TATA STEEL

WeAlsoMakeTomorrow

tsic@tatasteel.com

Mr. Kanhu Charan Khatai: +9190400 94194

Mr. Salil Gupte: +91 70330 95073

https://www.linkedin.com/showcase/tata-steel-industrial-consulting-tsic/

www.consulting.tatasteel.com

automation.tatasteel.com

TATA STEEL INDUSTRIAL CONSULTING

YOUR ASPIRATIONS, OUR ENDEAVOUR

Automation & Industry 4.0 Solutions

About TATA Steel

Tata Steel was established in India as Asia's first integrated private steel company in 1907. With this, Tata Steel also developed India's first industrial city at Jamshedpur. Today, it is among the leading global steel companies – authoring innovations, pioneering practices, and developing a world class team of committed employees. In its journey towards excellence, Tata Steel has developed its strengths in diverse areas such as Exploration and Mining, Technology and Best Practices, Human Resource Management, Organizational Efficiency, Research and so on.

TATA Steel Industrial Consulting

Tata Steel Industrial Consulting, the industrial consulting arm of Tata Steel brings to the table the experience and expertise of the entire Group. The journey of Tata Steel's organizational excellence enables it to offer insights that are applicable across industry groups. Tata Steel through this offers more than just consultancy – the vertical comprises practitioners and experienced subject matter experts who have delivered results in an organizational context allowing them to leverage their practical experience and execute proven solutions.

Our expertise includes but is not limited to the following areas:

- 1. Exploration and Mining
- 2. Technology and Best Practices
- 3. Organizational Excellence
- 4. Human Resource Management
- 5. Research and Analysis
- 6. Digital transformation & Automation Solutions

Tata Steel Digital Journey

Our Industrial 4.0 Architecture

Insight Platform	Visualization	
	Artificial Intelligence	
	User Apps	
Data Platform	Data & Analytics	
Infra Platform	Enterprise Applications	
	Sensors	Level I & II
	Network	Cyber Security, Cloud

Key Business Outcomes

1. Safety
2. Productivity
3. Yield, Throughput
4. Energy
5. Quality
6. Asset Performance
7. Knowledge Management
8. Data Privacy
9. Cyber Risk mitigation
10. Technology Obscelence

Goals

- Intelligent Enterprise
- Digital Enterprise
- Agile Enterprise

Laurels

- 4IR Lighthouses – TSK, TSJ, TSIJ
- Gartner: Globally top 6% in Covid Response & "Refined" Digital Maturity; Industry leader in Digital Execution
- Rated as "Synergized" in 2022
- Certified in-house R&D unit for IT & Digital

A Look Back at 2022 Accomplishments

- Cast House 4.0 won 3rd Prize in "Intelligent Manufacturing"
- Best Paper Award (Sole Awardee from India)
  1. A Smart Decision-Making Regrading tool in Steelmaking
  2. Real-time Prediction of Refractory Wear of BOF Steel Making
- Design Honour Award Winner "FerroHaat : The Mandi in the cloud"

1. Digital Safety & Environment

A Video Analytic Solutions for process safety

Objective:
To ensure process/industrial safety measurements


Social Distance


Mask Detection


PPE Detection


No Man Area Zones


Hand Rail Holding Detection


Fire Detection

Feature & Benefits:

1. Ensure Safety compliance at all levels inside the plant
2. Social distancing, Mask detection etc through video analytics improves containment & prevention of epidemic spread like COVID
3. Critical safety hazards are eliminated at process industry floors through PPE Detection, No man area zone & Hand rail holding detection
4. Fire Detection solutions contribute a major factor in zero harm for all personnel & property

B Explosive Detection System

Objective: Detect explosives mixed with scrap on the conveyor to the shredder and alarm accordingly to ensure safety


Cylinder Detected on Conveyor

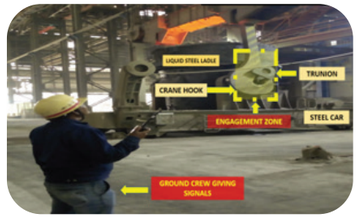
HMI View

Feature & Benefits:

1. Automatic detection of explosives in material yards/scrap yards that could be hazardous
2. Added safety with enhanced vision over a bulk of materials
3. Zero Human intervention required thus reducing personnel harm

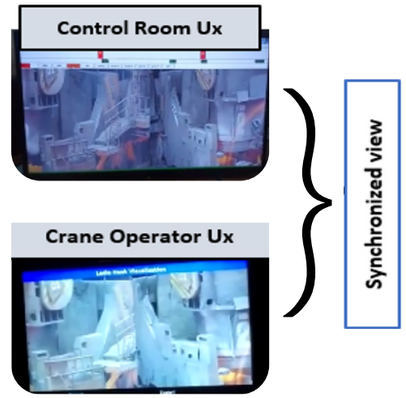
C Hook Vision

Objective: Provide real-time visualization of crane hook engagement with ladle trunnion without any intervention from the crane operator



Feature & Benefits:

1. Ban human signaling near the vicinity of hot metal
2. Multi-streamed latency-free auto-switched video transmission in both cranes & ground (like Dish TV Communication)
3. Minimum electronics & maintenance on crane side
4. Easy to use & hassle-free software design
5. Change in inherent work culture
6. Implemented in all steel melting shops of TSJ, TSK & TSM



D Remote Machines

RRC in Locomotives of Hot Metal Logistics	Video Wall in Bof Converter Handling	Manless Cranes in Scrap Management
Objective: To improve safety standards and productivity in the Movement of Hot Metal Torpedoes	**Objective:** To ensure safety at BOF Control Room by using video wall instead of glass wall	**Objective:** To eliminate Human-machine interface in the operation of cranes inside Steel Melting shops
Features & Benefits: 1. 24x7 seamless RRC Control for critical assets 2. Increase in productivity by reduction of Time of travel and increased availability of Locos	**Features & Benefits:** 1. 24x7 latency-free real-time video streaming for critical application 2. Prevention of loss of life inside the control room during the worst case of BOF Converter's explosion	**Features & Benefits:** 1. Safe, ergonomic and productive operation of cranes 2. Easy to operate & enables maneuverability of critical crane operator resources inside steel melting shops


REMOTE LOCO IN TSJ


VIDEO WALL DESIGN


MANLESS CRANE DESIGN

E Remote Sprinkler for Stock Yards

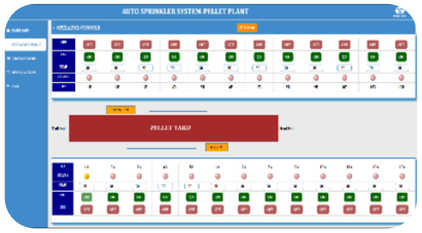
Objective: To eliminate human presence for operating sprinklers in stockyards

Issues & Concerns:

1. It is unsafe to use raw material storage yard to operate sprinklers
2. Waste of manpower resources for a simple job
3. Sprinklers working is necessary for environmental hygiene

Benefits:

