Industry 4.0 Awareness Seminars Reports Template

1.	Date of the Seminar	08th August 2019
2.	Organizers	EEPC India
3.	Title of the seminar	Awareness Programme on Industry 4.0
4.	Programme	Annexure 1
5.	Report: suggested contents (1) Main takeway / good suggestions,	-Emphasis on change in skill set and mind set for adoption of Industry 4.0 -Filling up of gap between industry and academia in implementation of Industry 4.0 through consulting -Adequate investment by private sector to build Industry academia linkages -Proposal to organise industry visit to Centre of Excellence in Advanced Manufacturing Technology at IIT – Kharagpur - Information on Ultra Compact SMART Foundry and Model for Smart Foundry - Need for Big Data Management in context of Industry 4.0 -Training and certification programmes by some institutes in advanced manufacturing an robotics
	(2) Clusters covered,	Foundry, steel re rolling, electrical appliances, mechanical engineering, handtools, surgical equipment.
	(3) Nos attended,	75+
	(4) Success stories that need to be	— Automatic Mould making

	compiled / shared	machine — Powder base & wire arc base Additive mfg. — Development of e- tractor with IoT features
6.	List of Speakers with contact details	As per Annexure 2
7.	Presentations	Annexure 3
8.	Resource persons for providing consultancy, skilling, guidance etc.	NA
9.	Photographs	Annexure 4
10.	Learnings from the seminar	- Skilling may be identified as an important parameter to be addressed for Industry 4. Sessions - Need to popularise concept of Industry 4.0 among SMEs - Industry academia linkage to be emphasisised

Annexure 1: Program copy

Industry 4.0 Seminar

8th August 2019, Kolkata

Conference Room, 'Vanijya Bhawan', 1st Floor. ITFC, 1/1, Wood Street, Kolkata 700016

Program

10.00 hrs	Registration
	Inaugural Session
10.30 hrs	Welcome address by Mr. Ravi Sehgal, Chairman, EEPC India
10.35 hrs	Address by Mr. Sanjay Shroff, President, Institute of Indian Foundrymen on Industry perspective on Industry 4.0
10.40 hrs	Special Address by Shri. Purnendu Sinha, FIE, Tata Sons Group Technology & Innovation Office
	Research Collaboration Opportunities
11.00 hrs	Different Industry Applications based on IoT platform: Dr Surjya K Pal, Professor-in-Charge, DHI

	Centre of Excellence in Adv Manuf Tech, Indian Institute of Technology Kharagpur
11.10 hrs	"SMART Foundry 2020 (Sustainable Metalcasting by Advanced Research and Technology)" - Dr. S. Savithri, Chief Scientist, CSIR-NIIST, Thiruvananthapuram
11.25 hrs	Significance of Artificial Intelligence(AI), Machine Intelligence (MI) & Internet of things(IOT) for Industry 4.0 by Professor Dipti Prasad Mukherjee, Deputy Director , Indian Statistical Institute, Kolkata
11.45 hrs	Advanced manufacturing and robotics, CMERI, Durgapur
12.00 hrs-12.45 hrs	**Panel Discussion on Adoption of Industry 4.0 in Indian Context: Challenges, Opportunities and the Road Ahead**
	Panellists for Panel Discussion
	- Dr. Nagahanumaiah, Director, CMTI - Ms. Uma Balakrishnan CEO, Axcend Automation & Software Solutions Pvt. Ltd. - Mr. Indranil Som, Digital Transformation & Industry Value Advisor, SAP India Pvt Ltd.
12.45 hrs	**Q & A session**
13.00 hrs	**Vote of Thanks**
13.05 hrs	**Lunch**

Annexure 2: Speaker details

Mr. Ravi Sehgal
Chairman
EEPC India, 1/1 Wood Street
Kolkata
Phone (O) : (91 33) 22878229, 22872256, 22872290
Mobile : 09830058442
Fax : (91 33) 22879938
Email : ravisehgal5@gmail.com

Mr. Sanjay Shroff
President
Institute of Indian Foundrymen
IIF Center,
335, Rajdanga Main Road, East Kolkata Township P.O., Kolkata – 700 107
Mobile: 9444017839
Email: shroff.iif@vish.com

Dr. Purnendu Sinha
Technology Leader-IoT & Analytics
Group Technology & Innovation Office
Tata Services Limited
Bombay House | 24 Homi Mody Street | Mumbai 400 001
Mobile +91 9972867561 | Phone +91 80-67160794
psinha@tata.com

Dr Surjya K Pal
Professor, Department of Mechanical Engineering
Professor-in-Charge, DHI Centre of Excellence in Adv Manuf Tech (http://www.coeamt.com)
Associate Dean, Alumni Affairs
Chairman, Steel Technology Centre
Executive Adviser, Science and Technology Entrepreneurs' Park (STEP)
INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
721 302, WB, INDIA
Ph: +91-3222-281576, +91-9434701972
surjya.pal@icloud.com

Dr. S. Savithri
Chief Scientist,Computational Modeling & Simulation group
National Institute for Interdisciplinary Science & Technology (NIIST)
Council of Scientific and Industrial Research
Trivandrum-695 019
India
Phone (O) : 0471 2515264
Mob: 9446183238
sivakumarsavi@gmail.com

Dr. Dipti Prasad Mukherjee, Ph D, FIE, FCSI
Professor & Head
Electronics and Communication Sciences Unit
Computer and Communication Sciences Division
Indian Statistical Institute
203 B T Road, Kolkata 700108, India.
Tel: 2575 2913, 2575 2902
Fax: 2577 6680, 2577 3035
Email: dipti @ isical.ac.in

Dr. Nagahanumaiah
Director
Central Manufacturing Technology Institute,
Tumkur Road, Bangalore - 560 022
Ph : +91-80-22188263
Telefax : +91-80-23372048
Mobile : +91-9449842675 / 9434181360
Email : director.cmti@nic.in
Website : www.cmti-india.net

Ms. Uma Balakrishnan
CEO
Axcend Automation & Software Solutions Pvt. Ltd.
uma@axcend.com
9845030363

