single unit.

```
def fact(n)
  return 1 if n == 0
  n * fact(n-1)
end
```

```
>>fact(2)
=> 2

>> fact(3)
=> 6

>> fact(10)
=> 3628800
```

```
say = "I love Ruby"
puts say

=> "I love Ruby"
```

```
say = "I love Ruby"
puts say
```

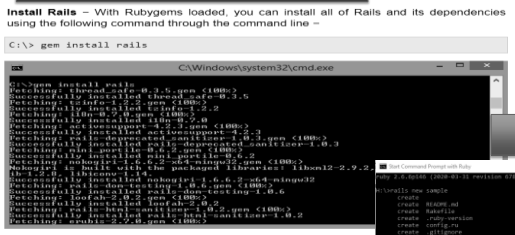
```
say = "I love Ruby"
say['love'] = "*love*"
puts say.upcase

=> "I *LOVE* RUBY"
```

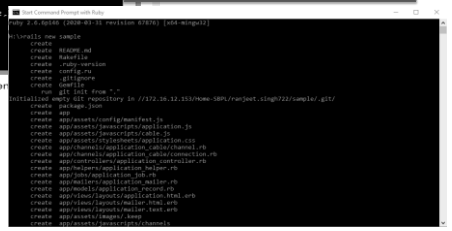
```
5.times { puts say }

=> "I *love* Ruby"
=> "I *love* Ruby"
=> "I *love* Ruby"
=> "I *love* Ruby"
=> "I *love* Ruby"
```


6. Installation of Rails using Ruby window



7. Generating New ROR Project



Various Functions & Methods of Numbers & Strings

- Methods
- Ruby methods are used to bundle one or more repeatable statements into a single unit.

```
def fact(n)
  return 1 if n == 0
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>>fact(2)
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```
5.times { puts say }

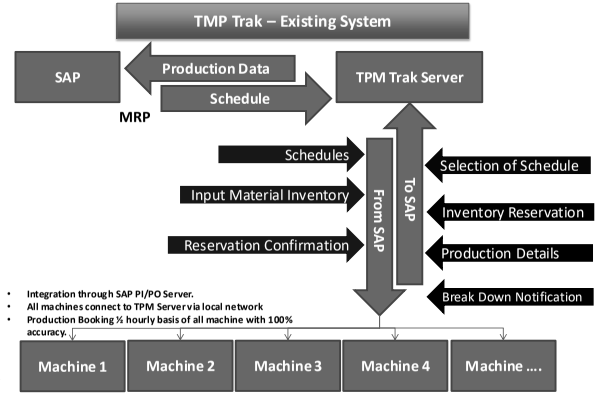
=> "I *love* Ruby"
=> "I *love* Ruby"
=> "I *love* Ruby"
=> "I *love* Ruby"
=> "I *love* Ruby"
```

8. CRUD Functionality

- CRUD operations are commonly used in web development and it stands for:
- Create – creating a record
- Read – reading a record
- Update – update/editing a record
- Delete – deleting the record

- Following this CRUD functions ROR provides 7 different routes-:
- Index – will display a list of all the records
- New – will let the user to create a new record
- Create – this will save the newly created record
- Show – will display the record
- Edit – will help to edit the saved record
- Update – will save the edited record
- Destroy – will delete the record

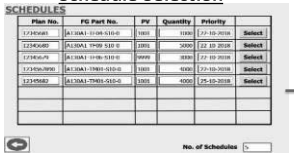
System



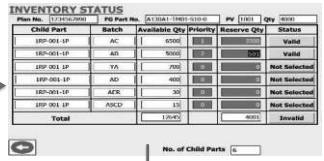
- Integration through SAP PI/PO Server.
- All machines connect to TPM Server via local network
- Production Booking ½ hourly basis of all machine with 100% accuracy.

User input on HMI

Schedule Selection



Child Item Selection with Batch wise



Release sending to SAP

Production Running

Sona Andon- Production Area Information

Work Center	Machine Description	Part Number	Schedule Quantity	To be Completed Till Time	Completed till Time	Shift OEE (%)	Machine Status	Last known Process Status
M06-047-01	MURATEC,MW 120 MC047	A130B1-SP01-300-0	2,500	488	633	130	Cycle Running	In Production
M06-047-02	MURATEC,MW 120 MC047	A130B1-MM16-300-0	2,289	374			ICD raised	Machine Breakdown [STRAT] Aug 15 2019 1:48/
M06-050	CNC MACHINE LT2LM	A130A1-LI05-300-0	540	146	107	80	BCD raised	PRODUCTION [END] Aug 19 2019 11:28AM
M06-051-01	MURATEC,MW 120	A130B2-MS06-300-0	2,500	586	535	91	Cycle Running	In Production
M06-051-02	MURATEC,MW 120	A130B2-MS06-300-0	2,000	586	534	91	Cycle Running	In Production
M06-056-01	MURATEC,MW 120	A130A1-LI05-300-0	850	293	52	18	Cycle Running	In Production
M06-057-01	CNC TC20 MC005	A130B2-LI05-300-0	1,200	533	504	95	Cycle Running	In Production
M06-057-02	CNC TC200 MC005	A130B1-CI07-300-0	500	519	387	75	Cycle Running	In Production
M06-058-01	CNC TC20 MC005	A130B1-ES01-300-0	400	331	295	78	Cycle Running	In Production

Andon in Shop Floor

TPM Reports

Conclusion

Since Sona Comstar already had an existing TPM Trak Andon and tracking system which is integrated with Machine at shop floor and SAP servers using HMI, Management took the decision to upgrade the existing system instead of deploying addition ROR software

THANKS

A9.Final Report (Hero MotoCorp)

(CII-JICA Project)

VSME 2.0
Productivity Improvement through Integration of TPS & IOT/AI

March 2021

Hero MotoCorp Ltd.

The Aim of the VSME2.0 Kaizen and IoT/AI Course

Kaizen

- A Method of Managing People and Things
  - Process oriented
  - Continuous improvement
  - Long-term progressive effects
  - All working together
  - Open
  - Flexible
  - Tacit knowledge

Integration of Business Management
Master the Synergy between Kaizen and IoT/AI
to gain the knowledge of the embodiment of Competitive management structure

IoT/AI Reform by utilization

- Technology-centric management methods
  - Results-oriented (achievement-oriented)
  - Innovation
  - Short-term dramatic effects
  - Individual team creation
  - Close
  - Rigid
  - Explicit knowledge

Project Start Date:- Oct,2019
Project Completion Date:- June(2nd Week),2020

Theme:
To increase "First Time Right" & achieve ZERO DEFECT in Weld Shop (Current Defect 40%)

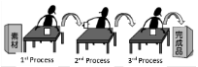
Project Facilitator :- Yashpal Sardana
Project Coordinator:- Vikasdeep
Project Leader :- S K Agrawal

TPS Team:-
1. Gurvinder Singh
2. Subhash
3. Akanshu Sharma
4. Arun Nandal
5. Sanjay Raghav

IOT /AI Team:-
1. Kapil Sharma
2. Vishal Vashishth
3. Subhash
4. Nitin Pancholi
5. Sunil Chahar

Experts
1. Mr. Kiyoshi Yoshida (JICA)
2. Dr. Hiroshi Jogasaki (JICA)
3. Mr. Hiroki Omiya (JICA)
4. Mr. Amit Vishnoi (CII)

Reference-***TOYOTA PRODUCTION SYSTEM*** *(Sensei Guidance)*



Production

Production flow must be entirely smooth.

One-piece-flow manufacturing easily finds problems in the production line.

One-piece-flow manufacturing is the best method to eliminate waste.

Quality

Quality should be ensured in each production process.

You must only send fine quality products to the next process.

We need to find the root cause when defective products are made.

We must be careful not to let these defects occur again.

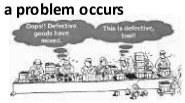
It is costly to keep making defects.

100% defect-free goods. The later process shouldn't accept any defects from the earlier process.
"Zone Control"

1. Selecting theme:

Visualization

Production process that can be find out immediately when a problem occurs
Process where the problem process can be seen visually



The spirit of TPS

First, "bring up a human being" then manage them.
The term "bring up a human being" encompasses the spirit of TPS.

Many people think that TPS is just a manufacturing method.
"To Human resource development" is the most important thing, and TPS is where people who grow up are making things while continues KAIZEN/improvements every day.
That's why there are no rebounds and you can always make the strongest manufacturing.

Manufacturing is not something that can be done with machines and methods.
The main constituent is just workers, and workers at the site can think better for themselves and solve for themselves.
"Manufacturing is human development"

2.Understanding the Current Situation and Setting Targets- 2.1 Current Scenario

Production

- Production flow not exactly smooth.
- Tough to find the problems in the current situation impacting responsiveness.
- One-piece-flow manufacturing like in TPS will be the best method to eliminate waste

Quality

- Quality is not being ensured in each production process.
- Focus on time bound corrective & preventive measures is weak when defective products are made
- Cost of poor quality is high.

The later process shouldn't accept any defects from the earlier process.
"Zone Control" is missing .

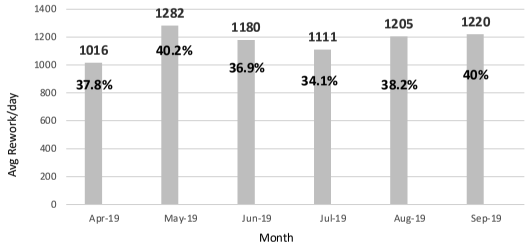
Visualization

Production process that can find out immediately when a problem occurs, Process where the problem process can be seen visually

Operational Excellence level is inadequate to achieve Zero-defect, So will be the focus area.

2. Understanding the Current Situation and Setting Targets Data collection

Rework trend for last 6 months:

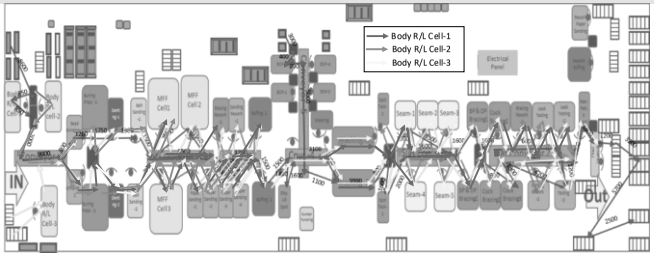


View:
- Too many in-line reworks [Even if there are multiple problems (defects) in one tank, the number of repairs is counted as one(defective)]
- Defects are sent to the next process (10% of defects are returned from Paint Shop-internal customer)

RW is high (40%) & consistent as well, proves it's chronical & complex nature.

2. Understanding the Current Situation and Setting Targets Data collection

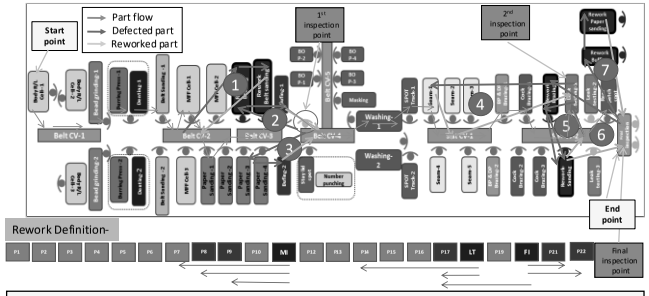
Scaled Existing layout of Fuel tank body welding line with operators and Flow of Material



Observation:
- Worker density is very high and workers interfere with each other
- Very complicated (congested enough to write the flow of all machines & workers)
- Difficulty in quality control (unable to identify workers for defects)
- No space for intermediate inspection and rework

Operational Excellence level is inadequate to achieve Zero-defect, So will be the focus area.

Rework path analysis done w.r.t. only one Body R/L MIG Welding machine

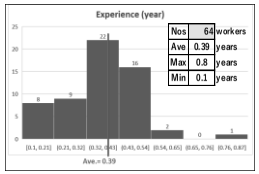


Observation-

- The defected part (Body R/L or Fuel Tank) travels through the production line without getting corrected at the point of generation.
- Process Operator don't have tools/means to Correct the defect at generation point.
- The defected part travels from one Zone to another and travels back for rework undergoing series of Operations.

It contributes to Zigzag part flow.

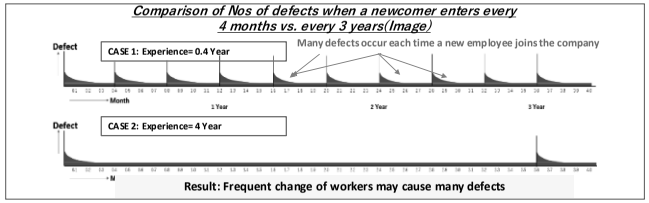
Defected part is not reworked at location of generation of defect. Rework path forms 7 loops. Zone wise defect control with quality gate to be Strengthened.



View:

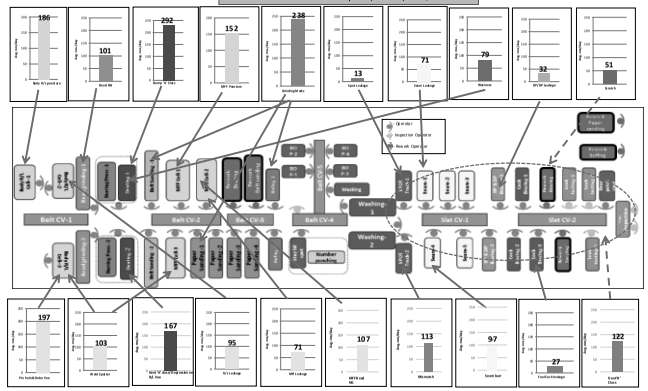
- **Very short work experience (0.39 months on average: By calculation, a fresh worker joins in every 2.3 days)**
- **Workers with only 4 months experience for jobs that require advanced skills**
- **In particular, Denting process gives secondary problems if there is little skill**

Experience v/s defect relationship



Defect occurrence is consistent because of frequent change of workers . A fresh worker joins in every 2.3 days

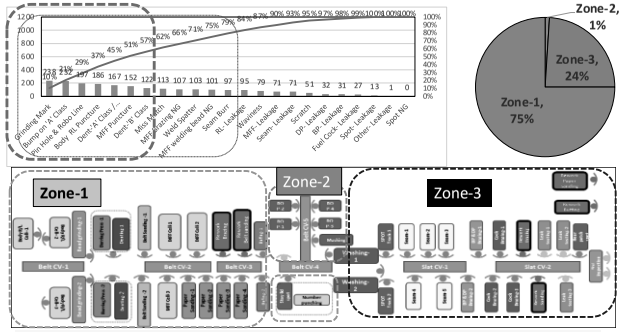
Data Collected as per:(18-22)Nov,19



Quality product is not produced in each stage. Defects are generated at nearly every stage.

Data Collection

Defect Pareto – Total defects of both groups (18-22 Nov 2019)



Zone-1 contributes to maximum % of defects(76%), followed by Zone-3(24%) & Zone-2(0% approx.)
Hence, Zone-1 will be the area to be focused further.

12 Phenomenon are contributing to 79% of the total defects and top 7 defects contributes 57%.

Top 7 defects

1. Grinding Marks
2. Bump
3. Dent A class
4. Pin Hole
5. Body R/L Puncture
6. MFF puncture
7. B class dent (side dents)

Top 6 defect Relationship with stages:

No.	Defect	Rank order	%	No.	OP-1	OP-2	OP-3	OP-4	OP-5	OP-6	OP-7	OP-8	OP-9	OP-10	OP-11	OP-12	OP-13	OP-14	OP-15	OP-16	OP-17	OP-18	OP-19
				Process	MIG WELD	BEAD GRIND	HYDRAULIC PRESS.	DENTING	BELT SANDING	MFF MIG WELD	BRAZING REWORK	PAPER SAND	BUFFING	BOP s/M	WASHING	WASHING	TAQUING	SEAM WELD	COOK, PIPE BRAZING	LEAK TESTING	NUMBER PUNCHING	RF PATCH s/M	FINAL INSPEC.
				No. of defects	3	2	2	2	2	3	1	4	2	4	1	2	2	5	5	3	1	1	1
				No. of workers	3	2	2	2	2	3	1	4	2	4	1	2	2	5	5	3	0	1	2
1	Grinding Mark	235	14%						C			A	A										
2	Bump on 'A' Class	138	8%		C			A															
3	Waviness	128	8%		A																		
4	Body R/L Puncture	113	7%		A																		
5	Dent-'A' Class / 凹	108	6%		C			A															
6	Miss Match	108	6%														A						
7	[illegible]	108	6%		A																		
8	MFF weld. bead NG	97	6%							A													
9	Dent-'B' Class	88	5%		C												C	C		C			
10	MFF Puncture	88	5%			B				C													
11	Seam Burr	88	5%															C					
12	MFF Brazing NG	83	5%								C												
13	Weld Spatter	68	4%							C													
14	Seam- Leakage	67	4%															C					
15	Others	178	10%																				
	Total	1,688	100%	A	3	0	0	2	0	1	0	4	1	0	0	0	1	0	0	0	0	0	0
				B	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				C	2	0	0	0	0	2	1	0	0	0	0	0	1	3	0	1	0	0	0

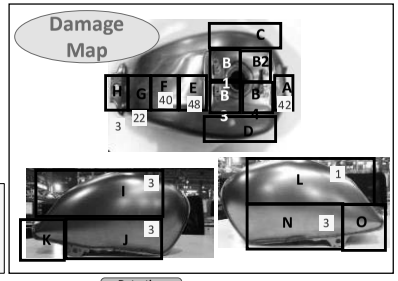
View:
Critical reworks due to body R/L MIG welding

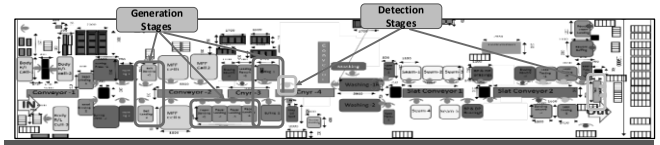
View:
Many critical reworks due to

To control rework generation due to workers , practical training stations to be provided e.g. bead grinding, denting, Paper sanding, Buffing .

2.9.1 *GRINDING MARKS*

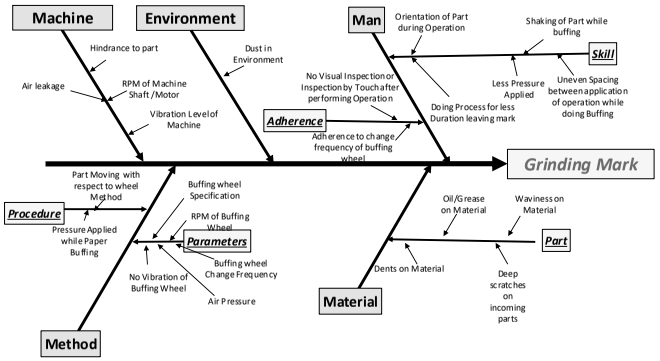
Grinding Marks:- Scratches generated in Belt sanding & Paper sanding process which are not removed in Buffing process.