1. Remote operation of sprinklers (No line of sight required)
2. Enhanced safety and productivity
3. Compliance with statutory environmental rules and regulations

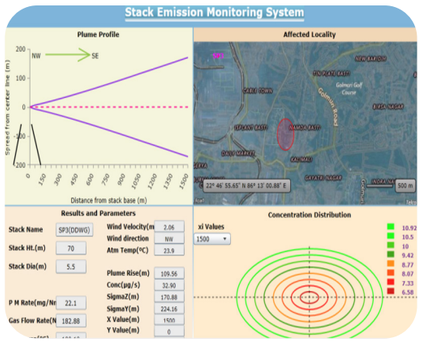


F Plume Dispersion System

Objective: Estimation and visualization of pollutants deposition (PM, SOx, NOx) in real time to demonstrate the environmental impact

Solution:

Developed a real-time process model using Gaussian distribution methodology for estimation of plume dispersion and deposition



Benefits:

1. Results are displayed on an HMI screen which is overlaid with Google map
2. Displays the deposition profile of each stack for the last 24 hours
3. Early intervention in case of emergency

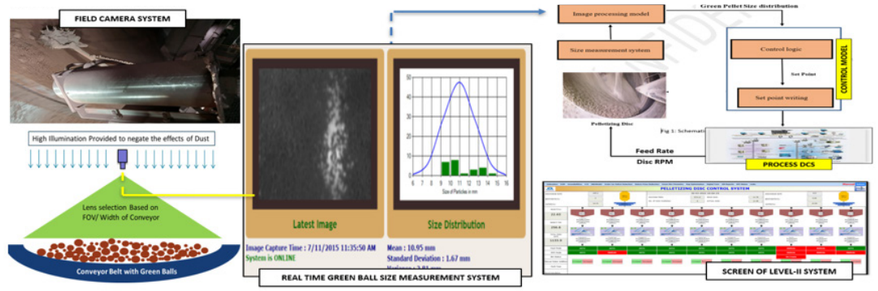
2. Iron Making (Pellet, Sinter, Coke & Blast Furnaces)

A Auto Pelletizing Disc

Objective: Develop an automated pellet size control system using Level II Automation System parameters to control the size distribution of green pellets

Result & Benefits:

1. Elimination of manual inspection of discs to identify discs producing reject and elimination of human judgement in size control
2. Effective control of reject and reduction of feed fluctuations to the induration machine
3. Implemented in all pelletizing disc (10 nos) of TSJ Jamshedpur

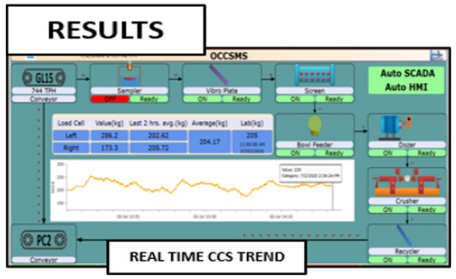


B Auto Pellet Tester

Objective: To provide a completely autonomous process of testing pellets without any delay in the process

Issues & Concerns:

1. Manual & cumbersome job
2. Time-consuming process



Benefits:

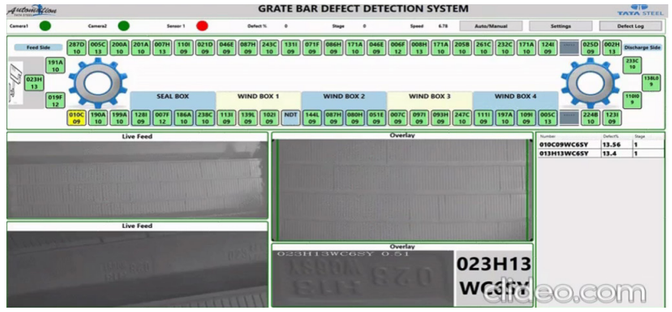
1. Fully autonomous process
2. Results in 1-minute
3. Real-time CCS testing
4. Overall high productivity

C Grate Scan

Objective: To develop an automated defect logging, tracking & positioning system for Pallet Cars thus enabling faster detection and maintenance of defective cars which lead to loss of pellets while transport

Automated system is required for

1. Individual car's defects logging
2. Individual car tracking in chair
3. Auto positioning of the defective car



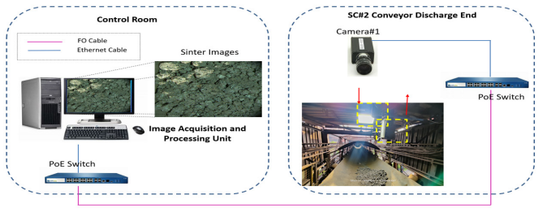
Key Features:

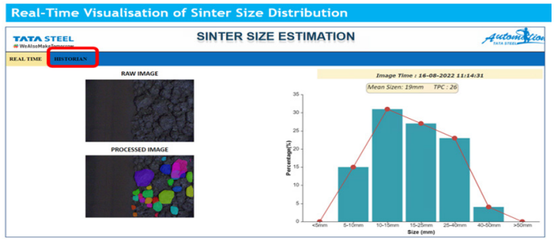
1. Defect logging
2. Pallet car tracking
3. Precise positioning of cars
4. Overall productivity improvement

D Sinter Sizing Estimation

Objective: Image-Analytics-based system to calculate the Sinter size distribution in real-time

Novelty: Using a CNN based Object detection + Instance segmentation model for estimating size distribution





Benefits

1. Assessment of the sinter granulometry of sinter in real-time
2. Bad-sized Sinter diversion from BF line, minimizing the impact on Blast Furnace productivity

E Sinter Plant Level II System

Objective: A complete Level II system for process improvement and an overall increase in productivity at sinter plant through effective operation, management & visualization with analytical models

Process Visualisation

Dash board for Process Overview. Trend/Graphs of a process parameter with history

Digitization of Daily Management

Monitoring and abnormality analysis of prominent KPIs like are CaO Std Dev, RDI TI and SPM. Control charts and usage of abnormality analysis framework of DM gives a better way to control the parameters. HMI to capture the reason for abnormality and there by maintain the history of abnormality events

Sinter heat balance mode

Heat balance model to predict the bed temperatures, gas flow, stack gas composition etc. and to provide insights which will help in process optimization. Simulation feature to understand the effect of different parameters on sintering and for operator training

Optimisation model

Prescription model based on the insights from sinter heat balance model, SOPs and data analysis. Feature to acknowledge the model recommendations

A. Green mix demand auto control

Automatically sets the green mix demand based on the sinter machine speed and surge bin level . This results in elimination of frequent tripping of green-mix circuit (due to high surge bin level) by efficient control of Surge bin level

B. Burn-through auto control

Auto control system for maintain the burn though temperature by automatically adjusting the sinter machine speed and waste gas fan RPM. This model results in

» Better control of Burn-through temperature
» Improved production.
» Reduction in coalicoke consumption
» Elimination of manual intervention