Mr. Indranil Som

Digital Transformation & Industry Value Advisor
SAP India Pvt. Ltd.
Indranil.som@sap.com
Mob: 99868 01861

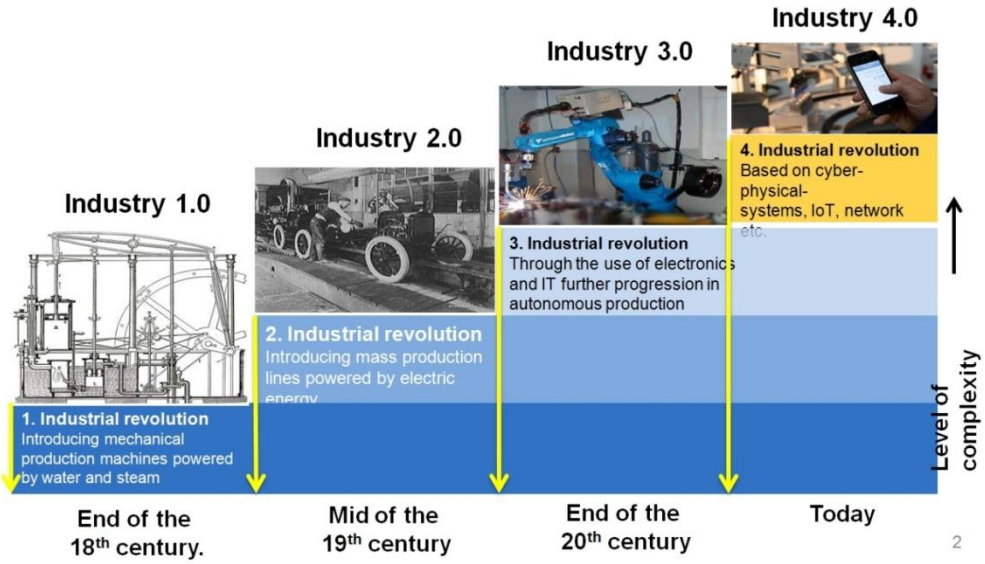
Annexure 3: Presentations

PPT 1: Advanced Manufacturing

CSIR- Central Mechanical Engineering Research Institute

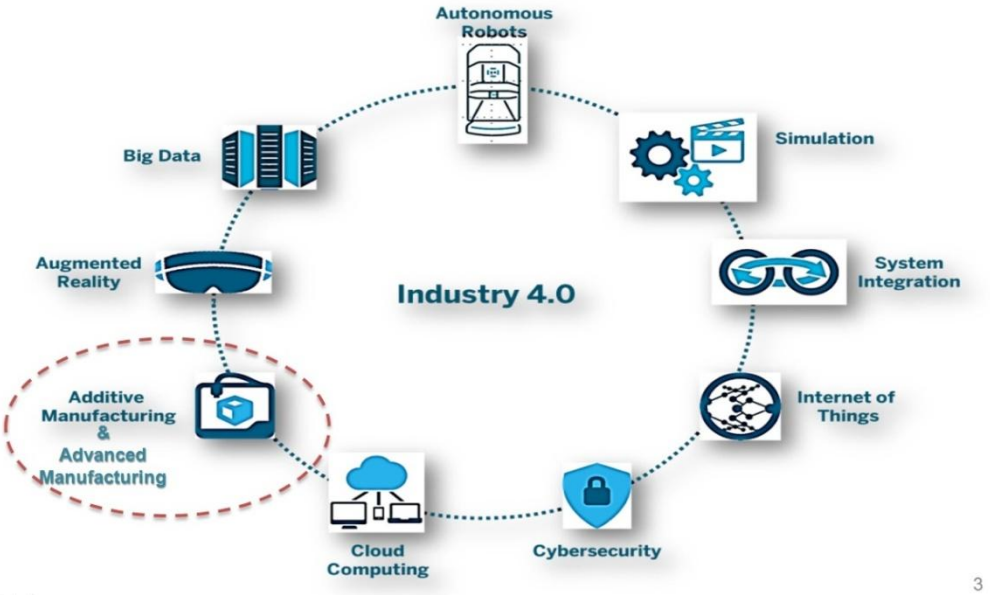
CSIR-CMERI

Industrial Revolution



CSIR-CMERI

Concept of Industry 4.0



CSIR-CMERI

Research on Advanced manufacturing

Major Projects

Industry 4.0

- ✓ Automatic Mould making machine
- ✓ Powder base additive manufacturing
- ✓ Wire Arc base additive manufacturing
- ✓ E- tractor with IoT features

Automation

- ✓ 5 Degree of freedom manipulator
- ✓ Material handling
- ✓ Shop floor applications
- ✓ Remote inspection

Near Net Shape Manufacturing

- ✓ Austempered ductile material (ADI)
- ✓ Reho pressure die casting Technology
- ✓ Material Injection moulding
- ✓ Ceramic injection moulding

Value Engineering

- ✓ Ceramic cutting tools
- ✓ Graphene based aqueous lubricant
- ✓ Die less hydro forming
- ✓ Multi fabrication machine
- ✓ 5 Axis milling machine
- ✓ Epoxy based composite propeller

CSIR-CMERI

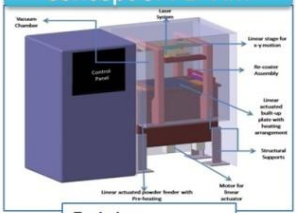
Research on Advanced manufacturing

Projects in Industrial 4.0

— Automatic Mould making machine
— Powder base & wire arc base Additive mfg.
— Development of e- tractor with IoT features

E- tractor concept

Concept of PB- AM



Bed size – 500x500x500mm³

Wire Arc base additive Manufacturing

Developed Additive Manufacturing setup

Developed Nozzle

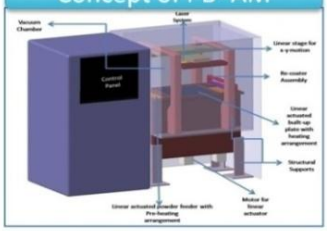
Developed Components

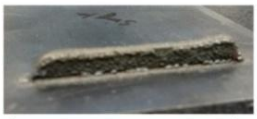
Additive Manufacturing

Developed Additive Manufacturing setup

Design and development of an indigenous powder bed fusion-selective laser melting machine with in-house developed controller, software and GUI for small and delicate engineering components.