Defect generation stages-Belt Sanding, Paper Sanding & Buffing. Detection stages-MI & FI

2.9.1.1 CAUSE AND EFFECT DIAGRAM: *GRINDING MARKS*



Probable Causes for Grinding Marks are determined through C&E Diagram.

4.1.1.2 Probable Causes for Defect Generation: *GRINDING MARKS*

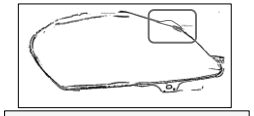
S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
1.	Part	Dents on Material	No Dents on Input Material	No Dents on Input Material	OK	
2.	Part	Oil/Grease on Material	No Oil	No Oil	OK	
3.	Part	Deep Scratches on input Material (R/L)	No Deep Scratches on Input Material	Minor Scratches on input material	NG	
4.	Part	Waviness on Material	No Waviness on Input Material	No waviness Present on Material	OK	
5.	Process	Pressure Applied while Paper Buffing	-	Manual operation	OK	
6.	Process	Part Moving with respect to wheel Method	-	Manual operation	OK	
7.	Process	Buffing wheel Specification	Grit Size-220 Dia-300 x T50		OK	Test Certificate Awaited
8.	Process	RPM of Buffing Wheel	2800	2800	OK	
9.	Process	Buffing wheel Change Frequency	300 Components	300 Components	OK	
10.	Process	Air Pressure/Leakage on Paper sanding	4.5 kg/cm2	4.5 kg/cm2	OK	
11.	Process	Buffing Machine grouting	4 point	4 points	OK	
12.	Process	Hindrance to part	No Hindrance	No Hindrance	OK	

Dents, deep scratches, waviness on input material & Buffing wheel change frequency are NG factors

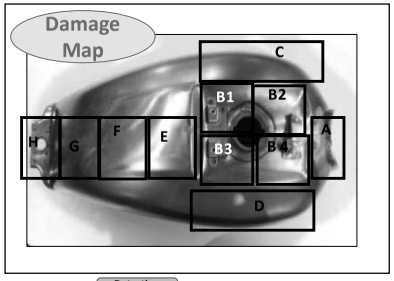
S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
13.	Process	Doing Process for less Duration leaving mark	20 Secs Min	22 Secs	OK	
14.	Process	Orientation of Part during Operation	Vertical & Horizontal	Vertical & Horizonta	OK	
15.	Process	Shaking of Part while buffing	No Shaking	Part not fixed and vibrating while buffing	NG	
16.	Process	Uneven Spacing between application of operation while doing Buffing	No Space	No Space	OK	
17.	Process	No Visual Inspection or Inspection by Touch after performing Operation	Operator should check by Hand	**Procedure followed by all operators**	OK	

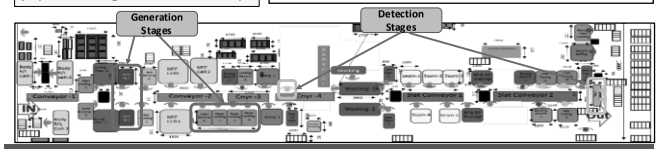
Shaking of part & No self inspection of part are NG factors.

2.9.2 *BUMP 'A' CLASS*



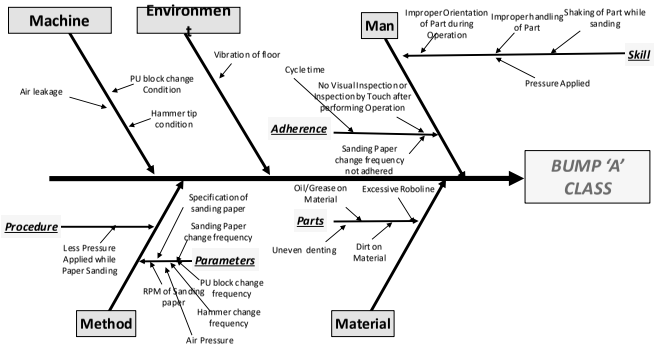
Bump :- Fuel Tank R/L sheet hit (Denting) at welding point from bottom side to remove extra bead on R/L top surface, A segment which is not leveled at paper sanding is known as bump.





Generation Stages-Denting & Paper Sanding. Detection Stages-MI & FI

2.9.2.1 CAUSE AND EFFECT DIAGRAM: *BUMP 'A' CLASS*



Probable Causes for Bump 'A' Class defect are determined through C&E Diagram.

2.9.2.2 Probable Causes for Defect Generation: *BUMP 'A' CLASS*

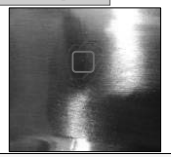
S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
1.	Process	Less Pressure Applied while Paper Sanding	-	Manual operation	OK	
2.	Process	Specification of sanding paper	Grit Size-180	Grit Size 120	NG	
3.	Process	Sanding Paper change frequency	Every 30 Components	30 Components	OK	
4.	Process	Hammer change frequency	-	Weekly	OK	
5.	Process	Air Pressure/Air leakage	4.5 kg/cm2	4.5 kg/cm2	OK	
6.	Process	RPM of Sanding paper	-		NG	No Specification
7.	Process	Uneven denting	Denting should be Even	Denting uneven due to manual operation	NG	
8.	Process	Vibration of Denting Station	-		OK	
9.	Process	No Visual Inspection or Inspection by Touch after performing Operation	Operator should check by Hand	Procedure not strictly followed by all operators	OK	
10.	Process	Cycle time	-	Manual operation	OK	
11.	Part	Dirt on Material	No Dirt should be present	Minor Dirt Remains	OK	
12.	Part	Oil/Grease on Material	Oil/Grease shouldn't be present	No Oil	OK	
13.	Part	Excessive Roboline	Roboline should be within limits		OK	

Uneven denting, Vibration of floor, Oil/grease on material & Sanding Paper change freq. are NG factors.

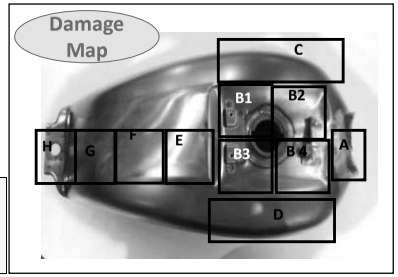
S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
14.	Process	Improper Orientation of Part during Operation	-	Manual operation	OK	
15.	Process	Improper handling of Part	Part should be Handled with Care	Part handled properly	OK	
16.	Process	Shaking of Part while sanding	Part shouldn't shake	Part not fixed and vibrating while sanding	NG	
17	Process	Wrinkle after MFF welding	No wrinkle	Observed in SP+ Model	NG	

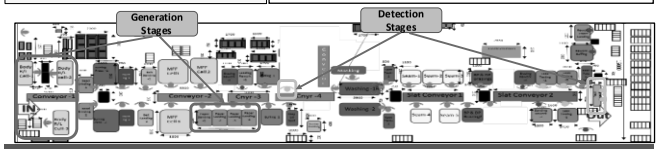
Shaking of part while handling is NG factor.

2.9.3 *PIN HOLE*



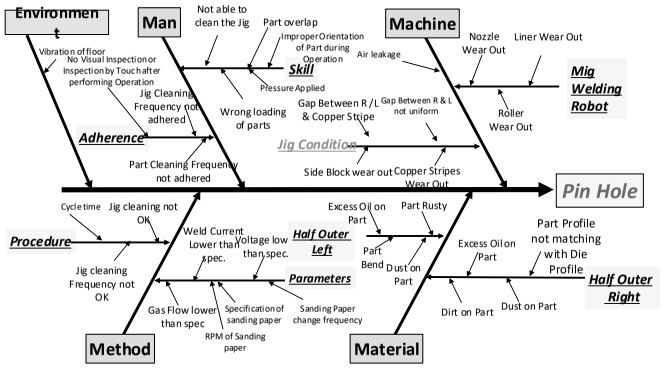
Pin Hole:- A small hole generated at Body R/L MIG welding process due to incomplete penetration/contamination of molten metal, Which is not grinded & leveled at Paper sanding operation.





Generation Stages- Body R/L MIG Welding & Paper Sanding. Detection Stages-MI & FI

2.9.3.1 CAUSE AND EFFECT DIAGRAM: *PIN HOLE*



Probable Causes for Pin Hole defect are determined through C&E Diagram.

2.9.3.2 Probable Causes for Defect Generation: *PIN HOLE*

S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
1.	Part	Dirt/Dust on Part (R/L)	No Dirt/Dust on Part	No Dirt/Dust	OK	
2.	Part	Excess Oil on Part (R/L)	No oil on Part	Minor Oil Remains	OK	
3.	Part	Part Profile (R/L) not Matching with Die	Should be 0.3-0.5mm	Found 0-1 mm (Visual Check)	NG	Filler gauge unavailable
4.	Part	Bending/Dent on part (R/L)	No Dents on Part	Waviness and Dent on Part due to handling	NG	
5.	Process	Gap between R/L and Copper Stripe	No Gap	No Gap	OK	
6.	Process	Side Block/Copper Stripes Wear Out	No Wear Out	No Wear Out	OK	
7.	Process	Specification of sanding paper	Grit Size-180	Grit Size 120	NG	To be Verified by PE
8.	Process	Sanding Paper change frequency	Every 30 Components	30 Components	OK	
9.	Process	Gap between R/L not Uniform	Gap should be Uniform	Gap varying with more at centre and less at end points	NG	
10.	Process	Nozzle/Liner/Roller Wear Out	No Wear Out	No wear out	OK	
11.	Process	Improper Jig Cleaning	Proper Jig Cleaning	No blackness and oil	OK	
12.	Process	Part Overlap	No Overlapping	Slight Overlap along neck area SPL+	NG	
13.	Process	Cycle Time	-	Manual operation	OK	
14.	Process	No Visual Inspection or Inspection by Touch after performing Operation	Operator should do visual Inspection before Paper Sanding	Procedure not strictly followed by all operators	NG	

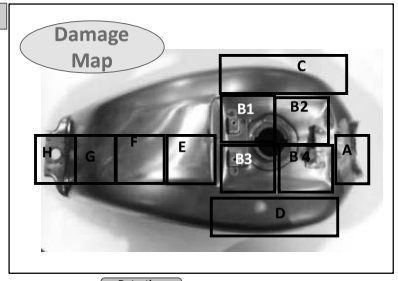
Oil on part, mismatching Die, Dent on part, R/L gap, Unclean Jig are NG factors.

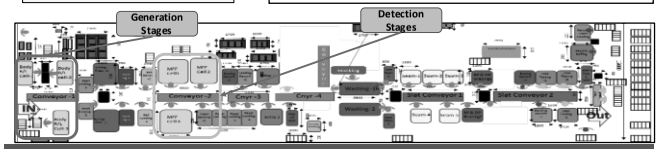
S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
15	Process	Wrong Loading of Parts	Proper Loading of Parts	Parts Loaded Properly	OK	
16	Process	Weld/Voltage Lower than specified	14-18 V	17 V, 110 A	OK	
17	Process	Low Gas Flow Speed	16-22 LPM	21 LPM	OK	
18	Process	Low Inert Gas Concentration	82:18	18.53	OK	
19	Process	Outer Air Flow Interference	No Interference	No Interference	OK	
20	Process	Pressure Applied	-	Manual operation	OK	
21	Process	Improper Orientation of Part	-	Manual operation	OK	

Low inert Gas concentration is NG factor.

2.9.4 *BODY R/L PUNCTURE*

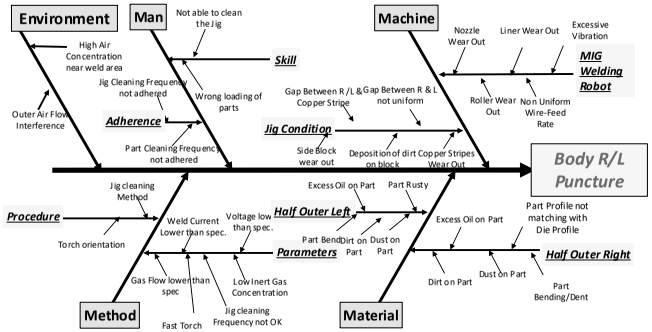
Puncture:- A hole generated at Body R/L MIG welding process.





Generation Stage- Body R/L MIG Welding. Detection Stages-MFF MIG welding.

2.9.4.1 CAUSE AND EFFECT DIAGRAM: *BODY R/L PUNCTURE*



Probable Causes for Body R/L Puncture defect are determined through C&E Diagram.

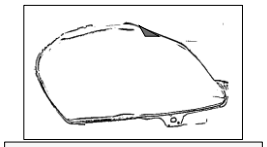
2.9.4.2 Probable Causes for Defect Generation: *BODY R/L PUNCTURE*

S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
1.	Part	Dirt/Dust on Part	No Dirt/Dust on Part	No Dirt/Dust	OK	
2.	Part	Excess Oil on Part	No oil on Part	Minor Oil Remains	NG	
3.	Part	Part Profile not Matching with Die	Should be 0.3-0.5mm	Found 0-1 mm (Visual Check)		Filler gauge unavailable
4.	Part	Bending/Dent on part	No Dents on Part	Waviness and Dent on Part due to handling	NG	
5.	Process	Gap between R/L and Copper Stripe	No Gap	No Gap	OK	
6.	Process	Side Block/Copper Stripes Wear Out	No Wear Out	No Wear Out	OK	
7.	Process	Deposition of Dirt on Block	No Dirt on Block	Dirt/Oil on Block	NG	
8.	Process	Gap between R/L not Uniform	Gap should be Uniform	Gap Varying with more at Centre and less at end points	NG	
9.	Process	Nozzle/Liner/Roller Wear Out	No Wear Out	No Wear Out	OK	
10.	Process	Non-Uniform Wire Feed Rate	Should be Uniform	Uniform (No-Blackness)	OK	
11.	Process	Excessive Vibration		Excess Penetration at Puncture Region		No Specification
12.	Process	Fast Torch Travel Speed	Should be as per the specification	Remains as per the specification	OK	
13.	Process	Improper Jig Cleaning	Proper Jig Cleaning	Jig contains Blackness and Oil	OK	
14.	Process	Part Overlap	No Overlapping	No overlaap	OK	

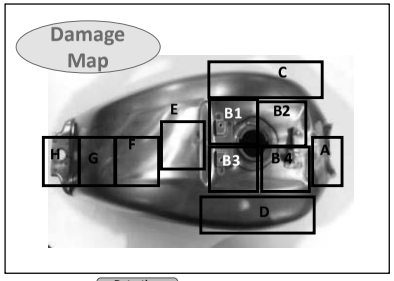
Oil on part, mismatching Die, Dent on part, Dirt on part, R/L gap, Unclean Jig, part overlap are NG factors.

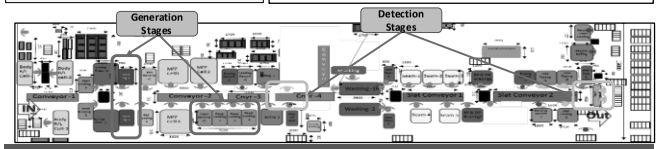
S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
15	Process	Wrong Loading of Parts	Proper Loading of Parts	Parts Loaded Properly	OK	
16	Process	Weld/Voltage Lower than specified	14-18 V	17 V, 110 A	OK	
17	Process	Low Gas Flow Speed	16-22 LPM	21 LPM	OK	
18	Process	Low Inert Gas Concentration	82:18	18.53	OK	
19	Process	Outer Air Flow Interference	No Interference	No Interference	OK	

2.9.5 *DENT 'A' CLASS*



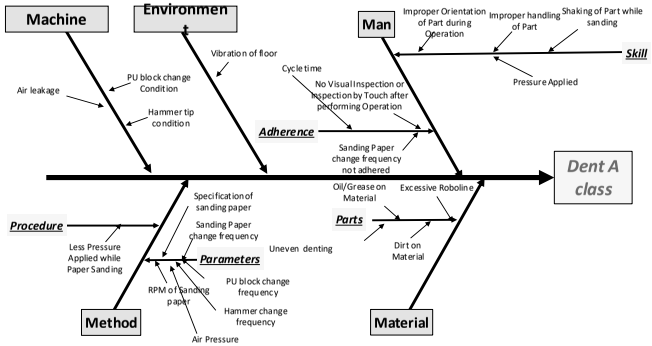
Dent :- Fuel Tank R/L sheet hit (Denting) at welding point from bottom side to remove extra bead on R/L top surface , A segment which is not leveled (depressed)at paper sanding.





Generation Stage-Denting & Paper Sanding. Detection Stages- MI & FI.

2.9.5.1 CAUSE AND EFFECT DIAGRAM: *DENT 'A' CLASS*



Probable Causes for Dent 'A' Class defect are determined through C&E Diagram.

2.9.5.2 Probable Causes for Defect Generation: *DENT 'A' CLASS*

S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
1.	Process	Less Pressure Applied while Paper Sanding	-	Manual operation	OK	
2.	Process	Specification of sanding paper	Grit Size-180	Grit Size 120	NG	To be Verified by PE
3.	Process	Sanding Paper change frequency	Every 30 Components	30 Components	OK	
4.	Process	PU block change frequency	-	As per condition	OK	
5.	Process	Hammer change frequency	-	Weekly	OK	
6.	Process	Air Pressure/Air leakage	4.5 kg/cm2	4.5 kg/cm2	OK	
7.	Process	RPM of Sanding paper	-			No Specification
8.	Process	Uneven denting	Denting should be Even	Denting uneven due to manual operation	NG	
9.	Process	Vibration of floor	-		OK	No Specification
10.	Process	No Visual Inspection or Inspection by Touch after performing Operation	Operator should check by Hand	Procedure not strictly followed by all operators	NG	
11.	Process	Cycle time	-	Manual operation	OK	
12.	Part	Dirt on Material	No Dirt should be present	No Dirt Remains	OK	

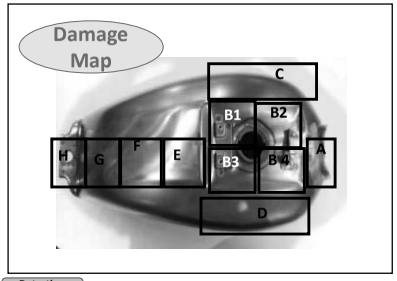
Sanding Paper changing frequency, uneven denting, no self inspection and oil remains on part are NG factors.

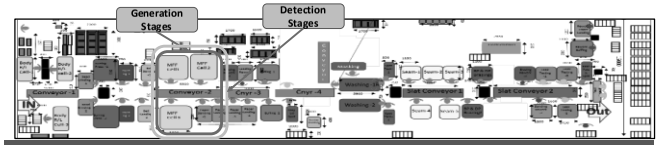
S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
13.	Part	Oil/Grease on Material	Oil/Grease shouldn't be present	No Oil	OK	
14.	Part	Excessive Roboline	Roboline should be within limits			No Specification

Sanding Paper changing frequency, uneven denting, no self inspection and oil remains on part are NG factors.