Digital twin

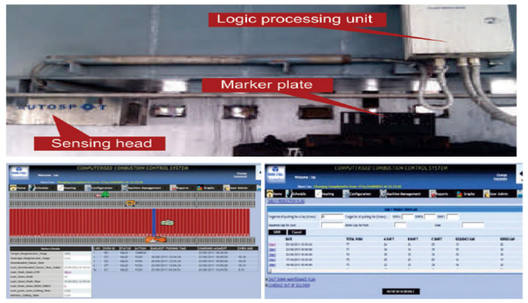
Integrated prediction mode! for return fines, SPM, RDI with simulation feature. Recommendation model based on process optimization

F COSMOS (Coke Oven Scheduling & Heating Monitoring System) - Coke Oven Level II System

Objective: Heating, scheduling & machine coordination in coke oven battery which leads to improved productivity, battery life, energy efficiency and quality of coke under reduced emission

Process:

1. Dynamic pushing schedule
2. Oven identification and machine coordination
3. Temperature visualization
4. Battery heating control model
5. MIS and data presentation
6. Data science-based models



KPI improves:

1. Energy saving of 6.09%
2. Standard deviation of Min 7.65 degree C° & max 18.14 degree C°

G Online Flue Temperature Measurement of Coke Ovens

Objective: To eliminate manual measurement and provide an online temperature of each flue

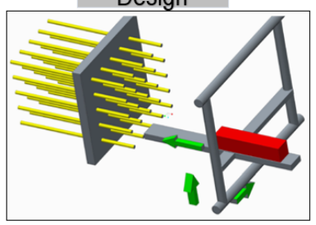
Solution:

1. Using FO, radiation travels from each flue into a central station
2. A single Pyrometer multiplexes IR radiation to give the temperature of each channel

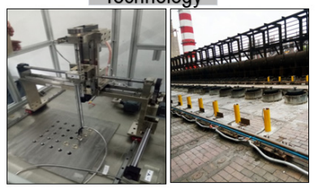
Benefits

1. To get the online temperature of Flue
2. Input for the heating model
3. Eliminate manpower to measure

Design



Technology



Outcome

H Tie Rod Load Cell Measurement in Coke Ovens

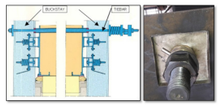
Objective: To provide Load changes that take place during different events of Oven operation

Solution: To install a high-temperature Loadcell on the tie rod

Benefits

1. Cost reduced and safety improved as manual campaigns decreased
2. Predict oven health conditions
3. Improved Process Visualization

Design



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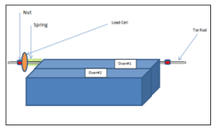

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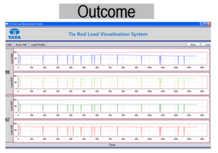


I Tuyere Eye

Objective: Visualizing the pulverized coal injection with analytics and eliminating manual observation of the tuyer platform

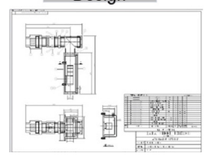
Solution:

1. Cameras are mounted on the tuyer peephole without compromising on human visibility
2. Live display of the PCI of all tuyers in the control room

Benefits:

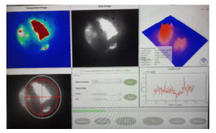
1. Improved visibility of PCI for decision making
2. Analytics to aid in decision making and also analysis after-the-fact
3. Human Safety

Design



Technology

Outcome



J Wireless Dip Lance

Objective: Wireless enabled measurement of hot metal temperature at the cast house

Features & Benefits:

1. Easy to use & improved safety quotient at cast house
2. Improved ergonomics for operator

K Provide BF (Process Visualization & Data Evaluation for Blast Furnace) : Blast Furnace Level – II System

Objective: Visualisation, Simulation & Optimisation of BF processes which improve operational efficiency, furnace health and quality of hot metal

Burden Control
Target setting for HM & Slag Chemistry & Auto Creation of Charging Matrix

Burden Distribution
Simulation of burden trajectory

Shaft Simulator
Burden location for each matrix of burden charged

Stock House Matrix
Facilitates preparation of charge matrix

Mass & Energy Balance
Compares minimum theoretical fuel rate & actual fuel rate

Water Ingress Detection
Early detection of water leakage through tuyeres

Stove Model
Determines the set points for fuel supply to stoves for energy efficiency

Liquid Level Monitor
Dynamic hot metal & slag levels in the hearth volume

Heat Loss
Axial & radial heat flux distribution from the furnace wall

Hearth Wear
Computes the hearth lining profile using the hearth thermocouples

Stockline Monitor
Slipping & Hanging states of Furnace are identified using Burden Descent Rate

Lab Browser
Retrieval of sample analysis data from Lab

3. Steel Making (BOF/EAF, Casters, Flat & Long Product Mills)

A Smart Raking System

Objective:
To facilitate the removal of slag optimally from molten iron

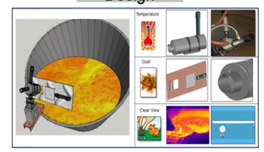
Solution:

1. IR camera differentiates steel and slag.
2. Imaging algorithm detects the endpoint of raking

Feature & Benefits:

1. Improved yield
2. Independent of human skill and experience

Design



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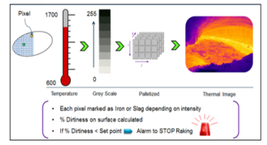

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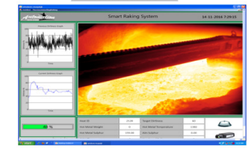


B Slag Detection System

Objective:
To avoid slag carryover into the ladle during tapping

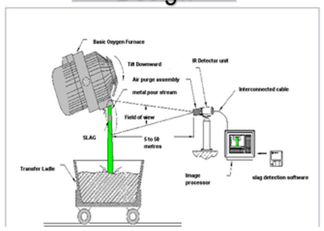
Solution:

1. IR cameras differentiates between steel and slag based on their emissivity.
2. Imaging algorithm detects slag at the end of the tapping cycle

Feature & Benefits:

1. Cases of Phos Reversal go down.
2. To improve the quality of the steel

Design



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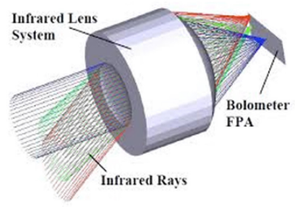

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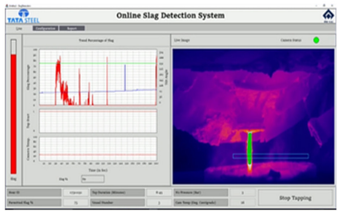


C Opti BOF: SMS Level II System

Objective:
Consistency in the end blow chemistry and temperature through different models which provides assistance in the planning of heats

Process Optimisation →
- » Charge Balance
- » Alloying Calculation
- » Dynamic Calculation

Tracking →
- » Hot Metal Ladles
- » Steel Ladles

Production Planning →
- » Daily Schedule Receipt
- » Heat Planning
- » Transfer Of Process Data

Communication Interface →
- » Caster Level-II System
- » Level-II System
- » SAP/Data Warehousing
- » Laboratory Management