Concept of PB- AM

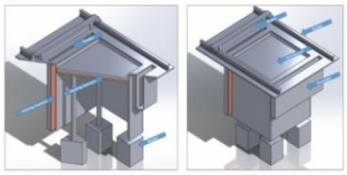




Developed Components

Developed Nozzle

In-house built coaxial nozzle with multi-channels for powder delivery



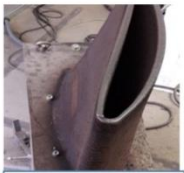
Bed size – 500x500x500mm³

Wire Arc Additive Manufacturing

Target to develop WAAM system for

4 m dia. Propeller

5 m long Body panel



1.5 m long hollow propeller blade

Setup of WAAM system

Parallel processing

- 2 x deposition
- Deposition + NDT + layer removal (machining)
- Deposition + metrology
- Deposition + cold work
- Combinations of the above

Projects in Automations

- 5 Degree of freedom manipulator
- Material handling
- Shop floor applications
- Remote inspection

Material Handling

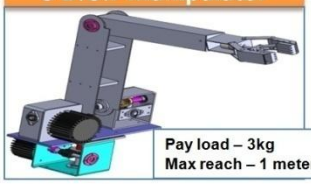
Pay load – 60kg
Max reach – 1.5 meter
Vertical travel – 1.8 meter
4 Degree of freedom

Remote Inspection

Vehicle spec
Pay load – 60kg
Max speed – 700mm/sec

Manipulator
Pay load – 3kg
Reach – 750 mm

5 D.O.F Manipulator



Pay load – 3kg
Max reach – 1 meter

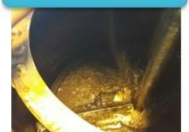
Shop floor application

Weight – 25 kg
Max velocity – 4.5 m/min

Projects in Value Engineering

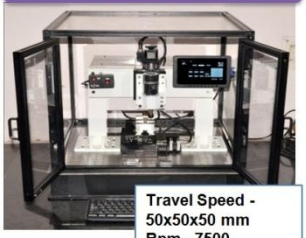
- Ceramic cutting tools
- Graphene based aqueous lubricant
- Die less hydro forming
- Multi fabrication machine
- 5 Axis milling machine
- Epoxy based composite propeller

Graphene lub



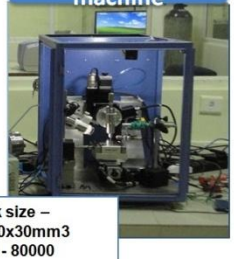
C.O.F – 0.04
Particle size – 3-4 micron

Multi fab



Travel Speed - 50x50x50 mm
Rpm - 7500

5 Axis milling machine



Work size – 20x20x30mm3
Rpm - 80000

Ceramic cutting tools

4X Improved Tool life

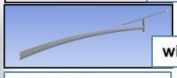
Cutting speed- 200 to 500 m/min

Composite Propeller

120% higher tensile strength

Die less Hydro forming

without



with

50% weight reduction

Projects in Near Net Shape Manufacturing

- Austempered ductile material (ADI)
- Rheo pressure die casting Technology
- Powder Injection moulding (PIM)

PIM component

Cu

Steel 4140

ADI component

ADI Crank shaft (35HP 3 Cylinder)
Achieved weight redn.: 8-10%

Rheo casting

Valve housing (ADC-12)
Material saving – 15 to 20%

PIM component

Arrow Heads made of 316L powder

Nozzle of MMD

12 angular holes of dia 10mm with 10µm tolerance

Components of Actuator

20µm tolerance in hole PCD & face Perpendicularity

Components of fish-fin like bio-mimetic actuator

Component min size 1 mm.

LINAC Vanes and Fixtures

950

Non uniform machining with 20µm tolerance in 950mm length

Knee and Hip Implants

Patient specific fixture less implants

Moulds Components

PDC Fan Mould and Component

Micro-PIM mould of surgical tool

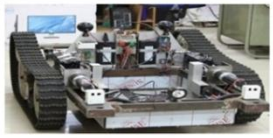
Injection moulded components

CSIR-CMERI

Product developments

Robotic wheel chair

All Terrain Mobile Robot



6

Small Tractor

Motor cycle driven plough

Soleckshaw

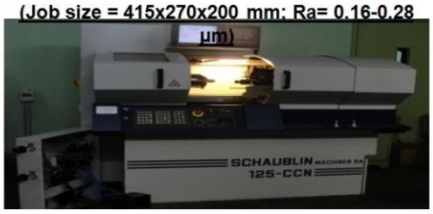
12

CSIR-CMERI

Facilities

Precision CNC turning m/c

(Job size = 415x270x200 mm; Ra= 0.16-0.28 µm)



4-axis CNC milling m/c

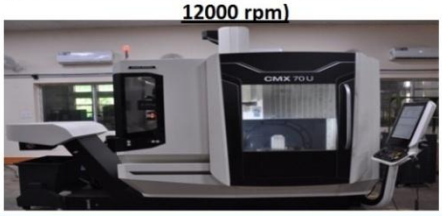
(Job size = 400x350x480 mm; Spindle speed: 60-6000 rpm)

Submerged Wire-EDM

(Job size = 725x560x215 mm; Ra= 0.18-0.25 µm)

Universal 5-axis CNC Machining centre

(Job size = 750x600x520 mm; Spindle speed: 50-12000 rpm)



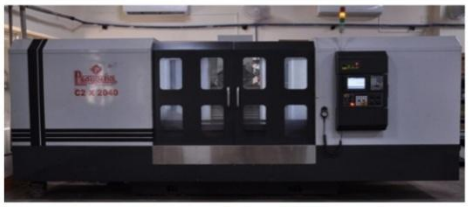
13

Precision CNC cylindrical grinding m/c

(Job length = 500mm; Wheel speed = 1600 rpm)