2.9.6 *MFF PUNCTURE*

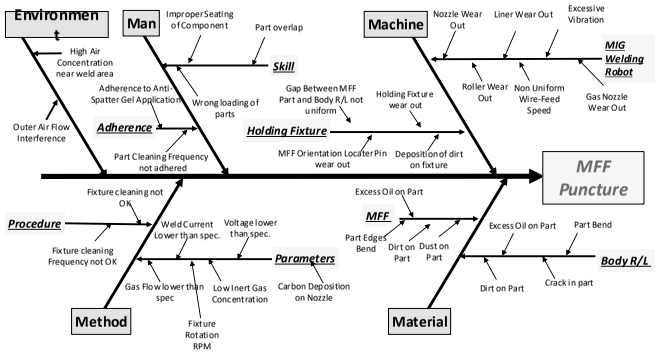
MFF Puncture :- A hole generated in MFF MIG welding process due to contamination/ over-penetration of arc.





Generation Stage-MFF MIG welding. Detection Stage-MFF MIG welding.

2.9.6.1 CAUSE AND EFFECT DIAGRAM: *MFF PUNCTURE*



Probable Causes for MFF puncture defect are determined through C&E Diagram.

2.9.6.2 Probable Causes for Defect Generation: *MFF PUNCTURE*

S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
1.	Part	Dirt on Part (R/L + MFF)	No Dirt should be Present	No Dirt on Part	OK	
2.	Part	Crack in part (R/L)	No Crack in Part	No Crack on Part	OK	
3.	Part	Part Bend (R/L + MFF)	No Bending of Part	No Bend	OK	
4.	Part	Excess Oil on Part (R/L + MFF)	No Oil on Part	No Oil on Part	OK	
5.	Part	Bead tear-off in Body R/L	No tear-off	Some parts have teared-off bead	NG	
6.	Process	Fixture cleaning	Fixture should be cleaned properly	Dirt/Oil present on fixture	NG	
7.	Process	Weld Current/Voltage Lower than spec.	14-19 V 60-80 A	17.6 A, 72 V	OK	
8.	Process	Gas Flow lower than spec	16-22 LPM	18.7 LPM	OK	
9.	Process	Fixture Rotation RPM/CT	43 secs	43 secs	OK	
10.	Process	Carbon Deposition on Nozzle	No Carbon Deposition on Nozzle	No Deposits	OK	
11.	Process	Outer Air Flow Interference	No Air Interference	No Interference	OK	
12.	Process	Adherence to Anti-Spatter Gel Application	-		OK	
13.	Process	Part Cleaning	Part should be cleaned Properly	Regular Cleaning	OK	
14.	Process	Improper Seating of Component	Part should be placed properly	Part placed properly	OK	

Presence of oil/dirt on fixture and dirty part are NG factors.

S. No.	Part / Process	Characteristics	Specification	Observation	Status	Remarks
15.	Process	Holding Fixture wear out	No Wear Out	No wear out	OK	
16.	Process	Gap Between MFF Part and Body R/L not uniform	Gap should be Uniform	Gap Non-Uniform Between Space	NG	
17.	Process	MFF Orientation Locator Pin Wear Out	No Wear Out	No wear out	OK	
18.	Process	Nozzle/Liner/Roller Wear Out	No Wear Out	No wear out	OK	
19.	Process	Non Uniform Wire-Feed Speed	Should be Uniform	Uniform	OK	
20.	Process	Excessive Vibration	-		ok	No Specification

Non-uniform gap in MFF and R/L and deposition of dirt on fixture are NG factors.

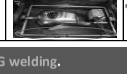
Summary

S. No.	Defect	Part / Process	Characteristics	Specification	Observation	Status	Remarks
1.	Grinding Marks	Part	Deep Scratches on input Material (R/L)	No Deep Scratches on Input Material	Minor Scratches on input material	NG	
2.		Process	Shaking of Part while buffing	No Shaking	Part not fixed and vibrating while buffing	NG	
3.	Bump A Class	Process	Specification of sanding paper	Grit Size-180	Grit Size 120	NG	
4.		Process	RPM of Sanding paper	-		NG	
5.		Process	Uneven denting	Denting should be Even	Denting uneven due to manual operation	NG	
6.		Process	Shaking of Part while sanding	Part shouldn't shake	Part not fixed and vibrating while sanding	NG	
7.		Process	Wrinkle after MFF welding	No wrinkle	Observed in SP+ Model	NG	
8.	BODY R/L PUNCTURE	Part	Part Profile (R/L) not Matching with Die	Should be 0.3-0.5mm	Found 0-1 mm (Visual Check)	NG	Filler gauge unavailable
9.		Part	Bending/Dent on part (R/L)	No Dents on Part	Waviness and Dent on Part due to handling	NG	
10.		Process	Gap between R/L not Uniform	Gap should be Uniform	Gap varying with more at centre and less at end points	NG	
11.		Process	No Visual Inspection or Inspection by Touch after performing Operation	Operator should do visual Inspection before Paper Sanding	Procedure not strictly followed by all operators	NG	
12.	MFF Puncture	Part	Bead tear-off in Body R/L	No tear-off	Some parts have teared-off bead	NG	
13		Process	Fixture cleaning	Fixture should be cleaned properly	Dirt/Oil present on fixture	NG	
14		Process	Gap Between MFF Part and Body R/L not uniform	Gap should be Uniform	Gap Non-Uniform Between Space	NG	

For top 6 defects , Total 14 nos abnormalities identified, same will be investigated further.

2.9.7 *B Class Dent*

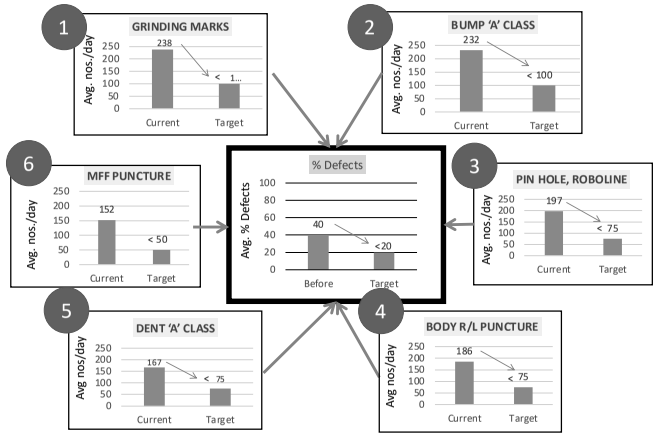
S.No.	Equipment	Before Picture	Abnormality
1	Belt Conveyor-2		Risk of Part hitting with cable tray
2	Conveyor Sensor		Risk of Part hitting with Mettalic sensor cover
3	Belt Conveyor-2		Risk of Part Hitting with Support Column of Conveyor
4	Paper Sanding		Risk of Part Hitting with Sh Corners at Paper Sanding Sta
5	Washing Machine		Risk
6	Slat Conveyor-1		g with Die Conveyor due t space
7	Washing Machine Table		Weared out Rubber Pads o Washing Machine Table

S.No.	Equipment	Before Picture	Abnormality
8	Washing Machine		Risk of Part getting Damaged because of Colliding with Metal Bar at Output Tray
9	Slat Conveyor-1		Risk of Part hitting with cable tray
10			Risk of Part hitting with Conveyor's Side Cover Projected Bolt
	Conveyor-2		Risk of Part hitting with Drive Side of Slat Conveyor due to less space between Conveyor, Leak Testing and Rear Spot Tacking Machine
12	Slat Conveyor Partition		Risk of Part Hitting Sharp Corners of Partition at Conveyor
13	Leak Testing		Risk of Fuel Tank colliding with leak testing pipe arrangement

Abnormalities identified through gemba round.

Generation Stage-MFF MIG welding. Detection Stage-MFF MIG welding.

2.Understanding the Current Situation and Setting Targets- 2.11 Target Setting



3. Create Plan of Action: 3.1 Decide implementation Plan(3W1H)

S.No.	What to do?	When? (deadline)	Who?
1.1	Proposing improvement in Layout for lines/zones.	18.06.2020	Gurvinder , Akanshu
1.2	Strengthening Zone Controls about defects in Existing Layout.	05.06.2020	Gurvinder
1.3	**Production of parts according to takt time**	15.01.2020	Gurvinder
1.4	Deep dive analysis as per Defects.	08.06.2020	Gurvinder
1.5	Rework Data capturing system development	20.11.2019	Gurvinder ,Vishal
2.1	Inspection of BOP (input) to be ensured as per defined standards & review the frequencies as per potential.		Arun nandal
2.2	Equipment's related Kaizens / Modification to reduce handling dents.	15.01.2020	Gurvinder
2.3	Elimination of denting process by changing of Jig.	21.06.2020 (Mgt approval)	Guvinder, Akanshu, Subhash
3.1	Deployment of Operators on stations in accordance with Skill Levels.	Already implemented	Gurvinder
3.2	Stage wise skill attributes to be finalized	15.05.2020	Gurvinder
3.3	Stage wise training material to be prepared	15.05.2020	Gurvinder
3.4	Practical Training Machines to be provide for Training of Denting, Bead Grinding, paper Sanding & Buffing	10.07.2020 (Mgt approval)	Guvinder, Akanshu
3.5	Review reward System for Motivation/Moral of Workers		Gurvinder
4	Improve work environment, dust, noise level and welding light containment		Gurvinder, Vikas

Based on data collection ,abnormalities identified & Sensei guidance action plan prepared .

1.1Proposing improvement in Layout for lines/zones.

4. Analyzing the factors- Proposing the new layout

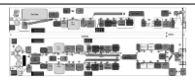
1.1Proposing improvement in Layout for lines/zones.

1.1 Features of appropriate Process layout & Concept

Guidance

1. **Quality assurance can be ensured**
   - **Tank flows do not intersect**
   - **No interference between workers**
   - **Easy to find the process where the problem occurred & the operator**
   - **Create an intermediate inspection & rework process**
   (Especially when producing new products or adjusting equipment)

Develop 2 (or 3) production lines



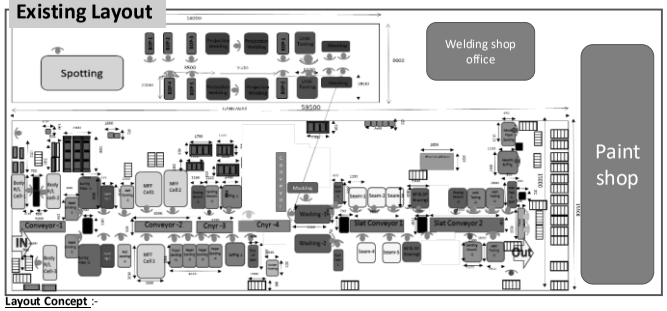
Improve quality / productivity while competing for each production lines

2. **Be flexible with production fluctuations**
   - **Multiple models can be produced simultaneously**
   - **Easy relocation of machines and workers**
3. **Low running cost**
4. **Safe and good working environment**

Guidance provided by Yoshida San to be implemented during layout option prepration.

4. Analyzing the factors: Analyzing the existing

Existing Layout



Layout Concept :-
Layout created to maximize productivity by merging 3 fuel tank manufacturing lines . Capacity based on Leak Testing station

PRODUCTION	MAN POWER	PRODUCTIVITY
1638 parts/shift	62	26.41

- Operator
- Inspection Operator
- Rework Operator

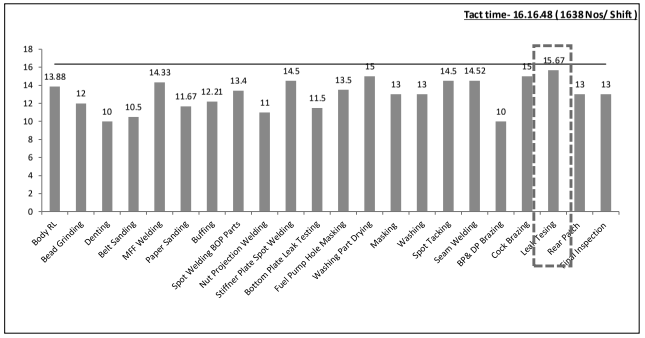
	Operator	Reworker	Inspector	Total
Current	53	6	3	62

Existing Layout focuses on Maximizing the productivity.

4. Analyzing the factors: Analyzing the existing

Data for Takt time and Cycle time-Existing Layout

[Cycle time & Tact time is calculated in accordance with BSIV to BSVI transition]



Tact time for Existing Layout-16.36 seconds. (Bottle Neck Operation- Leak Testing)

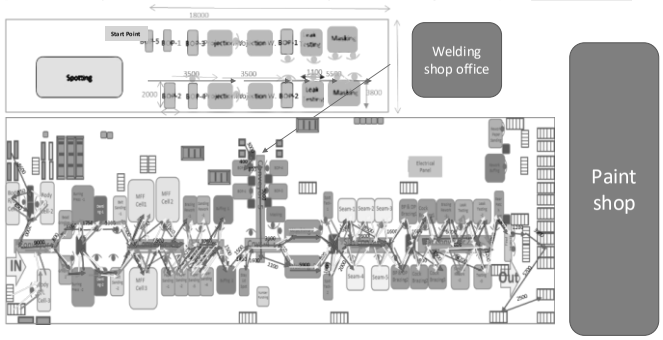
4. Analyzing the factors: Existing Layout-Material Flow

Material Flow for Existing Layout

Part movement (meters)
172

- Body R/L Cell-1
- Body R/L Cell-2
- Body R/L Cell-3

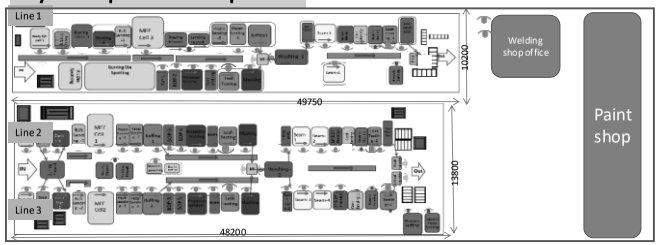
[Three material flows are shown, each w.r.t. One Body R/L MIG welding machine.]



This material flow shows Zig-zag movement of part throughout the line.[Traceability is hard to achieve]

4. Analyzing the factors: Improvement Option 2

Layout Improvement Option 1



Layout Concept :-
2 Fuel tank manufacturing lines
Line 1 :- Single fuel tank mfg line production capacity based on Body R/L Station
Line 2: 2 fuel tank mfg merged lines with common machines (High Investment cost)

Current			Option 1		
Production/ Shift	M/P/Shift	Productivity	Production / Shift	M/P/shift	Productivity
1638	**62**	**26.41**	1595	**72**	**22.15**

- Operator
- Inspection Operator
- Rework Operator

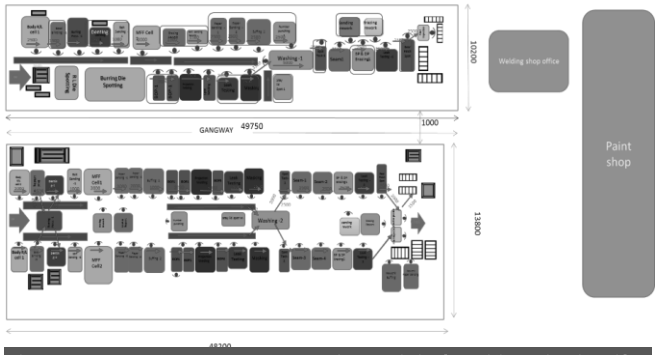
	Operator	Re-worker	Inspector	Total
Current	53	6	3	62
Option 1	59	9	4	72

Integrated line is divided into 3 lines: Line-1, Line-2 & Line-3.(Line-2 & 3 being merged lines)

Layout Improvement Option 1 Material flow

Part movement (meters)
62

[For each line, Part movement is shown according to BODY R/L m/c with LINE-2 having single Washing m/c.]



The Zig-Zag part motion in Existing Layout is improved to Smooth Flow.[Traceability can be achieved.]

NEW MACHINE REQUIREMENT FOR LAYOUT OPTIONS OPTION 1

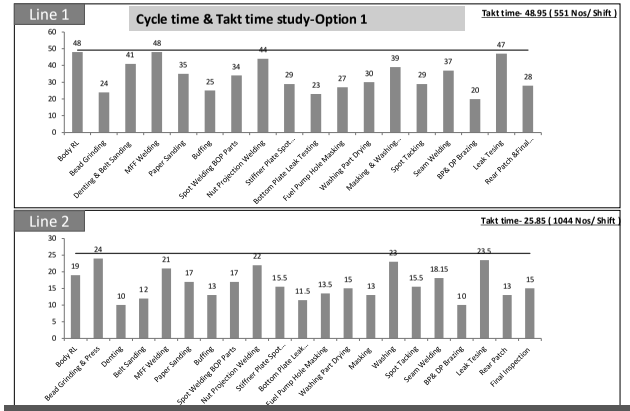
MACHINE	QUANTITY	COST
BEAD GRINDING	1	
DENTING	1	
BELT SANDING	1	
BRAZING R/W	1	
BELT SANDING R/W	1	
PAPER SANDING	2	
BOP SPOT WELDING	2	
BUFFING	1	
NUMBER PUNCHING	1	
BOTTOM PLATE LEAK TESTING	1	
MASKING	1	
STAY LID SPOT WELDING	1	
REINFORCEMENT PLATE SPOT WELDING	1	
SPOT TACKING	1	
SEAM WELDING	1	
BP/DP BRAZING	1	
REAR PATCH SPOT WELDING	1	
BUFFING R/W	1	
SANDING R/W	1	
TOTAL	**21**	

ZONE 1

ZONE 2

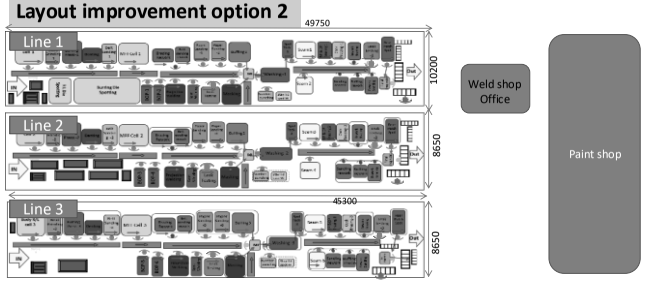
ZONE 3

In total, 21 new machines are needed to implement improvement Option-2.



Cycle time and Tact time for LINE-1 and LINE-2 are shown Separately.

Layout improvement option 2



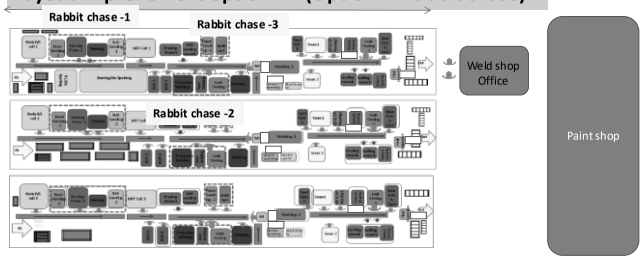
Layout Concept :-
3 Fuel tank manufacturing lines
Each Line has capacity based on Body R/I Station .