HMIs →
- » Online Display Of Process Parameters

Process Analysis →
- » Online Trends Of Key Parameter

Benefits:

1. Reduction in the standard deviation of turndown temperature
2. Reduction in reblows
3. Reduction in time consumption
4. Reduction in a variation of turn down phosphorous for a given grade
5. Standardization of operational practices

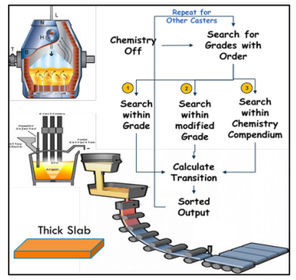
D Slab Auto De-grader for SMS

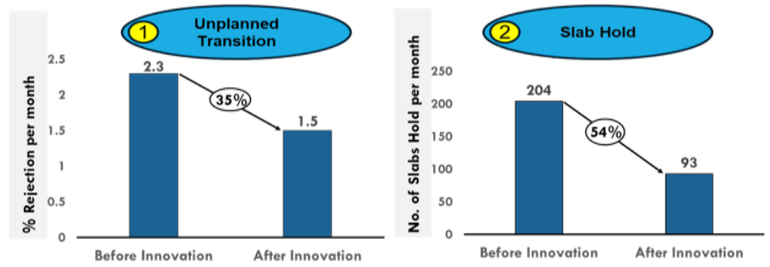
Objective:
An automated ML model with gradient boosting algorithm to determine the best possible alternate for unplanned transitions/degradation due to chemistry

Innovation:

1. Automated searching of the most suitable alternative in terms of Order availability, defect generation due to grade mixing (transition loss) and cost margin
2. A novel approach involving machine learning (Gradient Boosting Algorithm) and search optimization has been used
3. Pro-active correction of the unplanned outages via automated system-driven efficient decisions instead of manually dependent systems at early steelmaking stages

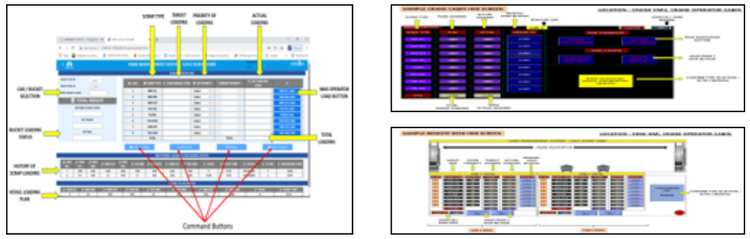
Benefits:





E Scrap Yard Management System

Objective:
Auto scrap loading information system eliminates manual-based data logs of scrap charged in BOF and other manual practices coupled with autonomous scrap charging to improve overall productivity



Features & Benefits:

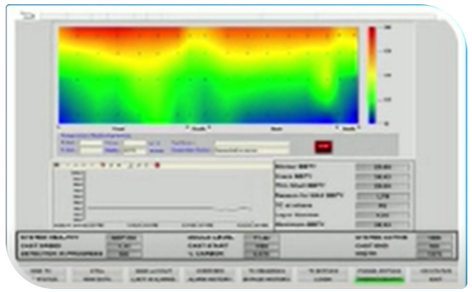
1. Completely automated scrap management system
2. Able to identify the requirement as per the work order received to charge the scrap
3. Complete interface with the level II system and identify the required scrap recipe
4. Camera Lidar system enables to generate a position reference for the crane system to operate

F Casting Online Diagnostics system (Break out prediction system)

Objective:
CODS continuously monitors the embedded thermocouple values in real time and generates early alarms to arrest potential sticker breakouts

UPS:
Gives a breakout ability factor

Improved KPIs:
Improved KPIs, 80% true/false sticker alarms



G Slab Dimension Measurement System

Objective:
To develop a system that comprehensively measures various casting parameters like Length, Width, Thickness, Bulging and Taper to provide real-time feedback to the operation about the casting quality

Previous Practice:
Length (Auto-Encoder based), Width (Manual), Thickness (Manual), Taper (None), Bulging (None)

New Initiative:
A hybrid of Machine Vision and Laser technology has been developed to measure Slab dimension

Features & Benefits:

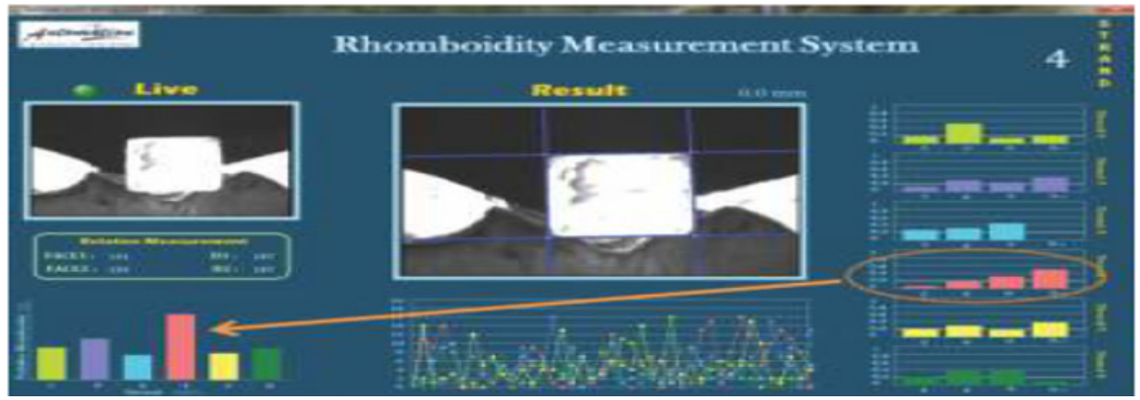
1. Efficient data analysis tools to analyze casting performance embedded in Level II
2. Breakout detection due to Taper Loss

H Rhomboidity Measurement System

Objective:
Real-time, precision vision machine for Rhomboidity measurement of Billets/Blooms to improve yield by a reduction in downstream rejects & reduce man-machine interface

Features & Benefits:

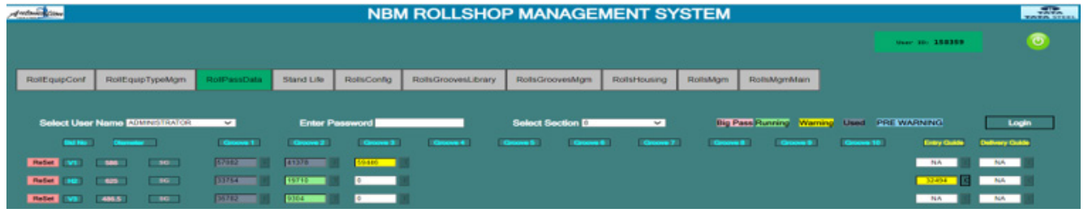
1. The system being real-time can measure each billet individually for Rhomboidity, giving an accurate value
2. Able to withstand high-temperature dust and harsh environments
3. Non-contact type system