Precision 3-axis CNC universal grinding m/c

(Job length = 1150mm; Table speed = 2.5-25 m/min)

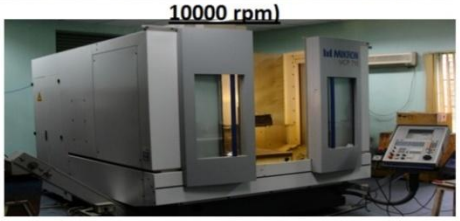


PLC 3-axis surface grinding m/c

(Job length = 700mm; Table speed = 2.5-25 m/min)

3-axis CNC vertical milling m/c

(Job size = 710x500x500mm; Spindle speed:50-10000 rpm)



CNC Plasma Cutting m/c

(Rapid feed control; Job size = 3000x1500 mm)

Submerged Wire-EDM

(Job size = 725x560x215 mm; Ra= 0.18-0.25 µ)

PLC Pipe bending m/c

(Feed control; Job size = 1000 mm; max. ϕ 100mm OD)

Friction stir welding

(RPM – 3000 max , Travel speed – 3000mm/min, Bench size 600x600 mm)

Facilities

Casting setup (100 kg to 200 kg)

Plastic injection micro moulding m/c (9cc/shot)

Rheo Pressure Die Casting(3.5 kg)

Forging setup (500 T)

Foreign Universities/ Institutes/Labs

Attended as Visiting Scientist / Post Doctoral Position

UNIVERSITY OF MICHIGAN
ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
NORTHWESTERN UNIVERSITY
TEXAS A&M UNIVERSITY
DLR
MAX-PLANCK-INSTITUT FÜR POLYMERFORSCHUNG
Friedrich-Alexander-Universität Erlangen-Nürnberg
RWTH AACHEN UNIVERSITY
MAX-PLANCK-INSTITUT FÜR CHEMIE
UNIVERSITÄT BAYREUTH
TECHNISCHE UNIVERSITÄT BERGAKADEMIE FREIBERG
Die Ressourcenuniversität. Seit 1765.
ARTS ET MÉTIERS ParisTech
UNIVERSITY OF PISA
University of Waterloo
ACADEMIA SINICA
berlin
KYOTO UNIVERSITY FOUNDED 1897
THE UNIVERSITY OF SYDNEY
TECHNICAL UNIVERSITY OF LIBEREC
www.tul.cz
Universidad Pontificia Bolivariana

CSIR-CMERI

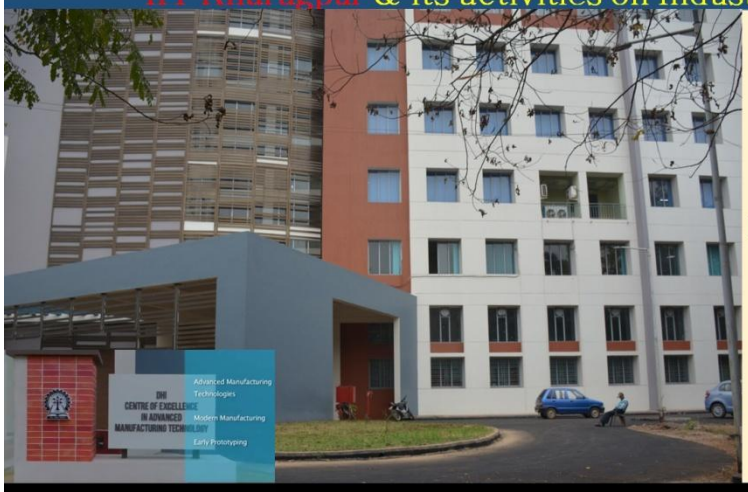
can offer

- Research & Development of new technology & products.
- Value added projects on the parts & the process plants.
- Certification courses & training programmes.
- PG Diploma, M.Tech. and Ph.D. programmes.

PPT 2: DHI Centre of Excellence in Advanced Manufacturing Technology

Prof. Surjya K Pal, PIC, DHI CoE AMT

DHI Centre of Excellence in Advanced Manufacturing Technology @ IIT Kharagpur & its activities on Industry 4.0



Prof. Surjya K Pal
PIC, DHI CoE AMT

@
EEPC INDIA
August 8, 2019

Centre of Excellence in Advanced Manufacturing Technology @ IIT Kharagpur

The Centre has been established under the support of *Department of Heavy Industry, Ministry of Heavy Industries & Public Enterprises*, and a consortium of *industry members*.

Total Project Cost
Rs 65.19 Cr

DHI Contribution
Rs 47.62 Cr

Consortium partners :

एच.ई.सी. HEC · TATA MOTORS · बीएचईएल BHEL · TATA STEEL · TATA SONS · TATA CONSULTANCY SERVICES

International adviser:

WMG THE UNIVERSITY OF WARWICK

Industry 4.0 : A research vertical of CoE

Focuses on :
- Corrosion and wear-resistant
- Light-weight materials
- Composites
- Electronic materials…

Focuses on :
- Design
- Manufacturing
- Automation

SPECIALTY MATERIALS

DESIGN & AUTOMATION

INDUSTRIAL IoT

ADDITIVE MANUFACTURING

DHI Centre of Excellence in Advanced Manufacturing Technology

Focuses on :
- Industry 4.0
- Digital twin
- Real time monitoring
- Computer integrated manufacturing

Towards an ecosystem for indigenous heavy equipment in mining, construction, automotive and aerospace

Focuses on :
- Prototyping forging components through additive manufacturing

Innovation Lab of CoE : To support the activities of Industry 4.0

*The **Innovation lab** houses several **state-of-the-art facilities** and is common for all the consortium members.*

*It facilitates the **culture of innovation, and open engineering**.*

- ***Opportunity for Start-ups***

✓ Innovation lab at CoE AMT can be utilized for their prototyping.

✓ End-to-end support from the experts of the CoE.

Cost of the Innovation Lab
Rs 24.87 Cr

State-of-the-art facilities : Additive & Digital Manufacturing, Reverse engineering, unobtrusive sensing systems, Robot assisted facilities..