Current			Option 2		
Production/ Shift	M/P/Shift	Productivity	Production / Shift	M/P/shift	Productivity
1638	**62**	**26.4**	1750	**93**	**18.81**

- Operator
- Inspection Operator
- Rework Operator

	Operator	Reworker	Inspector	Total
Current	53	6	3	62
Option 2	69	18	6	93

Layout improvement option 2A (Option 2 Rabbit chase)



Layout Concept :-
3 Fuel tank manufacturing lines with rabbit chase
Each Line has capacity based on Body R/l Station.

Current			Option 2A		
Production/ Shift	M/P/Shift	Productivity	Production /Shift	M/P/shift	Productivity
1638	62	26.4	1750	65	26.92

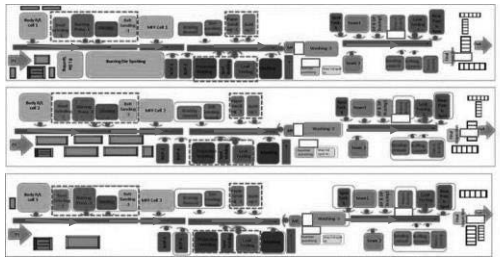
- Operator
- Inspection Operator
- Rework Operator

	Operator	Reworker	Inspector	Total
Current	53	6	3	62
Option 3	56	9	0	65

Layout Improvement Option 2A Material flow

Part movement (meters)
59.6

[For each line, Part movement is shown according to BODY R/L m/c with LINE-2 having single washing m/c.]



The Zig-Zag part motion in Existing Layout is improved to Smooth Flow.[Traceability can be achieved.]

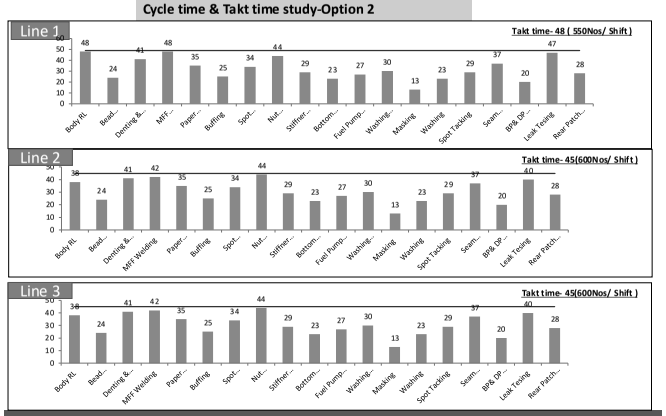
NEW MACHINE REQUIREMENT FOR LAYOUT OPTIONS

OPTION 2 & 2 A

MACHINE	QUANTITY	COST	
BEAD GRINDING	1		ZONE 1
DENTING	1		
BELT SANDING	1		
BRAZING R/W	2		
BELT SANDING R/W	2		
BUFFING PRESS	1		
PAPER SANDING	2		
BOP SPOT WELDING	2		
BUFFING	1		
NUMBER PUNCHING	2		ZONE 2
BOTTOM PLATE LEAK TESTING	1		
MASKING	1		
STAY UD SPOT WELDING	2		
REINFORCEMENT PLATE SPOT WELDING	1		
WASHING	1		
SPOT TACKING	1		ZONE 3
SEAM WELDING	1		
BP/DP BRAZING	1		
REAR PATCH SPOT WELDING	2		
BUFFING R/W	2		
SANDING R/W	2		
TOTAL	**30**		

In total, 30 new machines are needed to implement improvement Option-3 and Option-3A.

Cycle time & Takt time study-Option 2



Cycle time and tact time for LINE-1, LINE-2 & LINE-3 are shown separately.

Layout improvement option 3

Rework manpower	Inspection manpower	Part movement (m)
18	12	49.2

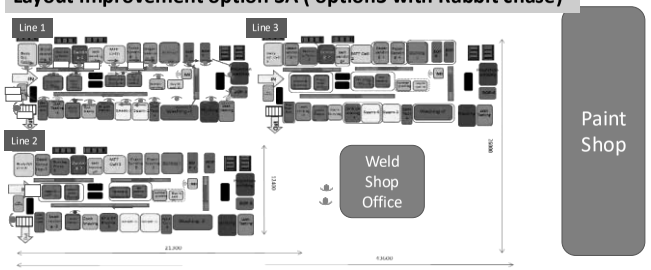
Layout Concept :-
3 Fuel tank manufacturing lines(U-Shaped lines)
Each Line has capacity based on Body R/I Station.

Current			Option 3		
Production/ Shift	M/P/Shift	Productivity	Production /Shift	M/P/shift	Productivity
1638	62	26.4	1750	93	18.81

- Operator
- Inspection Operator
- Rework Operator

	Operator	Re-worker	Inspector	Total
Current	53	6	3	62
Option 3	63	18	12	93

Layout improvement option 3A (option3 with Rabbit chase)



Layout Concept :-
3 Fuel tank manufacturing lines(U-Shaped lines)
Each Line has capacity based on Body R/I Station.

Current			Option 3		
Production/ Shift	M/P/Shift	Productivity	Production /Shift	M/P/shift	Productivity
1638	62	26.4	1750	65	26.92

- Operator
- Inspection Operator
- Rework Operator

	Operator	Re-worker	Inspector	Total
Current	53	6	3	62
Option 3A	56	9	0	65

Layout improvement option 3 Material flow

Part movement (meters)
49

NEW MACHINE REQUIREMENT FOR LAYOUT OPTIONS

OPTION 3

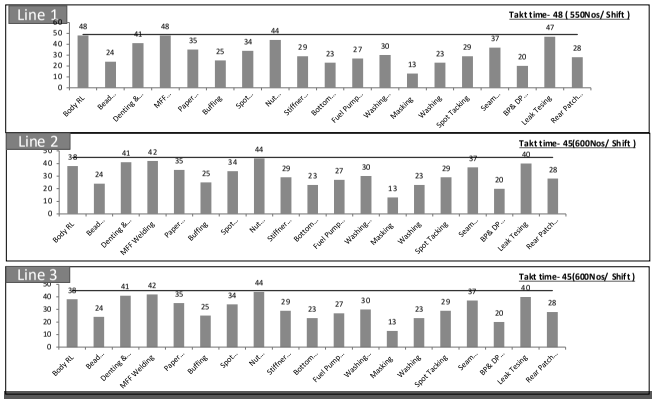
MACHINE	QUANTITY	COST
BEAD GRIN DING	1	
DENTING	1	
BELT SANDING	1	
BRAZING R/W	2	
BELT SANDING R/W	2	
BURRING PRESS	1	
PAPER SAN DING	2	
BOP SPOT WELDING	2	
BUFFING	1	
NUMBER PUNCHING	2	
BOTTOM PLATE LEAK TESTING	1	
MASKING	1	
STAY LID SPOT WELDING	2	
REINFORCEMENT PLATE SPOT WELDING	1	
WASHING	1	
SPOT TACKING	1	
SEAM WELDING	1	
BP/DP BRAZING	1	
REAR PATCH SPOT WELDING	2	
BUFFING R/W	2	
SANDING R/W	2	
TOTAL	**30**	

ZONE 1

ZONE 2

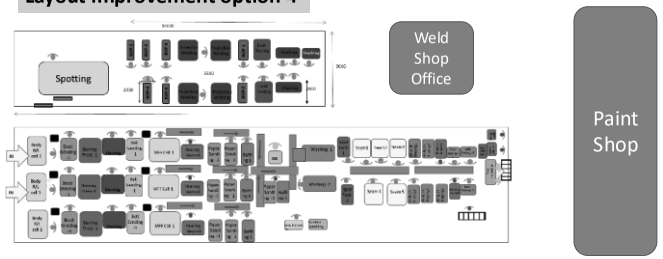
ZONE 3

In total, 30 new machines are needed to implement improvement Option-4.



Cycle time and tact time for LINE-1, LINE-2 & LINE-3 are shown separately.

Layout improvement option 4



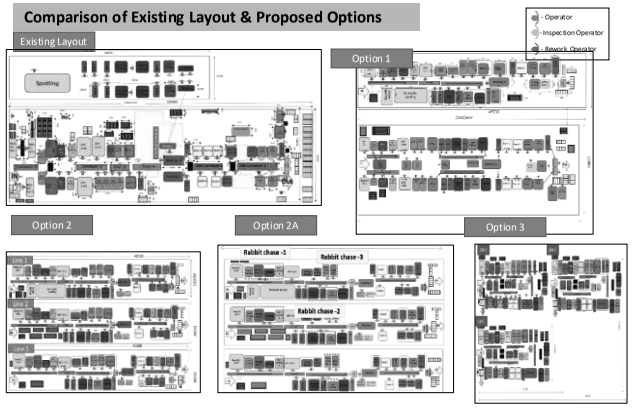
Layout Concept :-
3 Fuel tank manufacturing lines(for Body R/L Part).
Line has capacity based on Leak testing Station.

Current			Option 3		
Production/ Shift	M/P/Shift	Productivity	Production /Shift	M/P/Shift	Productivity
1638	62	26.4	1638	65	25.2

- Operator
- Inspection Operator
- Rework Operator

	Operator	Re-worker	Inspector	Total
Current	53	6	3	62
Option 4	52	9	3	65

Comparison of Existing Layout & Proposed Options



All the improvement Options are Shown together for Comparison.

Options Summary & Situation analysis for Comparison

Evaluation Criteria	Existing	Option-1	Option-2	Option-2A	Option-3
Quality	Difficulty in quality control (traceability of defects is very tough to retrieve)	Defects can be traced easily as compared to Existing options	Defects can be traced easily as compared to previous options	Defects can be traced easily as compared to previous options	Defects can be traced easily as compared to previous options
	No space for intermediate inspection and rework	Washing & Leak testing bottleneck	Easy to Create an intermediate inspection & rework process	Easy to Create an intermediate inspection & rework process	
Quantity	1500 FT/Shift	1595 FT/Shift	1750FT/Shift	1750OFT/Shift	1750FT/Shift
Cost–Initial	NA	65 lac (estimated)	175 lac (estimated)	175 lac (estimated)	190 lac (estimated)
Cost –Running	53 Rs/ veh.	55 Rs/ veh.	50 Rs/ veh.	50 Rs/ veh.	53 Rs/ veh.
	(estimated)	(estimated)	(estimated)	(estimated)	(estimated)
Manpower	62	76	93	72	93
Productivity	24.19	21.05	18.81	24.3	18.81
Shut down period		10 days	25 days	25 days	45 days
Ranking		2nd	3rd	1st	4th

Layout Option 2A (3 fuel tank mfg lines with rabbit chase) comparatively best option.

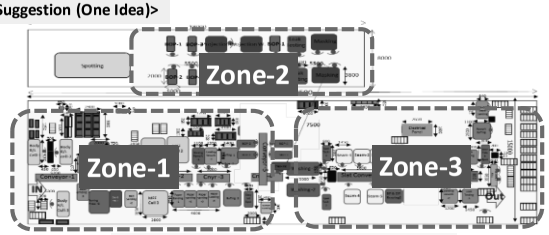
1.2 Strengthening "Zone Control System"

1.2 Strengthening "Zone Control System"

Guidance

1. Never pass-on defects parts to the following process
   - Implementation of interim inspection (& rework)
   - Accept only 100% good products → Creating pallets that can guarantee 100% quality
   - Only 100% good products are sent to Paint Shop

<Suggestion (One Idea)>

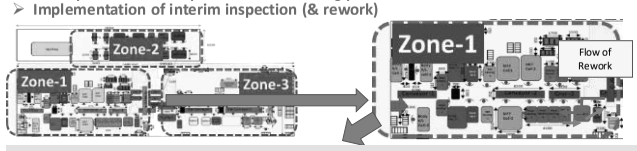


Implement Intermediate inspection (& rework)
Do not bring any defects into each zone
Do not leave any defects outside each zone

Guidance taken from yohida San for strengthening Zone Control System.

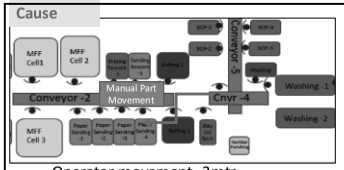
1.2.1 Introduce "Zone Control System"- Zone 1

1. Never pass-on defects parts to the following process
   - Implementation of interim inspection (& rework)



Observations – Middle Inspection already available in Zone 1 still defects passed to Zone 3

Cause



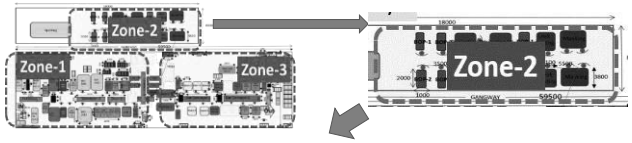
Operator movement- 3mtr

Middle Inspection Team member has to move 3 mtrs to send defective parts to rework station .
While transferring rework part team members misses inspection of 2-3 parts.

Middle inspection team member movement to be eliminated.

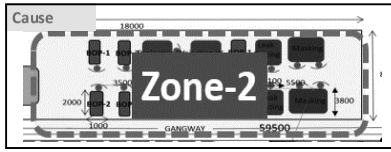
1.2.2 Introduce "Zone Control System"- Zone 2

1. Never pass-on defects parts to the following process
   - Implementation of interim inspection (& rework)



Observations – Part miss observed in BOP Spot welding operation at Zone 3.

Cause

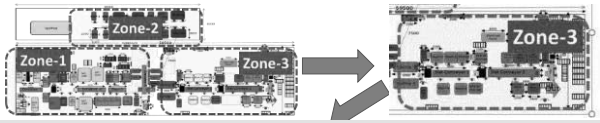


Inspection of BOP parts work content not assigned to any team Member.

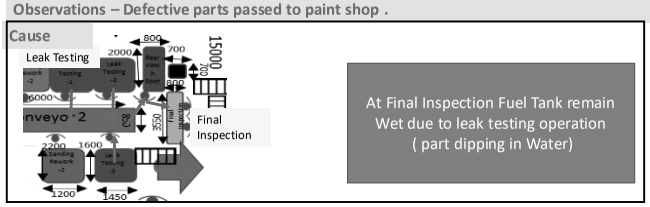
Quality gate/ Inspection to be ensured by defining work content to exixting station manpower/ new manpower

1.2.3 Introduce "Zone Control System" Zone 3

1. Never pass-on defects parts to the following process
   - Implementation of interim inspection (& rework)



Observations – Defective parts passed to paint shop .



Part must be dried before final Inspection. Manual/ Auto operation must be done to dry parts.

1.3 Production of parts according to takt time

1.3 Production of parts according to takt time

<Current problem>

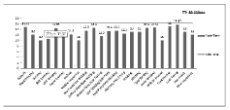
Guidance

The current production line cannot keep tact time

→ Tact Time is influenced by the cycle time of three MIG welding process

→ Tact time varies. It may cause workers MURI(overburden)/MURA(uneven)

- No "Visualization" of takt time

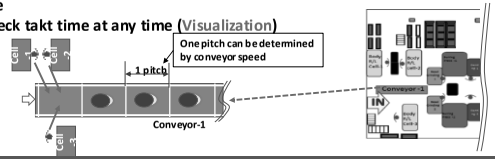


Suggestion (one idea)

- Right lines indicating takt on belt conveyor-1
- Operators place only one part in the frame

<Expected effect>

- Takt time can be accurately controlled according to production volume
- Can check takt time at any time (Visualization)



Guidance of Yoshida san to be implemented.

1.4 Deep dive analysis as per Defects.

1.4 Deep dive analysis as per Defects.

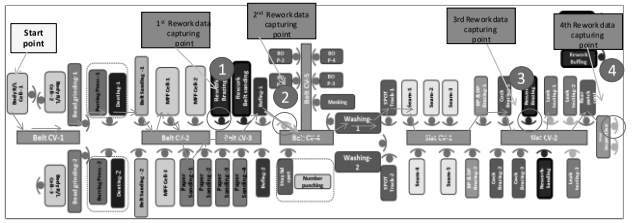
S. No.	Defect	Part / Process	Characteristics	Specification	Observation	Cause	Counter measure
1.	Grinding Marks	Part	Deep Scratches on input Material (R/L)	No Deep Scratches on Input Material	Minor Scratches on input material	1. Pallets condition poor 2. Over stacking of parts	1. Pallet condition restoration 2. Pallet audit 3. Stack level to be standardized
2.		Process	Shaking of Part while buffing	No Shaking	Part not fixed and vibrating while buffing	Part gripping method not standardized	JI sheet to be prepared
3.	Bump A Class	Process	Specification of sanding paper	Grit Size-180	Grit Size 120		Trial to be tken with 180 gritsize sanding paper
4.		Process	RPM of Sanding paper	-	RPM reduces intermutually	Less lubrication	FRL unit functioning to be restored
5.		Process	Uneven denting	Denting should be Even	Denting uneven due to manual operation	Operator fatigue	Denting process replacement with pressing.
6.		Process	Shaking of Part while sanding	Part shouldn't shake	Part not fixed and vibrating while sanding	Part gripping method not standardized	JI sheet to be prepared
7.		Process	Wrinkle after MFF welding	No wrinkle	Observed in SP+ Model	MFF dia less then spec after burring press	Mff Dia hole size to increase

1.4 Deep dive analysis as per Defects.

S. No.	Defect	Part / Process	Characteristics	Specification	Observation	Cause	Counter measure
8.	BODY R/L PUNCTURE & PIN HOLE	Part	Part Profile (R/L) not Matching with Die	Should be 0.3-0.5mm	Found 0-1 mm (Visual Check)	Filler gauge unavailable	Filler gauge to be procured as asset.
9.		Part	Bending/Dent on part (R/L)	No Dents on Part	Waviness and Dent on Part due to handling	1. Pallets condition poor 2. Over stacking of parts	1. Pallet condition restoration 2. Pallet audit 3. Stack level to be standardized
10.		Process	Gap between R/L not Uniform	Gap should be Uniform	Gap varying with more at centre and less at end points	Part cutting profile Specification & Inspection methods not available	Part profile to be inspected & report to be generated
11.		Process	No Visual Inspection or Inspection by Touch after performing Operation	Operator should do visual Inspection before Paper Sanding	Procedure not strictly followed by all operators	Quality checkpoints not displayed on station	Process Key Points & Quality checkpoints to be displayed on work stations
12.	MFF Puncture	Part	Bead tear-off in Body R/L	No tear-off	Some parts have teared-off bead	Quality checkpoints not displayed on station	Process Key Points & Quality checkpoints to be displayed on work stations
13		Process	Fixture cleaning	Fixture should be cleaned properly	Dirt/Oil present on fixture	Coating on input material gets burnt during welding.	
14		Process	Gap Between MFF Part and Body R/L not uniform	Gap should be Uniform	Gap Non-Uniform Between Space	Uneven pressing (Manual) of MFF during loading	Manual pressing of mff to be converted to auto mechanism.