4. Rolling Mills

A Roll Shop Management System

Objective:
The Roll Management monitors the usage of grooves, rolls, roll sets, roll modules and guide boxes in terms of the rolled tonnage and indicates when set limits are reached



Digital Features:

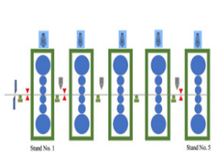
1. Application migrated to web-based
2. Backup and running rolls module
3. Roll shop inventory and production linking for all stands 1 to 16
4. NTM roll inventory and linking are in progress
5. Roll shop status module was deployed

B Mill Chatter detection System

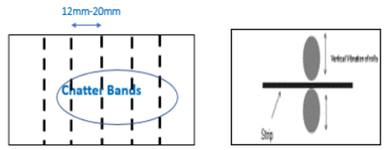
Objective:
Chatter marks on coils generated in Cold Rolling Mill often lead to rejection and downgrade downstream. In absence of an online chatter detection system, chatter defects are not detected in real-time which may take upto some days of actual rolling. So, no corrective action can be taken immediately and material rolled with this defect is always exposed to chatter defects

Product Features:

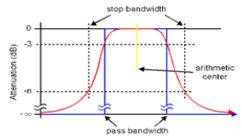
1. Real-time Chatter Detection
2. Long Term vibration trend
3. FFT analysis of stand vibration
4. Coil Wise Chatter severity prediction
5. Daily MIS
6. Data download
7. Configurable as per requirement



Mill housing with sensor mounted



Frequency Calculation



Butterworth Band Pass filter

UI/UX

C V.Eye (An eye for crop optimization)

Objective:
Real-time vision-based system for accurate computation of cut profile of the head and tail ends of Transfer Bar to reduce yield loss due to crop cut. The system also provides accurate speed measurement of the hot strips to assist precision cutting by crop shear

Principle of operation:

1. Imaging of the head & tail end of the transfer bar after the last pass of the roughing mill
2. Determination of the optimum shear lines
3. Downloading of the reference cut position to the shear control system
4. Accurate speed measurement & feedback to shear control system

Benefits:

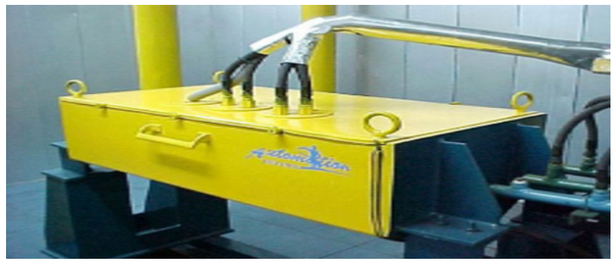
1. Reduction in yield loss due to crop cut up to 0.1%
2. Reduction in average crop cut length up to 60%
3. Avoids cobbles in mills

D Tru-Span

Objective:
Based on stereo photometry and triangulation principles, Tru- SPAN measures the hot/ cold coil widths with immaculate precision. Powered by a line laser, the new generation Tru-SPAN is also capable of carrying out width compensation in presence of a moderate bow in the surface

Improved KPIs:

1. Yield loss
2. Downstream rejections



E Surface Quality Inspection System

Objective:
Discretion alarms are raised only for significant defects missing zero defects and resulting in accurate classification and revised gradation standards

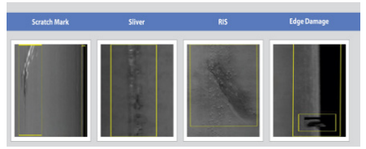
Principle of operation:

1. Acquisition of images
2. Processing of the images
3. Detection of "flaws"
4. Segmentation into "objects of interest"
5. Classification of these images into defects, e.g. silvers, scratches, edge damage, holes etc.
6. Severity indication
7. Real time result display
8. Detection of defects upto size 1mm^2
9. Modular & scalable architecture

FIELD INSTALLATION

FIELD UI/UX

DEFECTS DETECTED

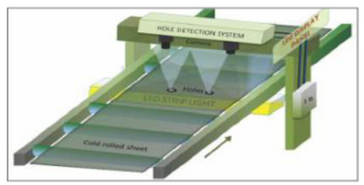


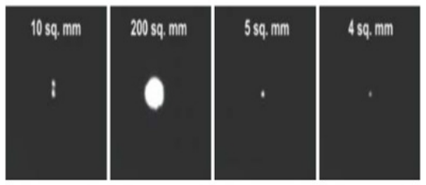
F Hole Detection System (HDS)

Objective:
A precision vision machine that will not let go of any holes undetected. Built on image processing, sophisticated and efficient algorithms are used to detect holes on the fly. Salient features include triggering of Audio/Visual alarm, customized report generation, and advanced analysis of hole defects

Benefits:

1. Real-time detection of holes during rolling
2. 100% coverage of sheet surface
3. Supports quality control & grading of sheets
4. Helps monitoring of the casting & rolling processes
5. Generates coil defects database to facilitate analysis
6. Archival of data

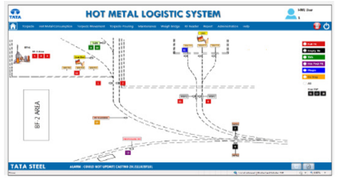




5. Logistics, Utilities & Maintenance

A Torpedo Ladle Tracking System

Objective:
Efficient coordination of torpedo ladles for serving Hot Metal "capacity buffers" for the Blast Furnaces and "feed buffers" for the Steel Making Shops



Improved KPIs:

Efficient & optimum management of hot metal movement

B Generic Yard Management System

Objective:
Solution for smart Material Handling

Features:

1. Easy to use human machine interface for real time visibility of all yard activities
2. Hand held terminal for the operator to perform field verification and server communication
3. Interfaces with business planning systems, process lines and crane automation systems
4. Centralised database to manage all activities from receipt to dispatch of materials

Benefits:

1. Real- time visibility and tracking of inventory and shipment
2. Reduced material handling time
3. Streamlining work order management to reduce vehicle loading, unloading, and waiting time
4. Prioritisation of transportation as per business needs
5. Online reports on crane performance, yard inventory execution time and VIVO time
6. Handheld terminals for the operator for communication with server

C Smart Solutions

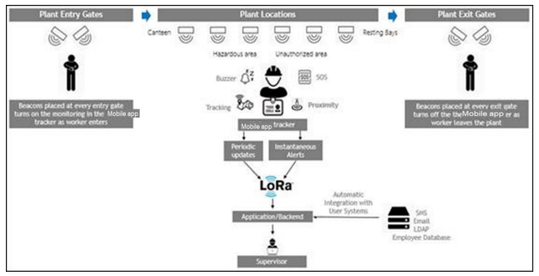
Objective:
It helps enable devices on the network, data streaming, data analysis, MIS reports/ exceptions, & control/enhance business operations

Process Flow:

Smart Devices → Cloud Search → Web Applications

C.1 Connected Workforce

Objective:
Smart solution for identification & tracking of manpower deployed inside plants



The Solution has 4 critical components – Lora Wan, BLE Beacons, Android / IOS Mobile App & Cloud application