Hybrid Additive Manufacturing

- ✓ *5-axes CNC machine tool with subtractive machining & direct laser deposition based additive system & MasterCAM Mill 3D professional software .*
- ✓ *Capability of building mid to large 3D parts by using metal powders in controlled atmosphere.*
- ✓ *Equipped with an Ytterbium Fiber laser of 2 kW.*

Make: Optomec
Model: LENS 860 Hybrid Machine

CT Scan System

- ✓ *450 kV CT system with large scanning area.*
- ✓ *Dual detectors for bigger objects and instant 2D and 3D imaging systems.*
- ✓ *Software for CT acquisition, reconstruction, metrological analysis, co-ordinate measurement, wall thickness measurement etc.*

Make: GE Technologies
Model: Phoenix V/tome/x c

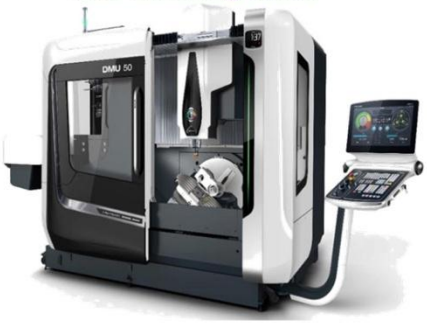
State-of-the-art facilities : Additive & Digital Manufacturing, Reverse engineering, unobtrusive sensing systems, Robot assisted facilities..

5 MP Blue light Scanner

- ✓ *Blue LED technology scans many surface types*
- ✓ *5 million points per scan*
- ✓ *5 interchangeable lenses*
- ✓ *Fast scanning, high accuracy and portable*
- ✓ *Rotary table for automatic scanning*

Make: Zeiss
Model: Zeiss Comet 5M

CNC Machining Centre

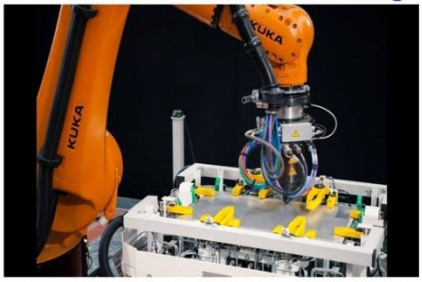


- ✓ *Industry 4.0 enabled with accuracy up to < 6 µm*
- ✓ *Optimized ergonomics and design*
- ✓ *Larger machining compartment*
- ✓ *Improved cooling in all drives and guides*
- ✓ *Direct path measuring system in all five axes*

Make: DMG Mori
Model: DMU 50

State-of-the-art facilities : Additive & Digital Manufacturing, Reverse engineering, unobtrusive sensing systems, Robot assisted facilities..

Robot-assisted Micro Friction Stir Welding Machine



- ✓ ***Industry 4.0 enabled FSW machine assisted by a 500 Kg payload robot with a reach of 2830 mm.***
- ✓ *Suitable for* ***micro-size jobs & dissimilar materials.***
- ✓ ***6D force sensor for monitoring forces and torque in all three directions.***

Make: KUKA
Model: KR 500 R2830 MT

UTM

- ✓ *State-of-the-art 50 kN tensile-compression-fatigue-creep testing unit along with non-contact video extensometer.*
- ✓ *Specimen tensile testing at 1200 °C.*
- ✓ *Low cycle creep fatigue tests under strain*

Make: Zwick Roell
Model: Kappa 100 SS-CF

State-of-the-art facilities : Additive & Digital Manufacturing, Reverse engineering, unobtrusive sensing systems, Robot assisted facilities..

Robotic 3D Laser Scanning Structural Vibration Test Station

- ✓ ***Frequency range: 0-100 kHz.***
- ✓ *3D laser scanning vibrometers* ***mounted on a multi-axis industrial robot,*** *payload= 90 Kg & controlled axes= 6 + 1 (****linear track of 4 m length****).*
- ✓ ***Software for incorporating FE geometry, external sensor data, & modal analysis.***
- ✓ ***Software for analyzing signals in time domain and principal component analysis.***

Make: Polytec
Model: PSV-500-3DH

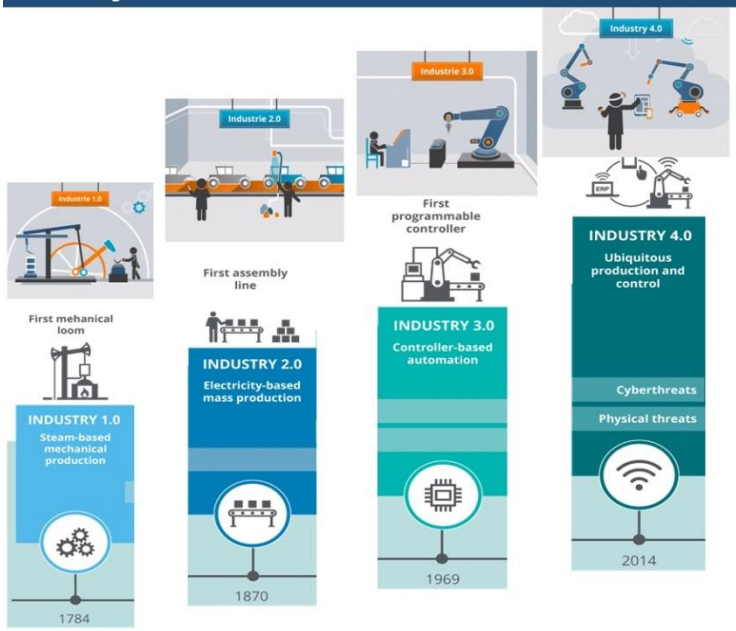
Acoustic Holography Facility

- ✓ *Complete system for real-time noise source identification (NSI) that can be used for both stationary and non-stationary measurements.*
- ✓ *Consists of a hand-held array, LAN-XI data acquisition hardware, BK Connect software.*