1.5 Rework Data capturing system development

1.5 Rework Data capturing system development



Counter measures

1. Defect wise , stage wise & part location wise rework data to be captured at 4 rework/ Inspection stations
2. Digitalization of data capturing to improve correctness of data.

Initially manual data capturing system to be developed which will further digitalized.

2.1 Inspection of BOP (input) to be ensured as per defined standards & review the frequencies as per potential.

Inspection of BOP (input) to be ensured as per defined standards & review the frequencies as per potential.

Guidance

Inspection of incoming parts & Report to be shared monthly with Prod'n.
Repair of pallets to be regularised
Pallet condition, check point to be added in CLRI of Body R/L
Pallets in Store to be kept with cover for pigeon feaces & Dirt related issue.

2.2 Equipment's related Kaizens / Modification to reduce handling dents

2.2 Equipment's related Kaizens / Modification to reduce handling dents.

S. No.	Equipment	Before Picture	Abnormality	Counter Measure
1	Belt Conveyor-2		Risk of Part hitting with cable tray	Installation of Rubber Cover on Cable Tray
2	Conveyor Sensor		Risk of Part hitting with Metalic sensor cover	Installation of Rubber Cover on Sensor
3	Belt Conveyor-2		Risk of Part Hitting with Support Column of Conveyor	Installation of Rubber Cover on Support Column
4	Paper Sanding		Risk of Pat Hitting with Sharp Corners at Paper Sanding Station	Installation of Rubber Beading on that Edges
5	Washing Machine		Risk of Part hitting with extruded part and sharp corners/edges of Slat Conveyor	
6	Slat Conveyor-1		Sha Sta	Cover of Slat Conveyor Edges (Forward Side of Line)
7	Washing Machine Table		Worn out Rubber Pads on Washing Machine Table	Installation of New Rubber Pads on Washing Machine Table
8	Washing Machine		Risk of Part getting Damaged because of Colliding with Metal Bar at Output Tray	Installation of Rubber Cover on Output Tray
9	Slat Conveyor-1		Risk of Pat hitting with cable tray	Shifting of Slat Conveyor Cable Tray (Forward Side of Line)
10	Slat Conveyor-1		Risk of Pat hitting with Conveyor's Side Cover Projected Bolt	Long bolts repaced with short bolts , Sensor position shifted
11	Slat Conveyor-2		Risk of Pat hitting with Drive Side of Slat Conveyor due to less space between Conveyor, Leak Testing and Rear Spot Tacking Machine	New Rubber sheet to be provided
12	Slat Conveyor Partition		Risk of Part Hitting Sharp Corners of Partition at Conveyor	Installation of Rubber Cover on all Slat Conveyor Edges
13	Leak Testing		Risk of Fuel Tank colliding with leak testing pipe arrangement	Bending of Leak Testing Pipe Downward in order to prevent Fuel Tank to collide with it

Equipment abnormalities identified & Countermeasures defined.

Equipment abnormalities identified & Countermeasures defined.

2.3 Elimination of manual denting process by changing of Jig

2.3 Elimination of manual denting process by changing of Jig

Current Process :- Body RL Bead pressing done by bead hitting with hammer manually

Proposed Process :- Body RL Bead pressing by Hydraulic Press . **Successful trial done**

Obsolete Model die modified & converted into pressing die

Groove Made in die (bottom part) as per part profile.

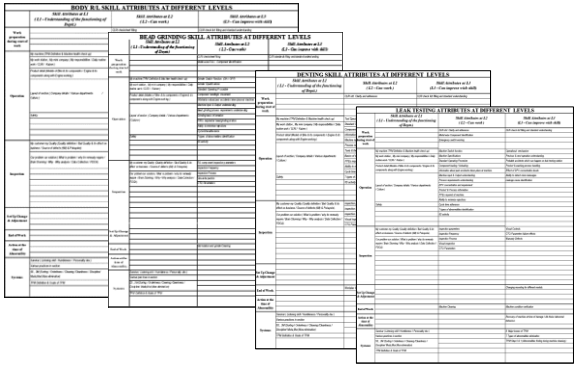
Bead Before Pressing

Bead After Pressing

Trial to be taken for 100 nos fuel tank with QA & PE.

3.1 Stage wise skill attributes & Current level

3.1 Stage wise skill attributes & Current level



Stage wise skill attributes preprared.

Suggestion / proposal for Talent promotion

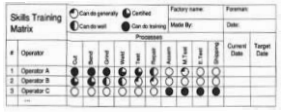
Guidance

1. Contract employee ⇒ Long-term employment (permanent employee)
   → "To Human resource development"

2. Develop human resource

- Enhancement of employee training (including Moral)
- Practical training for new employees (Develop "Training room")
- Review the morning meeting (including education, discipline, etc.)
- QC activity
- Multiple-skilled worker

Motivation: Multiple-skilled worker
→ rotation
→sub-leader
→leader (promotion)



Develop "Robust production line"

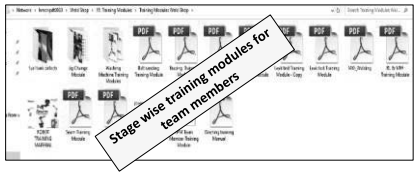
TPS is where people who grow up are making things while continues KAIZEN/improvements every day.

System to be designed with incorporation of Yoshida San guidance.

3.2 Stage wise training modules/ study material

3.2 Stage wise training modules/ study material

Key Contents
1. Dept. profiles
2. Basics of welding
3. Product & Processes
4. SOP & CLRI system
5. Suggestion scheme
6. Integrated Mgt. System



Key Contents
1. Equipment Structure
2. Equipment function
3. Working Principle of operation.
4. Quality check points
5. Optimal conditions- CLRI
6. Tools & Consumables

3.3 Team member deployment systems on various stages

3.3 Team member deployment systems on various stages

New Team member Induction Training .

New Team member Domain Training.

Classroom training & gemba round

New Team member On the job training .

Updating of Multiskilling chart

Based on criticality red, blue & pink stages defined.

Manpower deployment as per skill

3.4 Practical Training system on critical stages

3.4 Practical Training system on critical stages

Stages identified for practical training of team members

Bead Grinding

Paper Sanding

Denting

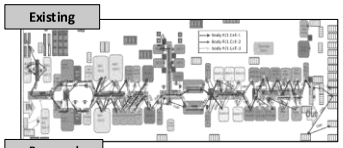
Buffing

Proposal to be prepared for creating new training area .

3.5 Review Reward system & Proposals

3.5 Review Reward system & Proposals

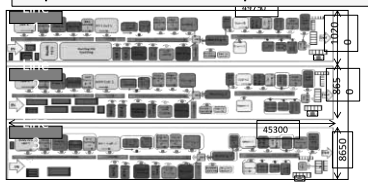
Existing



Problem-
1.In Existing system team member wise rework data can not be captured due to mix material flow.
2. Team member performance not measureable.

Proposed

Option 3 considered as final option for Reward System for rework reduction



Key Points :
1. **Daily rework data generation , team member wise ,stage wise & line wise .**
2. **Team Member wise , stage & Line wise rework targets & actual data comparison**
3. **Recognition for best performers as per company policy.**

Team members to be rewarded based on performance related to rework generation.

4. Work environment in current Scenario

4. Work environment in current Scenario

S. No.	Abnormalities Identified	Cause	Countermeasure	Target date
1	Duct system redesign & Repair of dust & smoke extraction system.	Design errors Not cleaned	Vendor to be called & rectification to be done	15.11.2020
2	High Noise in denting process	Elimination of Denting Process	New process development under progress	16.11.2020
3	Heavy Dust generation during buffing wheel dressing	Elimination of Buffing wheel dressing on line	Buffing machine (offline) to be provided for wheel dressing	16.11.2020
4	Heavy noise from Washing machine blowers	Washing machine blower vibration & noise reduction	Base structure of blower mountings to be strengthened	10.07.2020
5	Heavy noise from Spot welding machine solenoid valves	Noise silencer restoration on solenoid valves	Silencers to be provided on Solenoid	10.07.2020
6	Hydraulic pump abnormal noise reduction of Jig Spotting machine		General Inspection to be done of Hyd. Pump.	16.11.2020
7	Noise from continuous air release from seam welding MFF cap.	Direct air release from cap , no solenoid valve	Solenoid valve to be provided.	17.11.2020

As per below list of issues identified countermeasures implemented

S.No.	What to do?	When? (deadline)	Who?
1.1	Proposing improvement in Layout for lines/zones.	18.06.2020	Gurvinder , Akanshu
1.2	Strengthening Zone Controls about defects in Existing Layout.	05.06.2020	Gurvinder
1.3	**Production of parts according to takt time**	15.01.2020	Gurvinder
1.4	Deep dive analysis as per Defects.	08.06.2020	Gurvinder
1.5	Rework Data capturing system development	20.11.2019	Gurvinder ,Vishal
2.1	Inspection of BOP (input) to be ensured as per defined standards & review the frequencies as per potential.		Arun nandal
2.2	Equipment's related Kaizens / Modification to reduce handling dents.	15.01.2020	Gurvinder
2.3	Elimination of denting process by changing of Jig.	21.06.2020 (Mgt approval)	Guvinder, Akanshu, Subhash
3.1	Deployment of Operators on stations in accordance with Skill Levels.	Already implemented	Gurvinder
3.2	Stage wise skill attributes to be finalized	15.05.2020	Gurvinder
3.3	Stage wise training material to be prepared	15.05.2020	Gurvinder
3.4	Practical Training Machines to be provide for Training of Denting, Bead Grinding, paper Sanding & Buffing	10.07.2020 (Mgt approval)	Guvinder, Akanshu
3.5	Review reward System for Motivation/Moral of Workers		Gurvinder
4	Improve work environment, dust, noise level and welding light containment		Gurvinder, Vikas

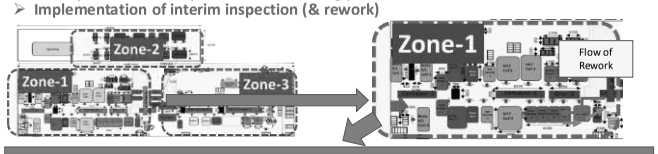
1.1 Appropriate Process layout & Concept

Approval under process

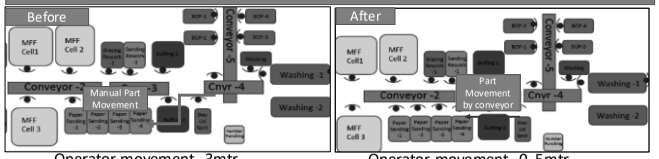
1.2.1. Introduce "Zone Control System"- Zone 1

1. Never pass-on defects parts to the following process

- Implementation of interim inspection (& rework)



Improvement in effectiveness of Middle Inspection by reducing work content of moving defective parts to rework station



Operator movement- 3mtr Operator movement- 0 .5mtr

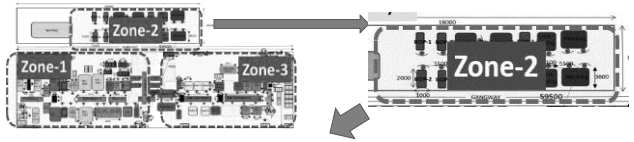
MI Operator effectiveness increased to 100%

Defect control achieved by strengthening Middle Inspection team member.

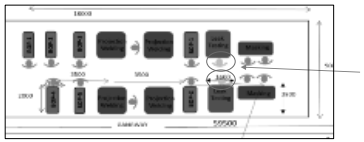
1.2.2 Introduce "Zone Control System"- Zone 2

1. Never pass-on defects parts to the following process

- Implementation of interim inspection (& rework)



Introduction of Inspection stage for Bottom Plate Welding cell.



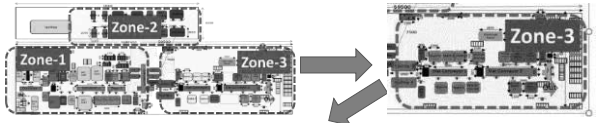
Bottom plate , child part inspection assigned to Bottom Plate Leak testing team member.

Defect control achieved by strengthening Middle Inspection team member

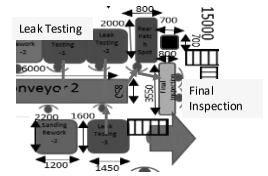
1.2.3 Introduce "Zone Control System" – Zone 3

1. Never pass-on defects parts to the following process

- Implementation of interim inspection (& rework)



Improvement in effectiveness of Final Inspection by drying fuel tank surface before inspection.



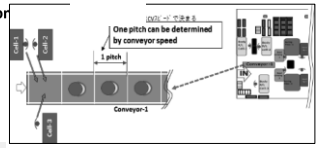
Issue :-At Final Inspection Fuel Tank remain Wet due to leak testing operation (Water dipping)

Counter Measure :- Fuel Tank dried up by team member with cloth and offered to final inspection team member.

1.3 Production of parts according to takt time

<Suggestion (One Idea)>

- Right lines indicating tact on belt conveyor-1
- **Operators place only on on the CV.**



<Implementation >

Takt Time – 14 secs
Marking Gap- 700mm
Conveyer Speed – 50mm/Sec
VFD Frequency- 18 Hz.

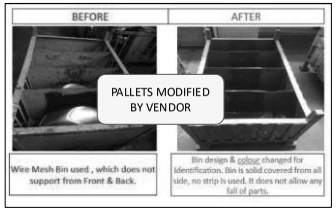
As per guidance slots made to match takt time.

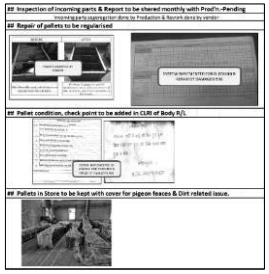
1.4 Deep dive analysis as per Defects

S. No.	Defect	Part / Process	Characteristics	Specification	Observation	Cause	Counter measure
1.	Grinding Marks	Part	Deep Scratches on input Material (R/L)	No Deep Scratches on Input Material	Minor Scratches on input material	1. Pallets condition poor 2. Over stacking of parts	1. Pallet condition restoration 2. Pallet audit 3. Stack level to be standardized
2.		Process	Shaking of Part while buffing	No Shaking	Part not fixed and vibrating while buffing	Part gripping method not standardized	JI sheet to be prepared
3.	Bump A Class	Process	Specification of sanding paper	Grit Size-180	Grit Size 120 used		Trial to be taken with 180 grit size sanding paper
4.		Process	RPM of Sanding paper	-	RPM reduces intermutually	Less lubrication	FRL unit functioning to be restored
5.		Process	Uneven denting	Denting should be Even	Denting uneven due to manual operation	Operator fatigue	Denting process replacement with pressing.
6.		Process	Shaking of Part while sanding	Part shouldn't shake	Part not fixed and vibrating while sanding	Part gripping method not standardized	JI sheet to be prepared
7.		Process	Wrinkle after MFF welding	No wrinkle	Observed in SP+ Model	MFF dia less then spec after burring press	Mff Dia hole size to increase

1.4 Deep dive analysis as per defects

1.4.1 Deep Scratches on input Material (R/L) &
2.1 Inspection of BOP (input) to be ensured as per defined standards & review the frequencies as per potential.





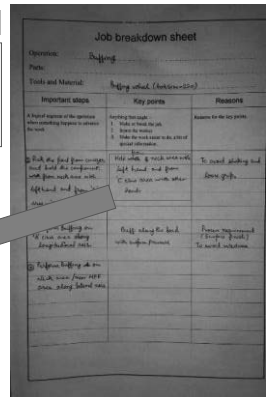
- BOP parts that are fed at Body RL are inspected and segregated (faulty parts) at the station only.
- Also the pallets in the storage area are covered to prevent any dust and dirt.

1.4 Deep dive analysis as per Defects.

1.4.2 Shaking of Part while buffing

Improvements :-
Defect:- Grinding mark
Cause : Part Shaking during buffing
Improvement: Gripping is standardized. JI breakdown for the operation done.

Hold R/L component from neck area with left hand and from 'C' class area from the other hand.



1.4 Deep dive analysis as per Defects.

1.4.3 Specified grit size(180) sanding paper not used.

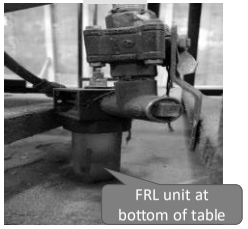
Improvements :-
Defect:- Bump 'A' class
Cause : Specified grit size(180) not used.
Improvement:- Results with grit size -180 not satisfactory. Cycle time increased by 40 % .

1.4 Deep dive analysis as per Defects.

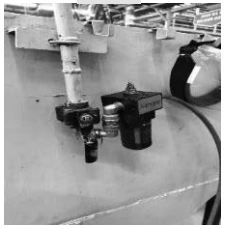
1.4.4 Reduction in RPM due to improper lubrication of paper sanding tools.

Improvements :-
Defect:- Bump 'A' class
Cause : Reduction in RPM due to improper lubrication.
Improvement:- FRL position raised from ground to a height so that lubricant monitoring can be done.

Earlier



Now

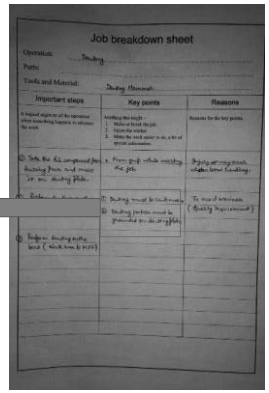


1.4 Deep dive analysis as per Defects.

1.4.5 Uneven denting

Improvements :-
Defect:- Bump 'A' class
Cause : Uneven denting
Improvement:- JI breakdown for the operation.

1.Denting should be continuous.
2.Denting with constant speed


Job breakdown sheet

Operation: Denting

Parts:

Tools and Material: Denting Hammer

Important steps	Key points	Reasons
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

1.4 Deep dive analysis as per Defects.

1.4.6 vibration and shaking of component

Improvements :-
Defect:- Bump A class
Cause : vibration and shaking of component
Improvement:- Gripping technique standardized. JI breakdown preparation.