1. **LoRaWAN Network –** LoRa Network to be installed depending on the Plant/office coverage and reach [only if the solution is used in collaboration with SafePass Cards]
2. **BLE Beacon –** BLE Beacons to be installed across the plant/office demarking various Zones. The BLE beacons will be configured as either:
   - » Entry Beacon – Demarking and indicating to the Mobile App that the worker is entering the plant/office
   - » Exit Beacon – Demarking and indicating to the Mobile App that the worker is exiting the plant/office
   - » Hazardous Beacon – Demarking a Hazardous area within the Plant / Office
   - » Safe Beacon – Demarking normal working zones within the plant / Office
3. **Mobile App** via Bluetooth capable of detecting the various beacons, collecting beacon information, and sending data, alerts via the internet as well generating user alerts via buzzer /vibration
4. **Application** to generate additional reports and alerts

C.2 Smart Barricade

Objective:
Remotely controlled smart access control systems deployable at any Process hazard areas

Features:

1. Works with all Employee/Contractor gate pass
2. Authentication via gate pass cell database over the cloud
3. Real-Time Access & control
4. MIS, Reports, Exceptions & Alarms

Smart Barricade at different Process locations

COMPONENTS:

1. Traffic light Led Indicator
2. Electronically operated Turnstile barricade.
3. RFID card reader & GSM modem
4. Turnstile tripod arm
5. Intelli-Controller

Benefits:

1. Remotely controlled
2. Scalable
3. Traceability ONLINE

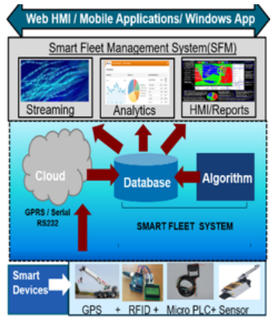
Process Flow

Centralized Web page & Mobile App

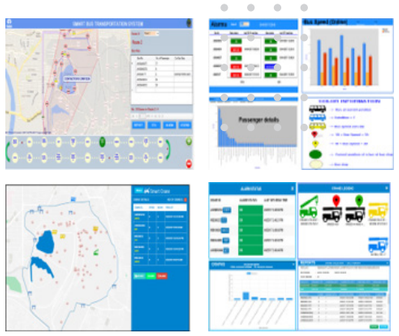
C.3 Smart Fleet Management System

Objective:
E-Tracking and Optimization of mobile equipment

FLEET



ARCHITECTURE



HMIs AND REPORTS

Key Functions:

1. GPS-enabled tracking of each fleet's route
2. Live ETA at various stops
3. Data retrieval of passengers/occupants from Cloud
4. Health Status Alarm of RFID/GPS
5. MIS, Reports, Exceptions & Alarms

Benefits:

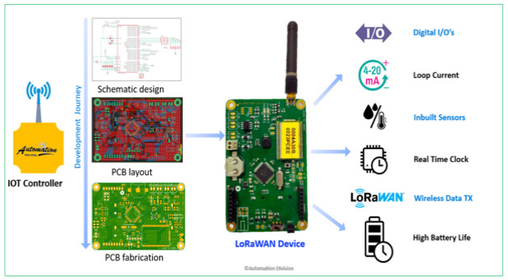
1. Enhanced Tracking and Optimization

C.4 UniLORD (Universal Lora wan Solutions)

Objective:
Implementation of smart solutions under LoRaWAN network for effective operation and monitoring on real-time basis

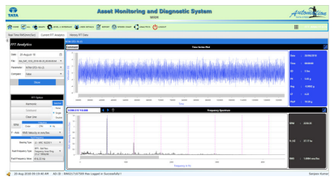
Application:

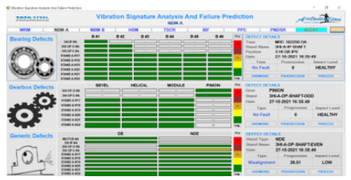
1. Spindle run time monitoring system
2. Digitised CO sensors
3. Smart energy meters
4. Anchor bolt monitoring
5. Smart sprinklers



D Centralized Condition Monitoring System

Objective:
The CCMS improves equipment reliability by automatically diagnosing and alerting equipment faults





Benefits:

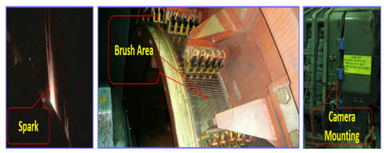
1. Online condition monitoring of critical all across plants
2. Generates alarm/warning and SMS for maintenance
3. Standardisation of maintenance system

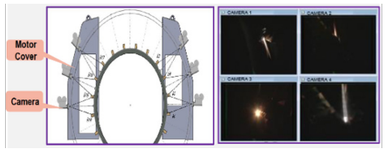
E DC Motor Spark Monitoring System

Objective:
Real-time monitoring of Sparks in DC motors

Improved KPIs:

1. Continuous monitoring in real-time
2. Machine Vision based, safe and non-intrusive methodology
3. Capable of detecting very short-lived sparks (~40 ms)
4. Enables proactive maintenance

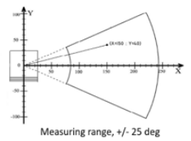


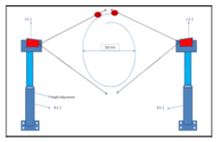


F Pipe Conveyor Monitoring System

Objective:
An online system capable of measuring the Overlap & Sway of the Pipe conveyor is needed which can trigger the alarm for corrective action

- Beam via oscillating mirror
- Optical sensor
- DSP module

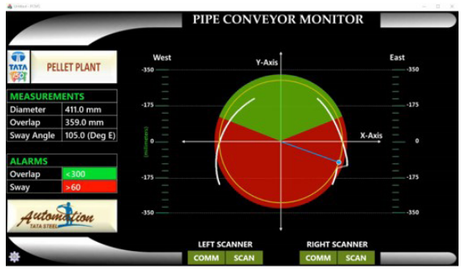




Features:

Depth X: 400-1100mm
Height Y: 372-928mm
Scan rate: 600 /min

O/p : RS232/RS485
Resolution : 0.1mm
Power : 28W@ 22-28V dc



Features & Benefits:

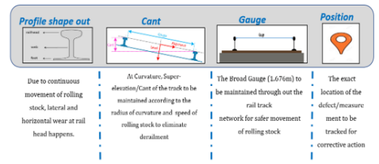
1. Online Pipe diameter,
2. Sway orientation
3. Overlap data for monitoring & control
4. Early warnings identify pre-mature failures
5. Belt adjustment can be done to maintain Blast Furnace burden

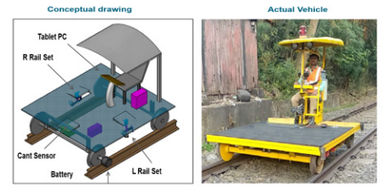
G Track Rail Inspection System (Trains)