Make: B & K
Model: 9712-W-FEN

Projects under DHI CoE AMT
on
Digital Manufacturing & Industry 4.0

Industry 4.0

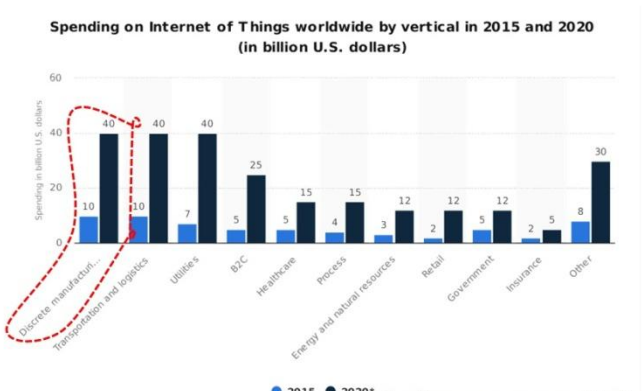


Seamlessly operating robots

Connected machines
in one shop floor

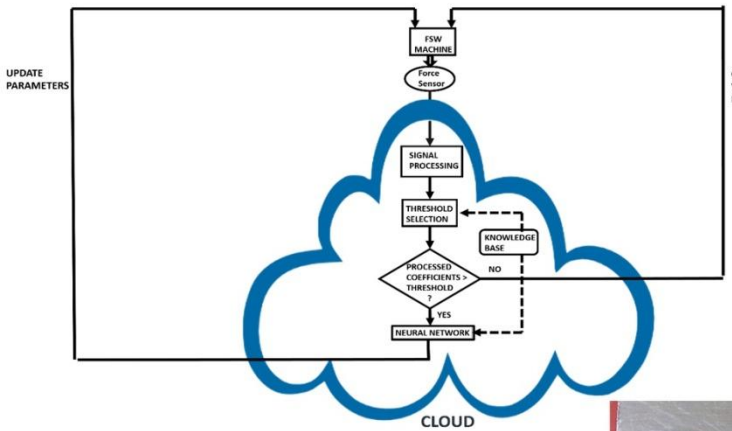
Project: Remote monitoring and real time control of defects in friction stir welding process and preventive health monitoring of friction stir welding machine. Industry Partner: TCS

Problem statement: *Development of an integrated, unobtrusive, multimodal sensing unit that can coherently acquire sensors' data to be analyzed in a composite engine for descriptive, diagnostic, and predictive analyses of machinery condition to optimize and take informed decisions.*



https://www.newgenapps.com/blog/8-uses-applications-and-benefits-of-industrial-iot-in-manufacturing

Real time control of defects using single sensor



Cloud-based remote and real time defect monitoring and control architecture

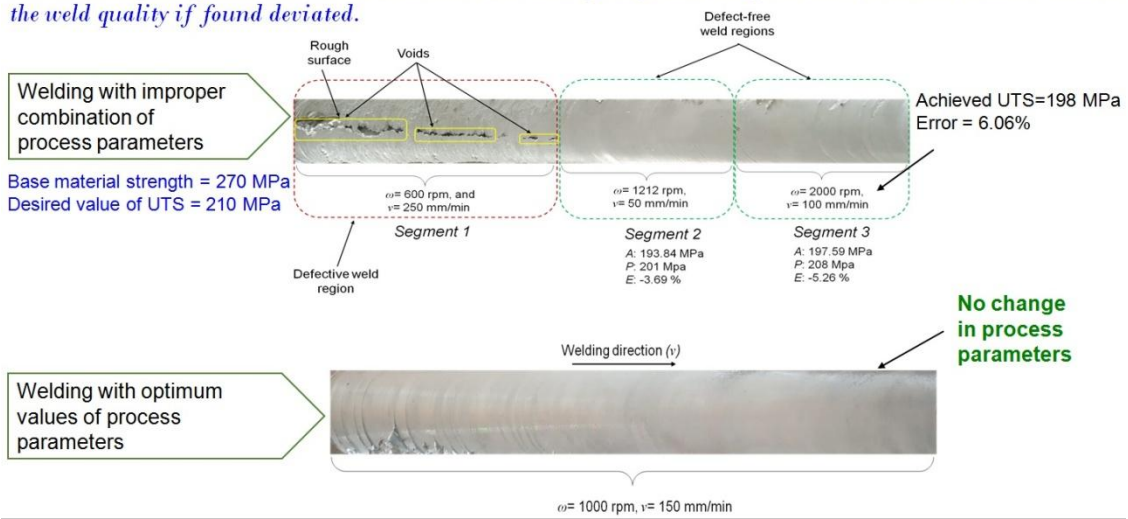
Patent filed on 30th December, 2017

Demonstration Video

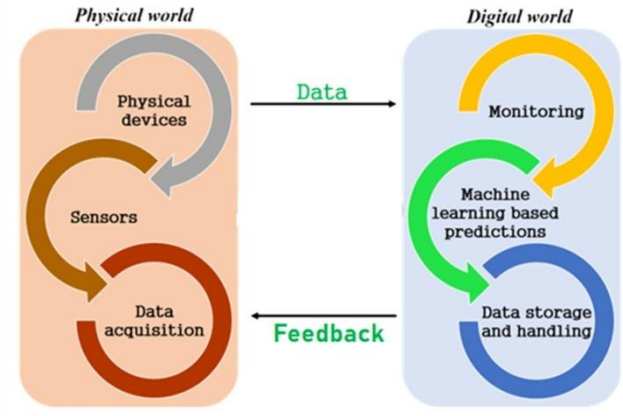
Welded sample's surface image

Real time control of defects using multiple sensors

A multiple sensors' (force, torque, and power) model has been developed which takes data from these three sensors as inputs, predicts the UTS to monitor the weld quality, and compares with a desired value to control the weld quality if found deviated.