JOB BREAKDOWN SHEET

Job description:	Paper sanding
Parts:	R/L component
Tools & Materials:	Paper sander(grit size-120)

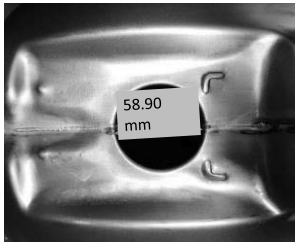
S.No.	IMPORTANT STEPS	KEY POINTS	REASON FOR KEY POINTS
	What is done	How it is done	Why it is done
1	Pick the R/L from conveyer and place it on the sanding booth.		
2	Take paper sander with grit size 120 and perform sanding over 'A' class area	Move the tool along longitudinal axis. Sanding paper should be cut from sides.	To avoid grinding marks.
3	Tilt the R/L part with neck region on upper side and gripped with left hand		
4	Now perform sanding over neck area.	Sand along lateral direction	
5	Look for any bump/dent and eliminate it	No bump/dent is left	Quality requirement

1.4 Deep dive analysis as per Defects.

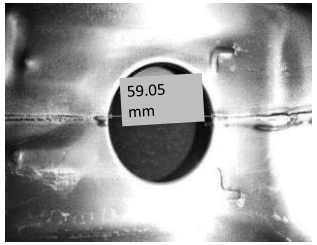
1.4.7 Wrinkle after MFF welding

Improvements :-
Defect:- Wrinkle after MFF welding
Cause : Smaller Hole diameter
Improvement:- Hole diameter increased(Modification in Burring press die).

Before



After



1.4 Deep dive analysis as per Defects.

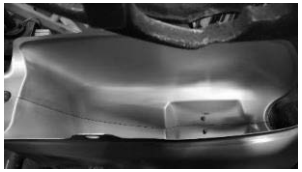
S. No.	Defect	Part / Process	Characteristics	Specification	Observation	Cause	Counter measure
8.	BODY R/L PUNCTURE & PIN HOLE	Part	Part Profile (R/L) not Matching with Die	Should be 0.3-0.5mm	Found 0-1 mm (Visual Check)	Filler gauge unavailable	Filler gauge to be procured as asset.
9.		Part	Bending/Dent on part (R/L)	No Dents on Part	Waviness and Dent on Part due to handling	1. Pallets condition poor 2. Over stacking of parts	1. Pallet condition restoration 2. Pallet audit 3. Stack level to be standardized
10.		Process	Gap between R/L not Uniform	Gap should be Uniform	Gap varying with more at centre and less at end points	Part cutting profile Specification & Inspection methods not available	Part profile to be inspected & report to be generated
11.		Process	No Visual Inspection or Inspection by Touch after performing Operation	Operator should do visual Inspection before Paper Sanding	Procedure not strictly followed by all operators	Quality checkpoints not displayed on station	Process Key Points & Quality checkpoints to be displayed on work stations
12.	MFF Puncture	Part	Bead tear-off in Body R/L	No tear-off	Some parts have teared-off bead	Quality checkpoints not displayed on station	Process Key Points & Quality checkpoints to be displayed on work stations
13		Process	Fixture cleaning	Fixture should be cleaned properly	Dirt/Oil present on fixture	Coating on input material gets burnt during welding.	Fixture to be cleaned after 50 parts & deep cleaning to be done weekly
14		Process	Gap Between MFF Part and Body R/L not uniform	Gap should be Uniform	Gap Non-Uniform Between Space	Uneven pressing (Manual) of MFF during loading	Manual pressing of mff to be converted to auto mechanism.

1.4 Deep dive analysis as per defects

1.4.8 Non uniform gap between Body R/L

Improvements :-
Defect:- Body R/L puncture
Cause : Non uniform gap between Body R/L.
Improvement: Jig spotting at regular intervals of 5000 welds.

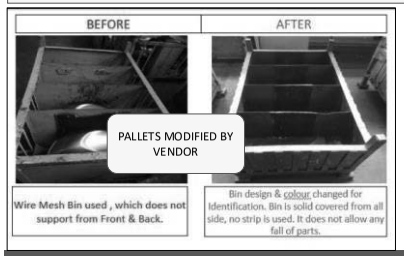
Jig Spotting



1.4.1 Deep dive analysis as per defects

1.4.9 Bending/dent on R/L part because of excess stacking of R/L in pallets

Improvements :-
Defect:- Body R/L puncture
Cause : Bending/dent on R/L part because of excess stacking of R/L in pallets.
Improvement:- Stacking number standardized as well as new pallets.



1.4 Deep dive analysis as per defects

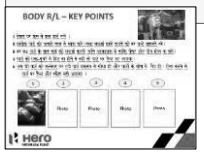
1.4.10 R/L gap not uniform

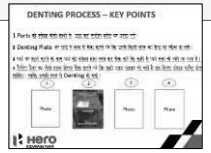
Improvements :-
Defect:- R/L gap not uniform.
Cause : Part cutting profile Specification & Inspection methods not available
Improvement:- Pending

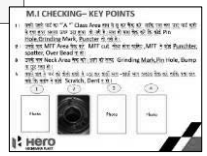
1.4 Deep dive analysis as per defects

1.4.11 No inspection after operation is performed.

Improvements :-
Defect:- No inspection after operation is performed.
Cause : Procedure not strictly followed by all operators.
Improvement:- Process Key Points & Quality checkpoints to be displayed on work stations





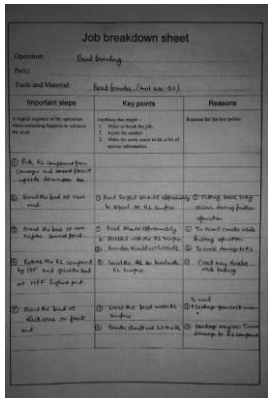


Key Point board content prepared in Hindi.

1.4 Deep dive analysis as per Defects.

1.4.12 Excess bead grinding

Improvements :-
Defect:- Bead tear-off in Body R/L
Cause : Excess bead grinding
Improvement:- JI breakdown for the operation.



1.4 Deep dive analysis as per defects

1.4.13 Dust/dirt present on fixture

Improvements :-
Defect:- MFF puncture
Cause : Dust/dirt present on fixture.
Improvement: Fixture cleaning at periodic interval of 50 welds.

Before

After

1.4 Deep dive analysis as per defects

1.4.14 Non uniform gap between MFF part and Body R/L- Defective MFF

Improvements :-
Defect:- MFF puncture
Cause : Non uniform gap between MFF part and Body R/L. Defective MFF
Improvement: Bin for segregating defective MFF profile parts. These components are returned back to vendor for rework.

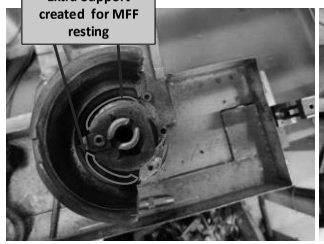
Bin for undesired MFF profile parts

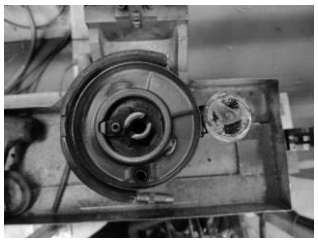
1.4 Deep dive analysis as per Defects.

1.4.15 MFF part unstable in fixture

Improvements :-
Defect:- MFF Puncture
Cause : MFF part unstable in fixture
Improvement:- Extra support created in MFF fixture for 100% resting of MFF in HF model.

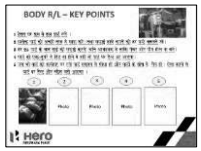
Extra Support created for MFF resting

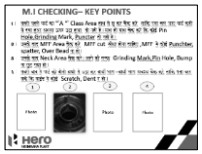




1.4 Deep dive analysis as per Defects.

Improvements :-
Defect:- Pin Hole
Cause : Gap in Part inspection after operation
Improvement:- Stage wise quality check points & Process key points boards to be displayed in front of team member on stage.



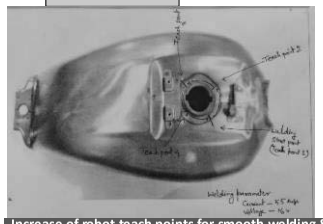


Key Point board content prepared in Hindi.
Target Date for Display :- 25.06.2020

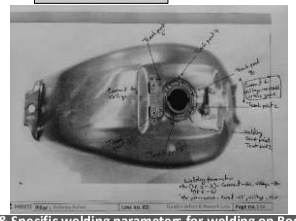
1.4 Deep dive analysis as per Defects.

Improvements :-
Defect:- MFF Puncture
Cause : Crack in bead after burring Press due to overgrinding by team member.
Improvement:- Reprogramming of robot & welding parameter modification to prevent puncture on mff welding operation in SP+ model

Before

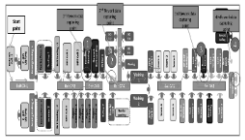


After



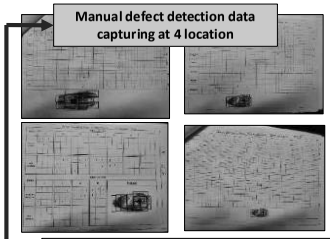
Increase of robot teach points for smooth welding & Specific welding parameters for welding on Body R/L Bead area created.

1.5 Rework Data capturing system development



Counter measures
1. Defect wise , stage wise & part location wise rework data to be captured at 4 rework/ Inspection stations
2. Digitalization of data capturing to improve correctness of data.

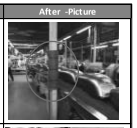
Manual defect detection data capturing at 4 location



Sample system prepared based on IOT related inputs for 2nd inspection stn (Middle inspection)

2.2 Equipment Modification to reduce handling dents.

Restorations

S. No.	Equipment	Before -Picture	Abnormality	Counter-Measure	After -Picture
1	Belt Conveyor-2		Risk of Part hitting with cable tray	Installation of Rubber Cover on Cable Tray	
2	Conveyor Sensor		Risk of Part hitting with Mettalic senser cover	Installation of Rubber Cover on Sensor	
3	Belt Conveyor-2		Risk of Part Hitting with Support Column of Conveyor	Installation of Rubber Cover on Support Column	

2.2 Equipment Modification to reduce handling dents.

Items below were proposed at the meeting on December 18, 2019

S. No.	Equipment	Before -Picture	Abnormality	Counter-Measure	After -Picture
4	Paper Sanding		Risk of Part Hitting with Sharp Corners at Paper Sanding Station	Installation of Rubber Beading on the Edges	
5	Washing Machine		Risk of Part hitting with extruded part and sharp corners/edges of electrical panel	Shifting of Washing Machine Electrical Panel	
6	Slat Conveyor-1		Risk of Part hitting with Drive Side of Slat Conveyor due to less space	Shifting of Drive side of Conveyor by 500 mm (Forward Side of Line)	

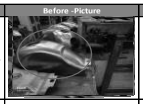
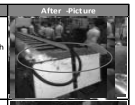
2.2 Equipment Modification to reduce handling dents.

Items below were proposed at the meeting on December 18, 2019

S. No.	Equipment	Before -Picture	Abnormality	Counter-Measure	After -Picture
7	Washing Machine Table		Weared out Rubber Pads on Washing Machine Table	Installation of New Rubber Pads on Washing Machine Table	
8	Washing Machine		Risk of Part getting Damaged because of Colliding with Metal Bar at Output Tray	Installation of Rubber Cover on Output Tray	
9	Slat Conveyor-1		Risk of Part hitting with cable tray	Shifting of Slat Conveyor Cable Tray (Forward Side of Line)	

2.2 Equipment Modification to reduce handling dents.

Items below were proposed at the meeting on December 18, 2019

S. No.	Equipment	Before -Picture	Abnormality	Counter-Measure	After -Picture
10	Slat Conveyor-1		Risk of Part hitting with Conveyor's Side Cover Projected Bolt	Long bolts repalced with short bolts , Senser position shifted	
11	Slat Conveyor-2		Risk of Part hitting with Drive Side of Slat Conveyor due to less space between Conveyor, Leak Testing and Rear Spot Tacking Machine	New Rubber sheet to be provided	
12	Slat Conveyor Partition		Risk of Part Hitting Sharp Corners of Partition at Conveyor	Installation of Rubber Cover on all Slat Conveyor Edges	
13	Leak Testing		Risk of Fuel Tank colliding with leak testing pipe arrangement	Bending of Leak Testing Pipe Downward in order to prevent Fuel Tank to collide with it	

2.3 Elimination of denting process by changing of Jig

Current Process :- Body RL Bead pressing done by bead hitting with hammer manually

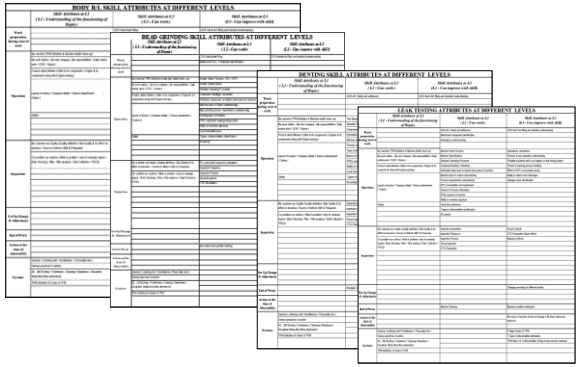
Proposed Process :- Body RL Bead pressing by Hydraulic Press . **Successful trial done**

Trial taken for 50 parts

Observations:-
1. Depression observed in part after paper sanding near mff area .
2. Manual denting done (4 impacts of hammer).

Equipment proposal under process.

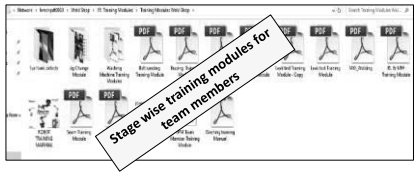
3.1 Stage wise skill attributes & Current level



Stage wise skill attributes prepared and skill certificate generated as per skill attributes.

3.2 Stage wise training modules/ study material

Key Contents
1. Dept. profiles
2. Basics of welding
3. Product & Processes
4. SOP & CLRI system
5. Suggestion scheme
6. Integrated Mgt. System



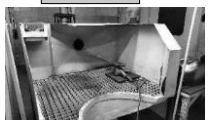
Key Contents
1. Equipment Structure
2. Equipment function
3. Working Principle of operation.
4. Quality check points
5. Optimal conditions- CLRI
6. Tools & Consumables

Training conducted using training material.

3.4 Practical Training system on critical stages

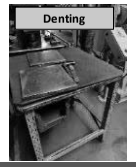
Bead Grinding

Paper Sanding



Stages identified for practical training of team members

Denting



Buffing

Proposal under Process

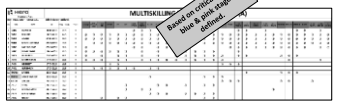
3.3 Team member deployment systems on various stages

New Team member Induction Training .

New Team member Domain Training.

New Team member On the job training .

Updating of Multiskilling chart

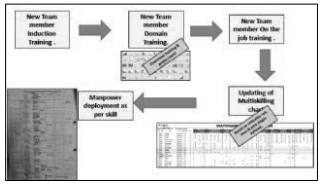


Manpower deployment as per skill

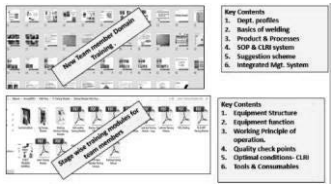
Manpower deployment done as per skill matrix.

3.4 Practical Training system on critical stages

5.2 Training system & execution in all shifts.



5.3 Video training module



Training Procedure implemented.

3.5 Review Reward system & Proposals

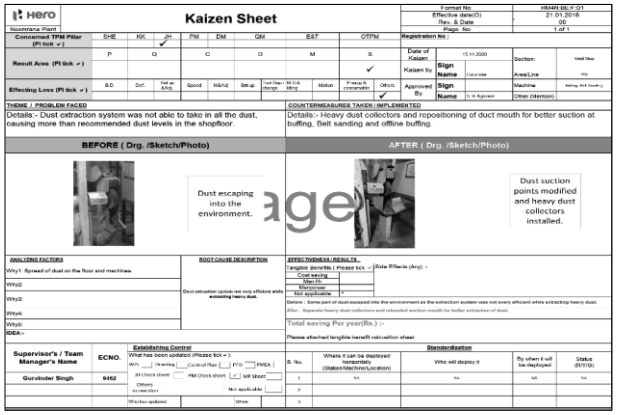
New Initiative

Key Points :
1. Group wise 2 defect data display boards prepared.
2. Stage wise & Group wise comparison of defect generation
3. Recognition to team which generates lesser defects by Section Head

Team members to be rewarded based on performance related to rework generation.

4. Work environment in current Scenario

S. No.	Abnormalities Identified	Cause	Countermeasure	Status
1	Duct system redesign & Repair of dust & smoke extraction system.	Design errors Not cleaned	Vendor to be called & rectification to be done	Completed
2	High Noise in denting process	Elimination of Denting Process	New process development under progress	Proposal for bead press included in CAPEX.
3	Heavy Dust generation during buffing wheel dressing	Elimination of Buffing wheel dressing on line	Buffing machine (offline) to be provided for wheel dressing	Proposal for offline dust extraction system
4	Heavy noise from Washing machine blowers	Washing machine blower vibration & noise reduction	Base structure of blower mountings to be strengthened	Completed
5	Heavy noise from Spot welding machine solenoid valves	Noise silencer restoration on solenoid valves	Silencers to be provided on Solenoid	Completed
6	Hydraulic pump abnormal noise reduction of Jig Spotting machine		General Inspection to be done of Hyd. Pump.	Not initiated
7	Noise from continuous air release from seam welding MFF cap.	Direct air release from cap , no solenoid valve	Solenoid valve to be provided.	Implementation to all machines under progress


Kaizen Sheet

Neemrana Plant

Format No: HMAN SIL F 01
Effective date(D): 31.01.2018
Rev. & Date: 00
Page No: 1 of 1

Registration No :

Concerned TPM Pillar (Pl tick ✓): SHE, KK ✓, JH, PM, DM, QM, E&T, OTPM

Result Area (Pl tick ✓): P, Q, C, D, M, S ✓

Effecting Loss (Pl tick ✓): B.D., Def., Set up A/Adj., Speed, M&N/I, Set up, Tool Rep / change, M.S.& Mtng., Motion, Energy & consumable ✓, Others ✓

Date of Kaizen: 15.11.2020

Kaizen by: Sign / Name: Gaurdev; Section: Weld Clean; Area/Line: PM

Approved By: Sign / Name: V. K.Agrawal; Machine: Welding Arm Assembly; Other (Mention):

THEME / PROBLEM FACED

Details:- Dust extraction system was not able to take in all the dust, causing more than recommended dust levels in the shopfloor.

COUNTERMEASURES TAKEN / IMPLEMENTED

Details:- Heavy dust collectors and repositioning of duct mouth for better suction at buffing, Belt sanding and offline buffing.

BEFORE (Drg. /Sketch/Photo)

Dust escaping into the environment.

AFTER (Drg. /Sketch/Photo)

Dust suction points modified and heavy dust collectors installed.

ANALYZING FACTORS

Why1: Spread of dust on the floor and machines.

Why2:

Why3:

Why4:

Why5:

IDEA:-

ROOT CAUSE DESCRIPTION

Dust extraction system not very efficient while extracting heavy dust.

EFFECTIVENESS / RESULTS

Tangible benefits (Please tick ✓): Cost saving; Man Hr; Manpower; Not applicable ✓

Side Effects (Any) :-

Before : Some part of dust escaped into the environment as the extraction system was not every efficient while extracting heavy dust.