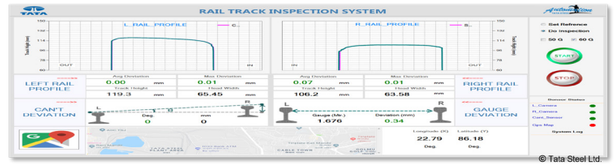
Objective:
To develop an automatic Inspection system to measure multiple inspection parameters, and process and visualize rail track on the fly

Key features:

1. Motorized vehicle
2. Contact-free measurement
3. Continuous measurement
4. Track joint detection
5. Rail-road crossing detection
6. Local data storage
7. Geo-mapping of inspection data







6. Digital Consultancy

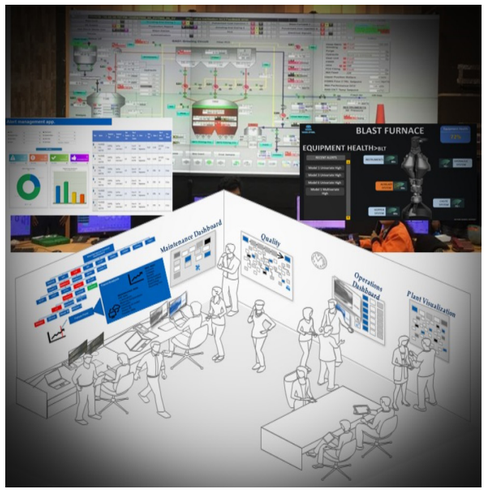
Industry 4.0 lighthouse visit

Tata Steel was quick to board the Industry 4.0 wave and had dedicated efforts to building organization wide enthusiasm for digital adoption since 2015. As the early wins started coming in, adoption picked up pace in and sizeable bottom-line impact and employee experience enhancement has been consistently achieved. Given this early adoption and hot pursuit of business goals through digitalization, Tata Steel currently has established an early lead in Industry 4.0 maturity.

Today, Tata Steel holds the unique distinction of having three of its sites recognised as Industry 4.0 lighthouses. Its oldest and newest site in India – Jamshedpur and Kalinganagar have both been bestowed with this recognition.

A visit to Tata Steel aimed at building an appreciation of the impact that digital transformation can achieve would involve interactions with the important stakeholders to the digital transformation process, witnessing digital technologies in action and correlating the same with real world business impact brought about by adopting Industry 4.0 technologies in Tata Steel.

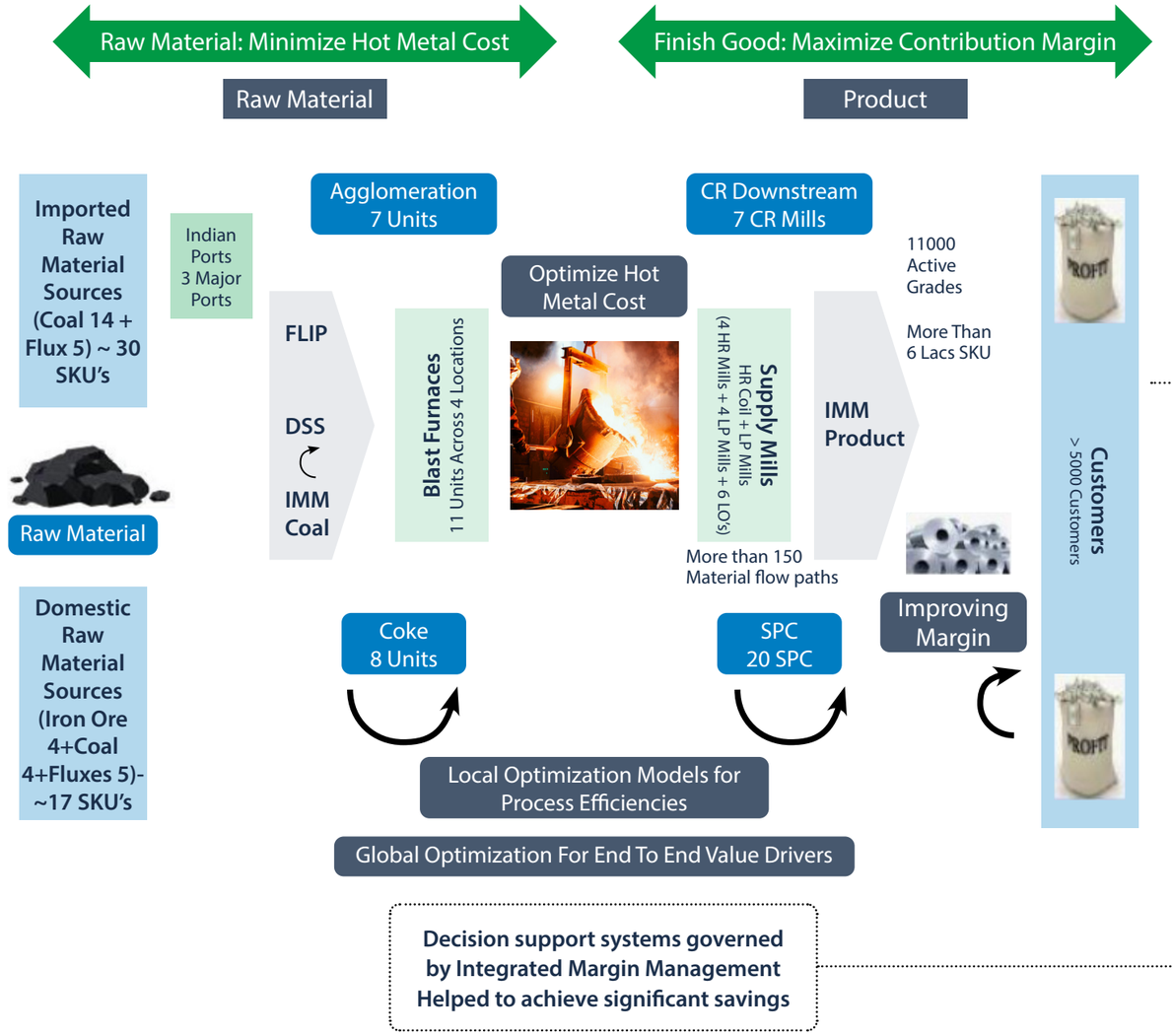
TSIC organizes customized Industry Visits to Tata Steel units enabling the participants to witness first-hand the impact of Industry 4.0 in a real-world setting. Participants also interact with the different stakeholders within the organization that deliver the change including line functions, Automation, IT Infrastructure and Business Process Enhancement.