After : Repaired heavy dust collectors and relocated suction mouth for better extraction of dust.

Total saving Per year(Rs.) :-

Please attached tangible benefit calculation sheet.

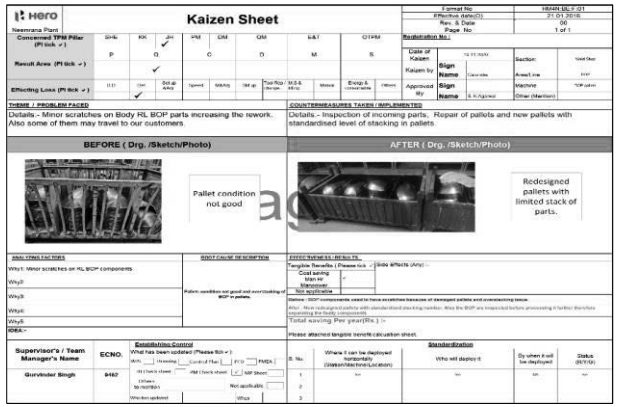
Supervisor's / Team Manager's Name: Gurvinder Singh; ECNO.: 9462

Establishing Control: What has been updated (Please tick ✓): Work; Training; Control Plan; FTD; FMEA; All Check sheet; PM Check sheet; MP Sheet ✓; Others to mention; Not applicable; Where updated; Where

Standardization

S. No.	Where it can be deployed horizontally (Station/Machine/Location)	Who will deploy it	By when it will be deployed	Status (R/Y/G)
1	NA	NA	NA	NA
2				
3				

Kaizen sheets prepared for modifications


Kaizen Sheet

Neemrana Plant

Format No: HMAN SIL F 01
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Page No: 1 of 1

Registration No :

Concerned TPM Pillar (Pl tick ✓): SHE, KK ✓, JH, PM, DM, QM, E&T, OTPM

Result Area (Pl tick ✓): P, Q ✓, C, D, M, S

Effecting Loss (Pl tick ✓): B.D. ✓, Def., Set up A/Adj., Speed, M&N/I, Set up, Tool Rep / change, M.S.& Mtng., Motion, Energy & consumable, Others

Date of Kaizen: 15.11.2020

Kaizen by: Sign / Name: Gaurdev; Section: Weld Clean; Area/Line: PM

Approved By: Sign / Name: V. K.Agrawal; Machine: Welding Arm Assembly; Other (Mention):

THEME / PROBLEM FACED

Details:- Minor scratches on Body RL BOP parts increasing the rework. Also some of them may travel to our customers

COUNTERMEASURES TAKEN / IMPLEMENTED

Details:- Inspection of incoming parts. Repair of pallets and new pallets with standardised level of stacking in pallets

BEFORE (Drg. /Sketch/Photo)

Pallet condition not good

AFTER (Drg. /Sketch/Photo)

Redesigned pallets with limited stack of parts.

ANALYZING FACTORS

Why1: Minor scratches on RL BOP components.

Why2:

Why3:

Why4:

Why5:

IDEA:-

ROOT CAUSE DESCRIPTION

Pallet condition not good and overloading of BOP in pallets.

EFFECTIVENESS / RESULTS

Tangible Benefits (Please tick ✓): Cost saving; Man Hr; Manpower; Not applicable ✓

Side Effects (Any) :-

Before : Some components used to have scratches because of damaged pallets and overstacking issue.

After : Now redesigned pallets with standardized stacking number. Also the BOP are inspected before processing it further therefore reporting the faulty components.

Total saving Per year(Rs.) :-

Please attached tangible benefit calculation sheet.

Supervisor's / Team Manager's Name: Gurvinder Singh; ECNO.: 9462

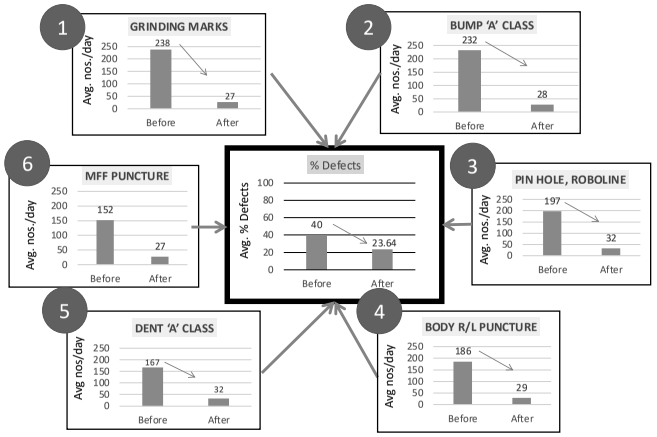
Establishing Control: What has been updated (Please tick ✓): Work; Training; Control Plan; FTD; FMEA; All Check sheet; PM Check sheet; MP Sheet ✓; Others to mention; Not applicable; Where updated; Where

Standardization

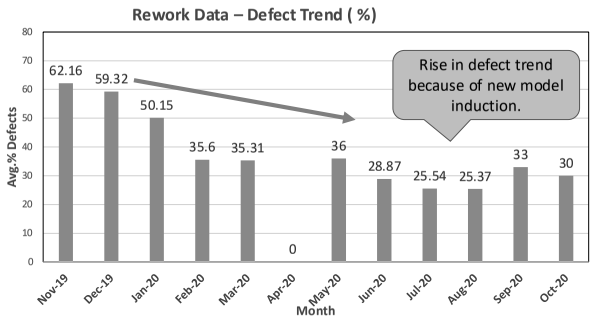
S. No.	Where it can be deployed horizontally (Station/Machine/Location)	Who will deploy it	By when it will be deployed	Status (R/Y/G)
1	NA	NA	NA	NA
2				
3				

Kaizen sheets prepared for modifications

6.Confirming results



6. Confirming Results

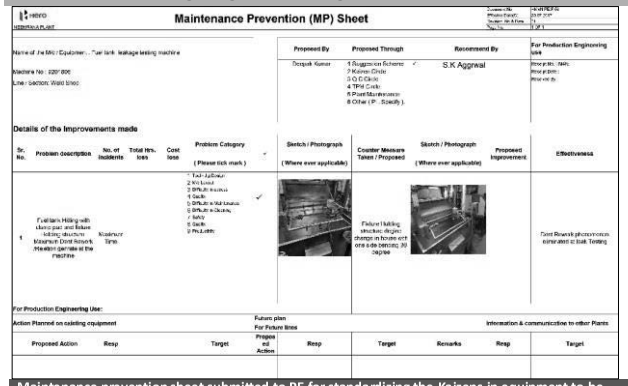


Overall defect level reduced from 62 % to 30%.

7. Standardization, Control & Reflection

Maintenance Prevention

Elimination of side dents, originating from Leak testing machine

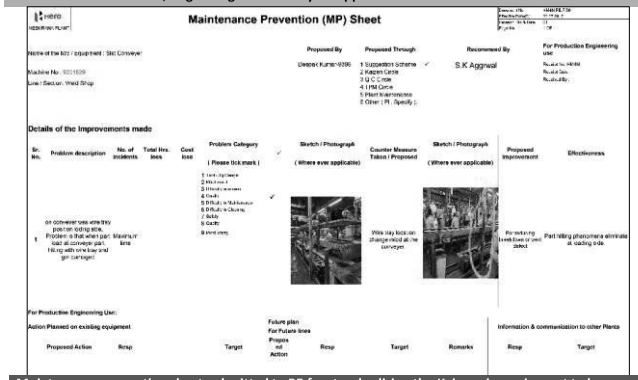


Maintenance prevention sheet submitted to PE for standardizing the Kaizens in equipment to be purchased in future.

7. Standardization, Control & Reflection

Maintenance Prevention

Elimination of side dents, originating from conveyer support columns

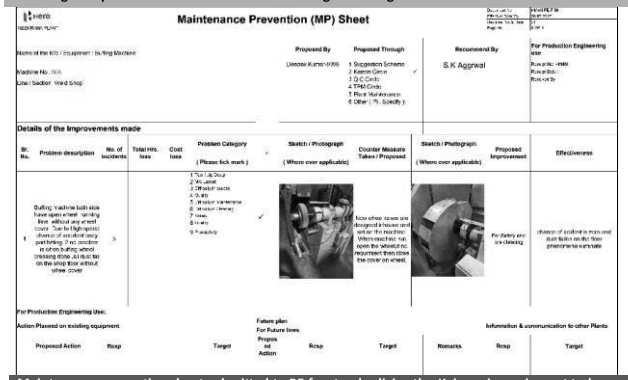


Maintenance prevention sheet submitted to PE for standardizing the Kaizens in equipment to be purchased in future.

7. Standardization, Control & Reflection

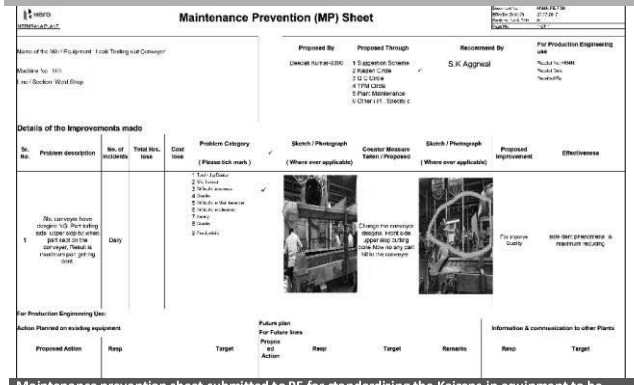
Maintenance Prevention

Reducing the spread of dust in the air while dressing of Buffing wheel.



Maintenance prevention sheet submitted to PE for standardizing the Kaizens in equipment to be purchased in future.

Elimination of side dents, originating at Leak Testing Slat conveyer


Maintenance Prevention (MP) Sheet

Proposed By | Proposed Through | Recommend By | For Production Engineering use

S.K Aggwal

Details of the Improvements made

Sr. No.	Problem description	No. of incidents	Total Hrs. loss	Cost loss	Problem Category (Please tick mark)	Sketch / Photograph (Where ever applicable)	Counter Measure Taken / Proposed	Sketch / Photograph (Where ever applicable)	Proposed Improvement	Effectiveness
1	No. conveyer have stoppers. Vib. Plant falling side upper side for when part reach on the conveyer, Result is maximum part getting dent	Daily					Change the conveyer designed. Install side upper stop, falling none. Now no any part fall to the conveyer		Fix improve Quality	side dent phenomena is maximum reducing

For Production Engineering Use:

Action Planned on existing equipment: Proposed Action | Resp | Target

Future plan For Future lines: Proposed Action | Resp | Target | Remarks

Information & communication to other Plants: Resp | Target

Maintenance prevention sheet submitted to PE for standardizing the Kaizens in equipment to be purchased in future.

Tangible Benefits :-

1. In-house rework generation reduction from 62% to 30% .
2. Reduction in Consumable Cost by 0.5 Rs/Veh.
3. Reduction in Customer complaints from 382 Nos/ Day to 220 Nos/day

Intangible Benefits :-

1. Understanding TPS & implementation
2. Deepening of understanding of defects
3. Understanding of Software development methodology for defect data capturing at inspection stages & real time data display on generation stages.

Thank you

A10. Shortening Die Set-up Time

Shree Amba Ind.

Shortening Die Set-up Time

April 2021
Web lecture

World Business Associates Co., Ltd (WBA)
Kiyoshi Yoshida

目次

Introduction

- Set-up change (or set-up) itself does not add value to productions; It must be viewed as waste (MUDA).
- Since waste is something you must always strive to eliminate, you must find a way to minimize set-up change time.
- Set-up change cannot be eliminated completely. However, through a step-by-step approach, you can reduce current changeover times by 70% at first, then cut by 50%, cut by 25%, cut by 15% and finally achieve less than 10 minutes (SMED=Single Minute Exchange of Dies)
- This is the basic approach to shortening set-up time.

- セットアップまたはセットアップ変更自体は、製品に付加価値を与えません。それはムダと見なされなければなりません。
- 無駄は常に排除する必要があるものであるため、セットアップまたはセットアップ変更時間を最小限に抑える方法を見つける必要があります。
- セットアップまたはセットアップの変更を完全に排除することはできません。ただし、段階的なアプローチにより、現在の切り替え時間を最初に70%削減し、次に50%削減、25%削減、15%削減、最終的に10分未満（SMED）を達成できます。
- これはセットアップ時間を短縮するための基本的なアプローチです。

- SMED(Single Minute Exchange of Dies) can really be what it is termed only when die changes in machine processing, aluminum die casting, injection molding, etc. can be completed within 10 minutes.
- For this reason, even Japanese enterprises have coped with time shortening in step-by –step manner for several months or years in order to accomplish SMED.
- In addition, a considerable amount of initial investments would be required for remodeling dies and jig/fixtures as well as purchasing efficient conveying equipment, tightening tools, etc. in order to achieve true effects of SMED.
- Therefore, it is very difficult to achieve a true SMED during this KAIZEN period, but let's think together about how the Set-up change can be shortened at the lowest cost.

- SMEDはSingle Minute Exchange of Diesの略で、機械加工、アルミニウムダイカスト、射出成形などの金型交換を10分未満で完了できる場合に呼ばれます。
- SMEDを達成するためには、一般的に数か月から数年の段階を経てようやく達成できる改善です。
- また、SMEDの真の効果を発揮するためには、金型や治具・治具の改造、効率的な搬送装置や締付工具などの購入に初期投資が必要となります。
- そのため、今回の改善期間で真のSMEDを達成するのは非常に困難ですが、Set-upchangeを最小コストでどのように短縮できるか、一緒に考えていきましょう。

2. Definition of Set-up change time

- Set-up change time is the time required until starting continuous production of the following kind of parts after processing of one kind of part ends.
- It includes all of the time needed for changeover of the dies, molds, jigs and fixture, cutting tools including transportation of those from shelves or stores.

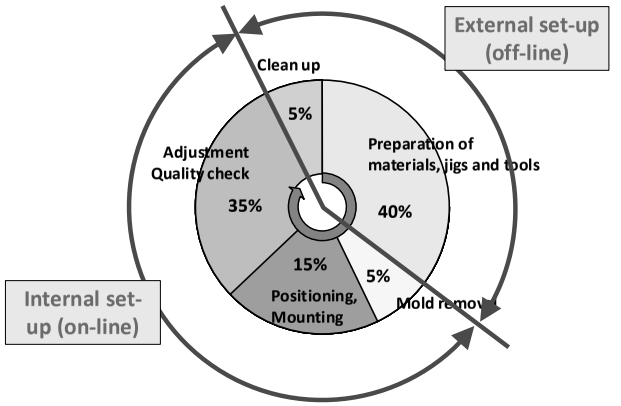
- 段取替え時間とは、1種類の部品の加工が終了してから、次の種類の部品の連続生産を開始するまでの時間
- 金型、治具、治具、棚や倉庫からの運搬を含む金型の交換に必要なすべての時間を含む

Set-up time is divided into two elements as follows.

1. Internal (on-line) set-up : Set-up work time done after machine is stopped. (Include “Adjustment time)
2. External (off-line) set-up: Set-up work while machine is operating.

段取替え時間は次の2つの要に分けられます
1. 内段取り:　機械を停止して行う作業（生産は中断）　　調整作業も含む
2. 外段取り:　機械が運転中に行う作業（生産は続行）

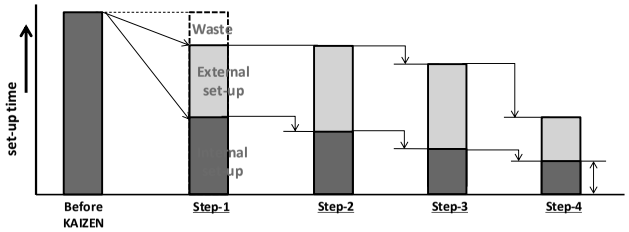
Example of mold setup change time configuration 構成

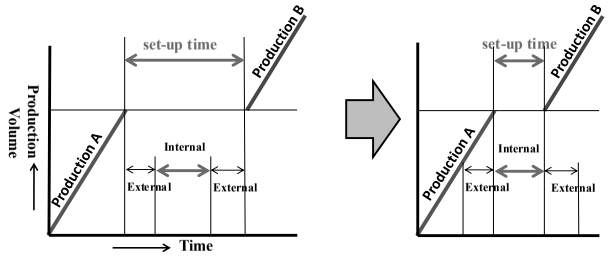


4. Concept for shortening set-up time-2

1. Separate Internal(on-line) set-up and External(off-line) set-up
2. Make the Internal set-up work as much as possible the External set-up
3. Reduction of Internal set-up time
4. Reduction of External set-up time

1. 内段取りと外段取りを区分する
2. 内段取り作業を可能な限り外段取りにする
3. 内段取り作業を低減する
4. 外段取り作業を低減する





KAIZEN of injection molding machine dies setup at Roorkee Plant.