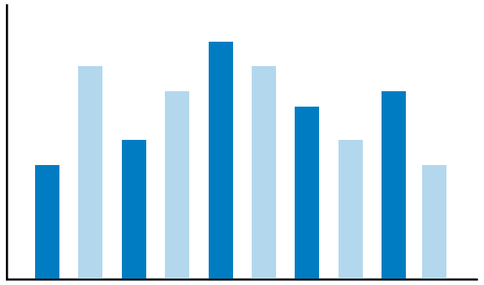
Value delivering use cases across the supply chain

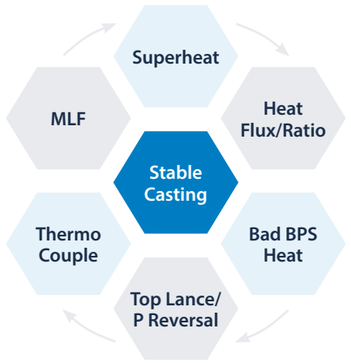
1. Managing portfolio of offerings
2. Order generation
3. Delivery management
4. Marketing
5. Enabling & support functions

A Integrated Margin Management Driving Global Optima in Multi Supply Chain



B Operational Excellence Application Case





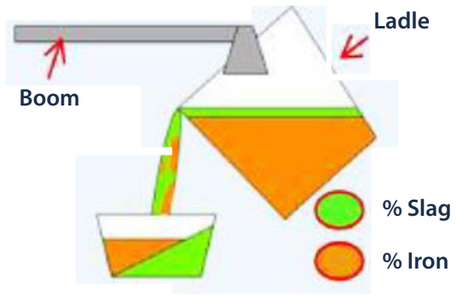
Dynamic Parameters Causing The Subjectivity During Casting At High Speed.

Capturing Operator Experience and Defining Business Rules

Heuristic Model Developed Based on Input Parameters, Model Recommends Optimum Casting Speed.

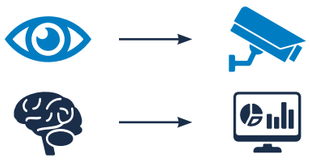
100 KTPA Additional Production

A. DESULPHURIZATION



Analogy: Loss of milk while taking out cream

Common Challenges

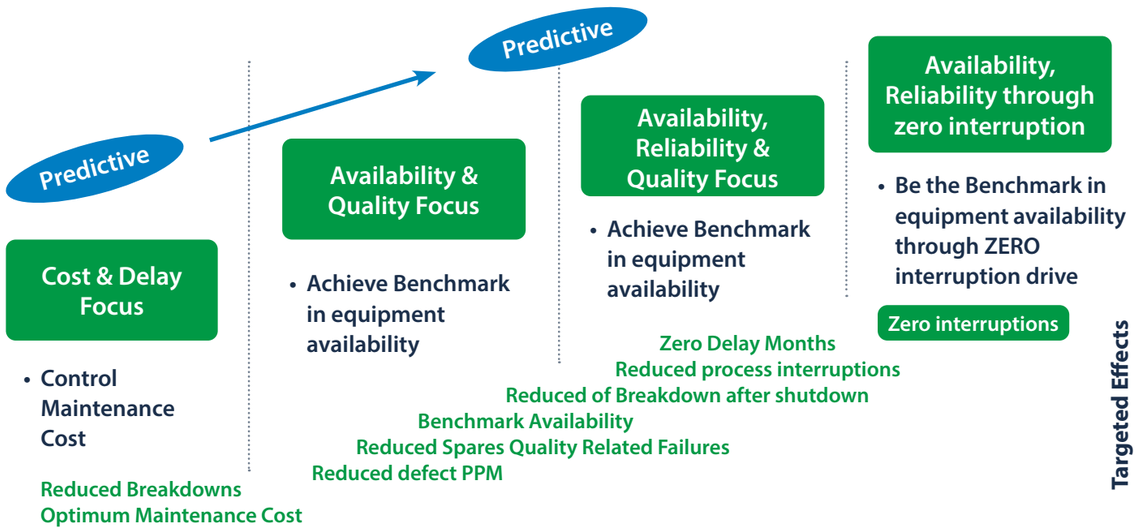


IR based detection technology

Result: HMDS Button Loss Reduction (Kg/tcs)

C Operational Excellence Application Case

Changing Asset Management Needs



The Enablers

- Data prediction based shutdowns
- Improve efficiency and effectiveness of shutdown management
- Zero failures between shutdown by reliability improvement

e-Imperatives

- e-Enable Asset Health Prediction Through IoT and CBM
- Shutdown planning and execution through technological improvisations and e-communication
- Monitor equipment health real time

Preparation of area wise business case based on Saving Potential and total solutioning Cost

Prioritization of area wise projects based on Actual loss, MTTR, Solutioning effectiveness & Cost

Further categorization of systems based on ease of implementation in tracks

35 no of failures and ~750 hrs of breakdown avoided in last two years

D Procurement 4.0 Application Case

	Problems Addressed	Impact
1. Digital Negotiation Factory	» Real time tracking of all negotiations » Availability of structured data in a single platform » Enable negotiation decisions based on past data (historical vendor data) , current data (clean sheet) and future data (forecast for materials) » Supplier's competitiveness will increase » Error free and faster executions » Maintain a digital repository of past negotiations	» Negotiations are now more objective backed by readily availability of data » Digital visibility will prevent cartelization » Help in achieving ~5% savings during negotiations
2. Catalogue Management System	» High transaction workload for category managers » High PR — PO time for MRO Items with multiple interactions between users and category managers » Competitive and Negotiated rate contracts availability through keyword search under ARC/Hosted Catalogue » Increased visibility of procured material by providing pictorial representation of item selected	» Rate reduction by 10%-15% across MRO categories due to increased vendor competition (Punchout/Hosted catalogs); increased vendor sale efficiency (annual rate contracts) » Base P2P system leveraged with E-Catalog integrated to minimize change management for users » ARC coverage increased by 20%
3. Life Cycle Tracking System	» Visibility of combined data from multiple systems involved in entire process (8-9 systems across entire cycle) » Frequent queries on status update by multiple stakeholders » Correspondence with the person responsible for the present stage of request	» Improvement in payment cycle time by ~20% Smooth Delivery of Materials as per schedule during Covid -19 » Improvement in PR-PO cycle time by 20%
4. DigiWheels	» Uitilzation Tracking of the vehicles » Ensuring optimal usage of vehicles » Manual record-keeping necessary to track vehicle distances/usage for fuel reimbursements and other payments	» Reduction in size of fleet. Increase in utilization figures from (20-40%) to (75-90%) » Real time monitoring of entire fleet to ensure 100% availability. ~25% savings on contracted vehicles

E Data Analytics - Unlocking Value

Problem Statement

- Manual & Static Forecasting process
- Time Consuming & Resource intensive process to sense demand
- No less indicators while appointing new dealers
- Generic incentives don't work effectively

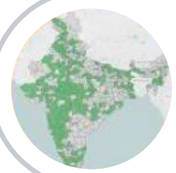
Action

A. Planning efficiency
Primary Sales Predictor (PSD) - (Dynamic Material Level Forecast)

Wishlist accuracy up by 20%

Identification of consumption centres for effective scale-up

B. Demand hotspots
Geo Spatial Demand Forecaster (Socio-economic + satellite data)



C. Reach enhancement
- Priority Dealer Identification-Using Machine Learning
- Online Booking Counters (OBC)

- 5 New attributes for dealer appointment
- Reached additional 600+ pin codes

Shop share increased by 22%

D. Channel effectiveness
Tailor-made retailer incentives