1. Survey of the current situation
   - Number of injection molding machines and their capabilities.
   - Which injection molding machine (mold) has the most setup changes? (Top 3 machines).
     How many times a week on average?
   - Which injection molding machine (mold) takes time to change the setup? (Top 3 machines)
     Average time per one setup?
   - Survey of WiFi environment in the factory (Trial of Holorens)
2. Determine the injection molding machine and mold to be improved (about 2 units)
3. Lectures and training
   - About setup change
   - Notes for video recording for setup analysis
   - Education on how to analyze work to reduce setup change time (see sample)

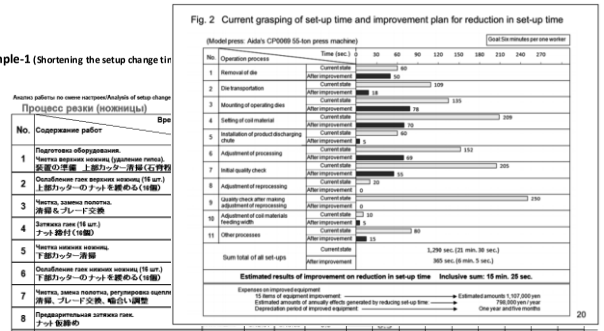
1. 事前調査
   ・射出成型機の数とそれぞれの能力
   ・段取替え回数の多い射出成型機(型)は、どれか？(上位3機)。 *週平均何回？*
   ・段取替えの時間がかかる射出成型機(型)は、どれか？(上位3機) *1回の平均時間？*
   ・工場内のWiFi環境の調査(Holorensのトライ)
2. 改善する射出成型機と型を決定する(2台程度)
3. 講義とトレーニング
   ・段取替えについて
   ・段取り解析用ビデオ撮りのための留意事項
   ・段取替え時間短縮作業の解析方法の教育(サンプル参照)

Steps for HoloLens KAIZEN of setup (Draft)

4. Video recording before KAIZEN (upload to file post)
5. Work analysis before KAIZEN (create analysis sheet while observing video repeatedly)
~~6. Check details and propose KAIZEN using a Holorens~~
7. Improvement KAIZEN ~~(1 to 3 months: Follow-up with Holorens as needed)~~
8. Work analysis after KAIZEN (create analysis sheet while observing video repeatedly)
9. ~~Check details and propose further improvements~~ using a Holorens
10. Effect confirmation

4. 改善実施前のビデオ撮り
5. 改善前の作業解析（ビデオを繰返し視聴しながら解析票を作成）
~~6. ホロレンズ~~による細部確認と改善提案
7. 改善実施~~（1～3か月：必要に応じてホロレンズでフォローする）~~
8. 改善後の作業解析（ビデオを繰返し視聴しながら解析票を作成）
9. ホロレンズによる細部確認と更なる改善提案
10. 効果確認

Sample-1 (Shortening the setup change tin



Анализ работы по смене настроек/Analysis of setup change

Процесс резки (ножницы)

No.	Содержание работ				
1	Подготовка оборудования. Чистка верхних ножниц (удаление пыла). 装置の準備 上部カッター清掃（石粉除				
2	Ослабление гаек верхних ножниц (16 шт.) 上部カッターのナットを緩める（16個）				
3	Чистка, замена полотна. 清掃＆ブレード交換				
4	Затяжка гаек (16 шт.) ナット締付（16個）				
5	Чистка нижних ножниц. 下部カッター清掃				
6	Ослабление гаек нижних ножниц (16 шт.) 下部カッターのナットを緩める（16個）				
7	Чистка, замена полотна, регулировка оцепл 清掃、ブレード交換、噛合い調整				
8	Предварительная затяжка гаек. ナット仮締め				
9	Проверка оцепления лезвий. ブレードの噛合い確認	текущее	0:13:31	0:14:20	0.8
		после кайдзена	0:13:00	0:13:00	0.0
10	Окончательная затяжка (16 шт.) ナット締付（16個）	текущее	0:14:20	0:16:28	2.1
		после кайдзена	0:13:00	0:14:20	1.3
11	Окончательная проверка оцепления лезвий, заверш ение работ. ブレードの噛合い最終確認、終了	текущее	0:16:28	0:17:31	1.1
		после кайдзена	0:14:20	0:14:45	0.4
	Всего (мин.) Total (minutes)		Before		17.5
			After		13.5

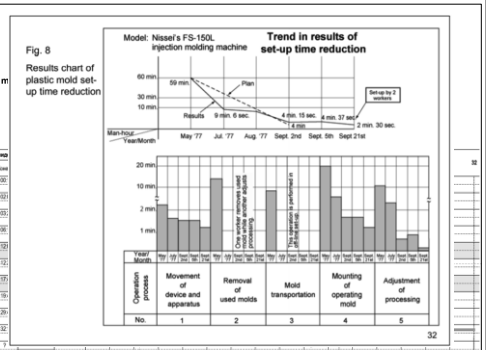
Effect: - 4.0

Sample-2 (Shortening the setup change tim

Анализ работы по смене настроек/Analysis of setup change work

Процесс торцевания

No.	Содержание работ		Начало	Конц
1	Снятие крышки (Болты Т шт.)	текущее	?	0:00:
		после кайдзена		
2	Снятие крепкой основания мотора, кабеля мотора.	текущее	0:00:11	0:02:
		после кайдзена		
3	Чистка.	текущее	0:02:08	0:03:
		после кайдзена		
4	Снятие фрез (2 шт.), смазка шпиндля.	текущее	0:03:24	0:06:
		после кайдзена		
5	Замена диска фрезы (Большой).	текущее	0:06:10	0:12:
		после кайдзена		
6	Установка диска фрезы (Большой) на мотор.	текущее	0:12:04	0:12:
		после кайдзена		
7	Замена диска фрезы (малой).	текущее	0:12:21	0:17:
		после кайдзена		
8	Установка фрез (2 шт.) на мотор.	текущее	0:17:44	0:19:
		после кайдзена		
9	Регулировка высоты направляющей плиты (Т)	текущее	0:19:45	0:29:
		после кайдзена		
10	Возврат мотора на прежнее место, затяжка 6 болтов.	текущее	0:29:40	0:32:
		после кайдзена		
11	Установка крышки (Болты Т шт.)	текущее	0:32:15	?
		после кайдзена		
	Всего (мин.)	текущее	32.1	11.3
		после кайдзена		



Effect: -11.3 minuities

- 11.3

5. 段取替え作業の解析例

Хронометраж
ТПА №8 переналадка

№	Описание действия	Ручная работа		Вид переналадки		Рабочее время, минута
		минута	сумма	Внутр.	Внешн.	
1	Отсоединить хвостовик от машины	0:00:13	0:00:13	○		
2	Продувка системы охлаждения, в т. числе: -Нанести антикор на ПФ - Установить стяжку - Снять прижимы с подвижн. плиты ливневой стор. 2шт. - Снять прижимы с непод.в. плиты ливневой стор. 1шт. - закрыть тельфер к ПФ	0:03:35	0:03:48	○		
3	Снять шланги охлаждения тыльная сторона ПТА	0:00:37	0:04:25	○		
4	Снять прижимы с подв. и непод. в. части ПФ 4шт.	0:01:16	0:05:41	○		
5	Снять шланги охл. Лиц. сторона. Снять хвостовик.	0:01:44	0:07:25	○		
6	Снять прижим непл.плиты с линейной стороны 1шт.	0:00:18	0:07:43	○		
7	Снять ПФ корпус GB-333 на стеллаж	0:01:01	0:08:44	○		
8	Положить снятый хвостовик на последнюю оснастку п ПФ	0:00:47	0:09:31	○		
9	Взять на стеллаже ПФ кор. GB-335 и завести в машину	0:02:05	0:11:36	○		
10	Закрепить неподв. часть ПФ линей. стор. 2 прижима	0:01:12	0:12:48	○		

６．段取替え時間短縮のためのヒント

ムダを除去するアイデア（金型の例）

Organize the mold storage location and make it easy to put in and take out the mold
Prepare the tools to be used in advance and place them on a setup change cart, etc.
Simplify the removal / installation of bolts, etc.
Reduce the number of bolts tightened
Create a walking route analysis map to find wasteful movements and eliminate walking as much as possible
Consider changing the setup for two-person work instead of one-person work
Train setup workers to reduce work time
Standardize work (anyone can work correctly and quickly)

a. 金型の保管場所を整理し、金型の出し入れを容易にする
b. 使用する工具類を事前に準備し、段取替え用カートなどに載せる
c. ボルトなどの取外し／取付を簡素化する
d. ボルトなどの締付本数を減らす
e. 歩行経路解析図を作成してムダな動きをみつけ、歩行を極力なくす
f. 1人作業ではなく、2人作業の段取替えを検討する
g. 段取り作業者をトレーニングし作業時間を短縮する
h. 作業を標準化する（誰でも正しく、早く作業ができる）

Lectures and training

A11.Notes for video recording for Die Setup analysis

- *Video images are very important because the analysis of setup change work is analyzed while watching the video.*
- *KAIZEN results depends on the perfection of the video footage.*

段取替え作業の解析は、ビデオを観ながら解析するためビデオは非常に大事です。
ビデオの完成度によって改善も左右されます

2021.4.12

CII & JICA
K.Yoshida

1. Purpose of taking a video
- To accurately grasp the work before KAIZEN(current situation) and after KAIZEN, analyze the work contents and each time, then make improvements.
- When analyzing, watch the video repeatedly and create an analysis table

2. Shooting equipment
- Use a video camera or a smartphone (because it measures time, it must have a counter)
- Be careful of the battery capacity as the shooting time is long (do not interrupt shooting while working)
- Use a fixed point camera as needed

1.ビデオを撮る目的

改善前（現状）と改善後状の作業を正確に把握し、作業内容と時間を解析して改善をするため
解析をするときは、繰り返しビデオを視聴して解析表を作成する

2.撮影機器

ビデオカメラかスマートフォンを使用する（時間を計測するのでカウンター付きであること）
撮影時間が長いのでバッテリー容量に注意すること（作業中は撮影を中断しないこと）
必要に応じて定点カメラを使用する

3. Number of times to take a video
- To confirm the KAIZEN effect (shortening time), shoot the video at least twice, before and after KAIZEN.
- Create analysis table before and after MAIZEN based on the recorded video (fill in one analysis table)

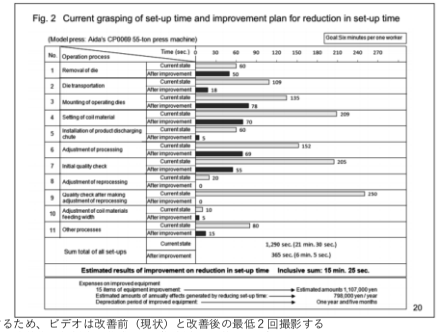


Fig. 2 Current grasping of set-up time and improvement plan for reduction in set-up time

(Model press: Aida's CP008B 55-ton press machine)

Goal:Six minutes per one worker

No.	Operation process		Time (sec.) 0 30 60 90 120 150 180 210 240 270
1	Removal of die	Current state	60
		After improvement	50
2	Die transportation	Current state	109
		After improvement	18
3	Mounting of operating dies	Current state	135
		After improvement	78
4	Setting of coil material	Current state	209
		After improvement	70
5	Installation of product discharging chute	Current state	60
		After improvement	5
6	Adjustment of processing	Current state	152
		After improvement	69
7	Initial quality check	Current state	205
		After improvement	55
8	Adjustment of reprocessing	Current state	20
		After improvement	0
9	Quality check after making adjustment of reprocessing	Current state	250
		After improvement	0
10	Adjustment of coil materials feeding width	Current state	10
		After improvement	5
11	Other processes	Current state	80
		After improvement	15
Sum total of all set-ups		Current state	1,290 sec.(21 min. 30 sec.)
		After improvement	365 sec.(6 min. 5 sec.)
Estimated results of improvement on reduction in set-up time Inclusive sum: 15 min. 25 sec.			

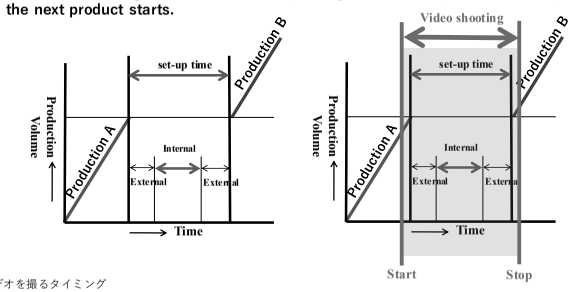
Expenses on improved equipment: 15 items of equipment improvement → Estimated amounts 1,107,000 yen
Estimated amounts of annually effects generated by reducing set-up time: → 798,000 yen / year
Depreciation period of improved equipment → One year and five months

20

3.ビデオを撮る回数

改善効果（短縮時間）を確認するため、ビデオは改善前（現状）と改善後の最低２回撮影する
撮影したビデオを基に、改善前と改善後の解析表を作成する（解析表は１枚に記入）

4. Timing to take a video
- In order to compare before and after KAIZEN, it is necessary to shoot the start and end of shooting under the same conditions (timing).
- The shooting period; Shooting starts just before the production of the previous product ends, and shooting ends when the setup change work is completed and the production of the next product starts.



4.ビデオを撮るタイミング
- 改善前と改善後を比較するので撮影開始と撮影終了を同じ条件（タイミング）で撮影する
- 撮影期間は、前の製品の生産が終了する直前から撮影を開始し、段取替え作業が終了して次の製品の生産が始まったら撮影を終了

5. Selection of workers
- The person who works is the worker who makes daily setup changes (not newcomers)
- The same worker should work before and after KAIZEN (To grasp the effect accurately)
- How many people will perform the setup change work?
  If there are multiple workers, multiple photographers are required

6. Precautions when shooting
- The video is shot so that the movement of the worker, the movement of his hands, his posture, etc. can be seen.
- For example, when the worker goes to get a tool etc., the photographer chases him and shoots so that we can understand what he is doing.

改善前の作業は、いつもやっている手順や方法で実施する

7. Data after shooting
Upload data to File Storage

5.作業者の選定

作業をする人は、日常段取替えをしている作業者（新人でないこと）
改善前と改善後の作業は、同じ作業者が作業すること（正確に効果を把握するため）
段取替え作業は何人で行いますか？
作業者が複数の場合は、撮影者も複数でそれぞれの作業者のビデオを撮ること

6.撮影時の注意事項

ビデオは、作業者の動き、手の動き、姿勢などがわかるように撮影する
例えば、作業者が工具などを撮りに行ったら、撮影者はその人を追いかけて撮影し何をしているかがわかるよう撮影する

7.撮影後のデーター：File Storageにデーターをアップロードする

Thank you

A12.How to set up Hololens2

Version 1.0

2021-04-10

World Business Associates

Hiroshi Jogasaki Ph.D.

First things you should know

1.Microsoft Hololens2 is a mass market holographic computer designed and marketed by Microsoft.
2.Please treat it very carefully. If you drop or throw it like normal glasses, it will be damaged and never works.
3.Microsoft Hololens2 is not delivered in Indian market yet. So if you need assistance or support or repair,
You should contact Japanese Distributer for the repair. Free maintenance can be available until the Nov of 2021.
When you send Hololens2 to Japan, delivery cost should cover by CII both from India and from Japan.
4.Glass cover surface should be cleaned by using soft cloth.
5.Only compatible AC adapter should be used for Hololens2.
Failure to take the following precautions can result in serious injury or death from electric shock or fire or in damage to the device. To select an appropriate power source for your HoloLens 2
• Use only the power supply unit and AC power cord that was provided with your HoloLens 2.
• Do not use non-standard power sources, such as generators or inverters, even if the voltage and frequency appear acceptable. Only use AC power provided by a standard wall outlet.
• Do not overload your wall outlet, extension cord, power strip, or other electrical receptacle.
Confirm that they are rated to handle the total current (in amps [A]) drawn by the HoloLens 2 (indicated on the power supply unit) and any other devices that are on the same circuit.
6. The HoloLens 2 contains a 9V at 2A built-in battery. The battery in the HoloLens 2 is not user replaceable.
Improper use or disposal of the battery may result in explosion.
Do not heat, open, puncture, mutilate, or dispose of the product in fire.
Do not leave the HoloLens 2 in direct sunlight for an extended period of time.
Extreme sunlight exposure can cause battery damage.

1. Package Open

When you open the big-egg case, you will find Hololens2 like below.
We are sending 2 units of them. One for CII and another one is for CII's client company.

2. Adjust the size of Hololens2

You can adjust the size of the Hololens2 suitable for Your size of Head.

2. Power on Hololens2

You can power on the Hololens2 using push the bottom of power.

3. Power charge on Hololens2

Please use the standard AC adaper and cable for the Hololens2
To charge the power.

4.After power on

After power on and put on the Hololens2, you will see the top menu
Like left.

Then chose the Tips for basic operation training.
I will take less than 5 minutes for basic operation using Hololens2.

5.WiFi setting

You should push the top left sign to connect your own WiFi.

Select the WiFi SSD which you want to connect. Then Password input will be
Requested by poping up virtual keyboard for you to input.

6.Remote Assist connection

After connecting WiFi network and connected to the Internet, you can get
The information from the Internet.

You can use Teams on the Hololens2. Push the bottom of Remote Assist.

Push the Arrow.

Then you will see the
Screen like this.

About MESH

You can refer to the document at the Internet.

https://meshprj.com/en/

User Group of this Temporary Test - 城ヶ崎研究所

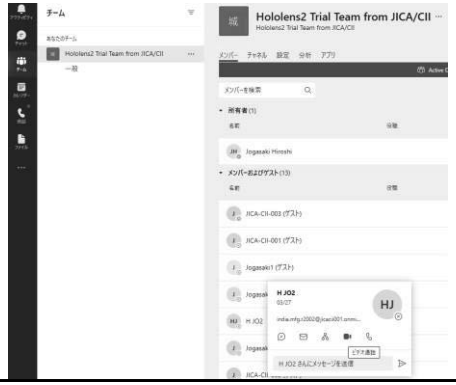
List of IDs

ID Name	Device	Email-ID	License	Password	PIN
H JO1	Hololens2	india.mfg.r2001@jicacii001.onmicrosoft.com	Dynamic365 Remote Assist, Dynamic 365 Guides, Microsoft Office 365	Y9rKGvha	200101
H JO2	Hololens2	india.mfg.r2002@jicacii001.onmicrosoft.com	Dynamic365 Remote Assist, Dynamic 365 Guides, Microsoft Office 365	Ka2NXP7M	200202
JICA-CII-001	PC	Jica.india.mfg.r2001@gmail.com	-	Y9rKGvha	
JICA-CII-002	PC	Jica.india.mfg.r2002@gmail.com	-	Ka2NXP7M	
Amit Kumar	PC	India.mfg.r2005@gmail.com	-	XdXTkeP>	
Hiroshi Jogasaki	PC	hololens2@jicacii001.onmicrosoft.com	Dynamic365 Remote Assist, Dynamic 365 Guides, Microsoft Office 365	My admin	

Microsoft 365 Admin Center
https://admin.microsoft.com/

One Drive
https://onedrive.live.com/about/en-us/signin/

From PC to call Hololens2 on Microsoft Teams, select the person you want to contact and start a video call.



Remote Assist To take a picture and share it with members(1/4)

Step 1:From the screen of Remote Assist, Select Asset.

Remote Assist To take a picture and share it with members(2/4)

procedure2 : Select Assets From the screen, then select Folder or create a new folder.
procedure3: Select the Photo(camera) icon

Remote Assist To take a picture and share it with members(3/4)

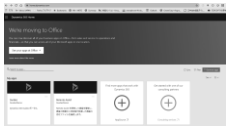
procedure4 : From the Hololens2 screen, get a photo with finger gestures.

For videos, you can't shoot while communicating on Teams If you take a picture when you are not on the phone, The file is automatically shared.

Remote Assist To take a picture and share it with members(4/4)

procedure5 : PCOn the side,Dynamic365 Go to the page of ,Remote AssistSelect .
procedure6: Remote AssistAssets in(Asset)and look at the specified folder to share the photo.
This file contains the entire group(P11is shared with blue members).

HomePage: http://home.dynamics.com/
ID:Jica.india.mfg.r2001@jicacii001.onmicrosoft.com Password:Y9rKGvha



Advanced functionality of Hololes2
CASE STUDY

Advanced functionality of Hololes2 : (1) Skill Transfer

https://www.youtube.com/watch?v=vy3tgmOvnVI

Advanced functionality of Hololes2 : (2) Free Hand Manual

https://www.youtube.com/watch?v=J2beSikvJw0

Advanced functionality of Hololes2 : (3) Mixed Reality Factory Assessment in TOYOTA

https://www.youtube.com/watch?v=Rcct5aBGWs8

Additional functionality of Hololes2 : (4) BIM project in Construction industry from Germany

https://www.youtube.com/watch?v=JyNidHwIIIE

Additional functionality of Hololes2 : (5) Mixed Reality in Medical

https://www.youtube.com/watch?v=fU7Dk8ZZSLY