Machine health prediction: Digital twin concept

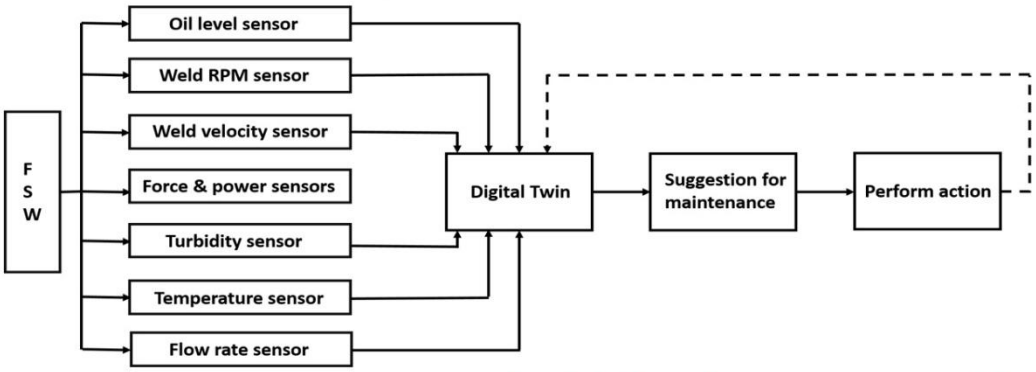


Framework of DT: Interaction between digital world and physical world

- *The DT is a virtual and a digital model of a physical process.*
- *It is mapped through the sensors' information, acquired in real time from the physical process.*
- *It can run simulations for various purposes*

Digital twin model for FSW

A simple digital twin has been developed for the existing FSW machine.



The digital twin of the FSW machine ***acquires data through sensors***, detects ***machine faults*** with signal processing techniques and ***suggests maintenance actions*** to be taken with the help of embedded machine learning algorithms.

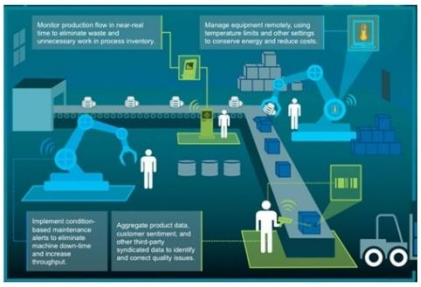
DIGITAL TWIN model

Project: Digital manufacturing and industrial internet of things for enhanced supply chain co-ordination, quality and maintenance. Industry Partner: TATA Sons

Problem statement:

To understand, build a framework and analyze the solution for

- *IoT in Supply Chain Management*
- *IoT in Manufacturing Operating Efficiency*
- *IoT in Predictive Maintenance*
- *IoT in Inventory Optimization*



Digital manufacturing Lab

Key Features:

- Manufacturing (Machining process)
  CNC Milling and CNC Turning
- Inspection / Quality Control
  Vision Control System
- Assembly/Raw Material & Finished Good Storage
  Industrial Robot, Storage and Retrieval System
- Material handling & Transfer Systems
  Industrial Robot, RFID System, Conveyor Belt
- Sensors
  Vibration, Temperature and Proximity for Sensing manufacturing Data

✓ Objectives :

- Sensing various data of the manufacturing process – using different sensors.
- Data storage, retrieval, manipulation and presentation- using IoT gateway.
- Application of Data Science, Machine Learning, Optimization for achieving the goals of all **four modules** of the project.
  1) IoT in Supply Chain Management 2) IoT in Manufacturing Operating Efficiency 3) IoT in Predictive Maintenance
  4) IoT in Inventory Optimization

IoT in manufacturing efficiency

- True capacity assessment of tier-1 vendor for excavator parts using simulation accounting for cycle time, breakdowns, material availability and identify room for efficiency improvement

- Understanding failures by mining downtime logs for Centrifugal Casting Machine (CCM)

Thank you

For more information about the Centre, please contact us at:

+91-3222-281984

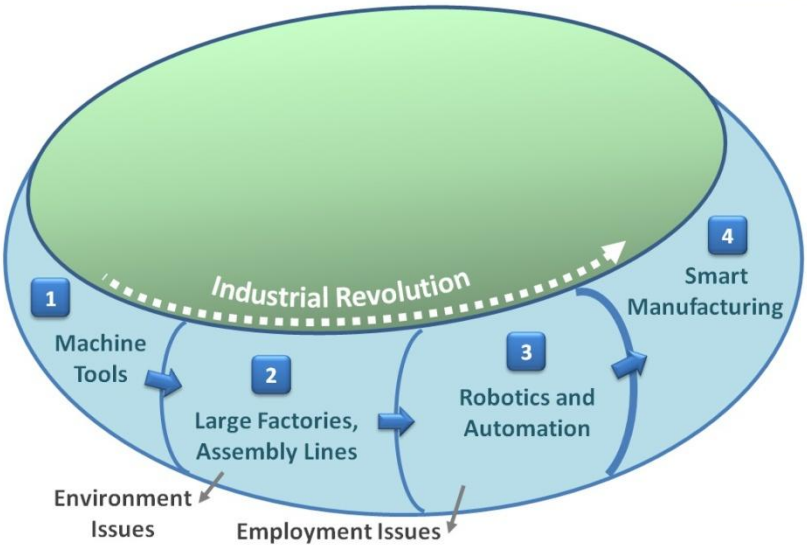
coeamt@iitkgp.ac.in

www.coeamt.com

PPT 3: Smart Foundry 2020

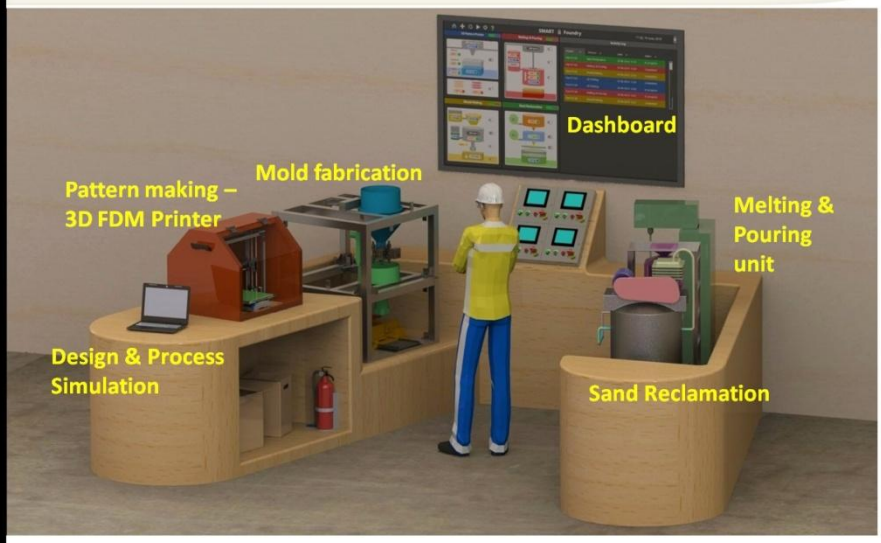
Dr. Savithri, NIIST

Manufacturing Industry – Evolution



Contributing to 'Make in India' Mission

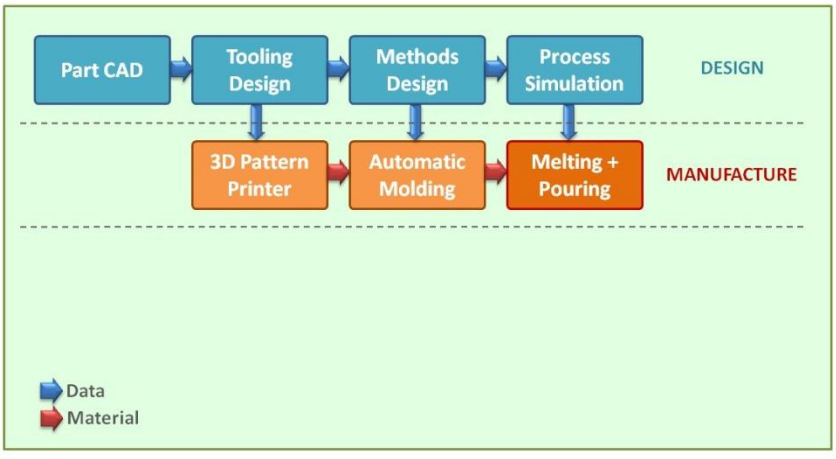
SMART Foundry



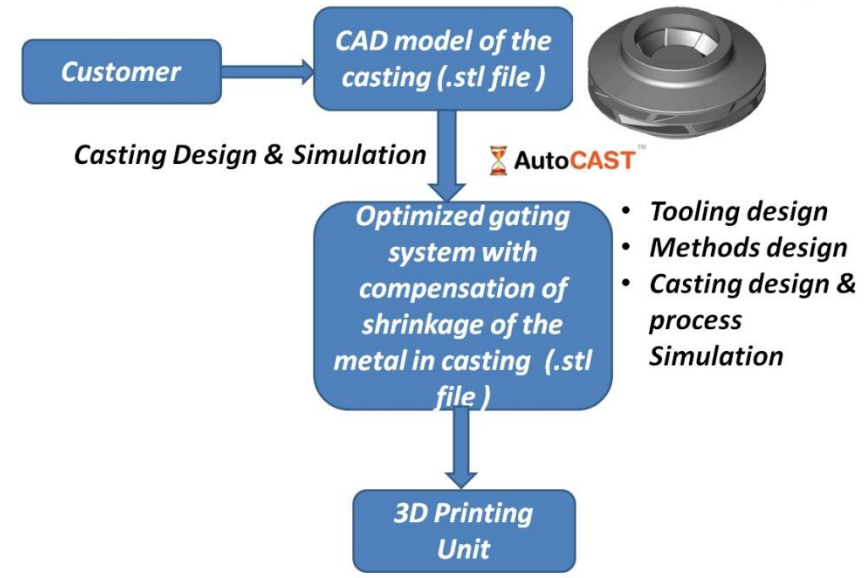
Goal: Ultra-compact SMART Foundry, for sensor-driven automatic and economic production of small intricate metal parts with high quality

SMART Foundry: Software + Hardware + Cloud

SMART: **S**ustainable **M**etalcasting by **A**dvanced **R**esearch & **T**echnology



SMART Foundry -Process Flow Chart



SMART Foundry -Process Flow Chart

Software | **Casting Process Simulation** | **CSIR-NIIST & 3DFT**

AutoCAST X1

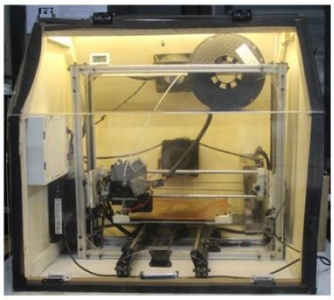
Multi-Physics Casting Process Simulation :

Simulates a variety of casting processes for ferrous and non-ferrous alloys

SMART Foundry -Process Flow Chart

3D Printing → **Dimension checking & polishing the surface**

3D FDM Plastic Pattern Printer



Pattern is handed over to the mold making team

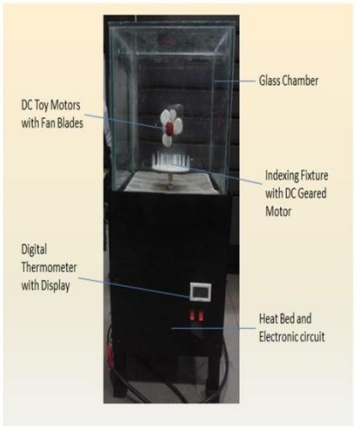
Molding Unit

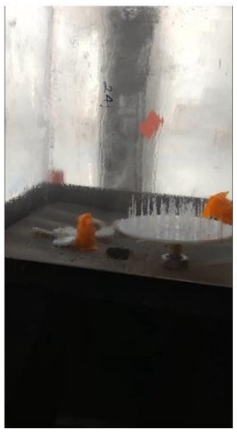
Novel Features:

Enclosure to take care of warping, adhesion between layers

New design of nozzle, Controlled by open-ware slicing software.

SMART Foundry – Vapour polishing – add-on unit





A patent has been filed E-2/102/2018/MUM

SMART Foundry -Process Flow Chart

Process Flow Chart

Molding Unit → Sand container, Sand mixing, mold box & ramming device

Sand container, Sand mixing, mold box & ramming device → Verification of the hardness, permeability of the mold etc. → Melting & bottom pouring Unit

The mold box with cavity will be moved below the melting Unit

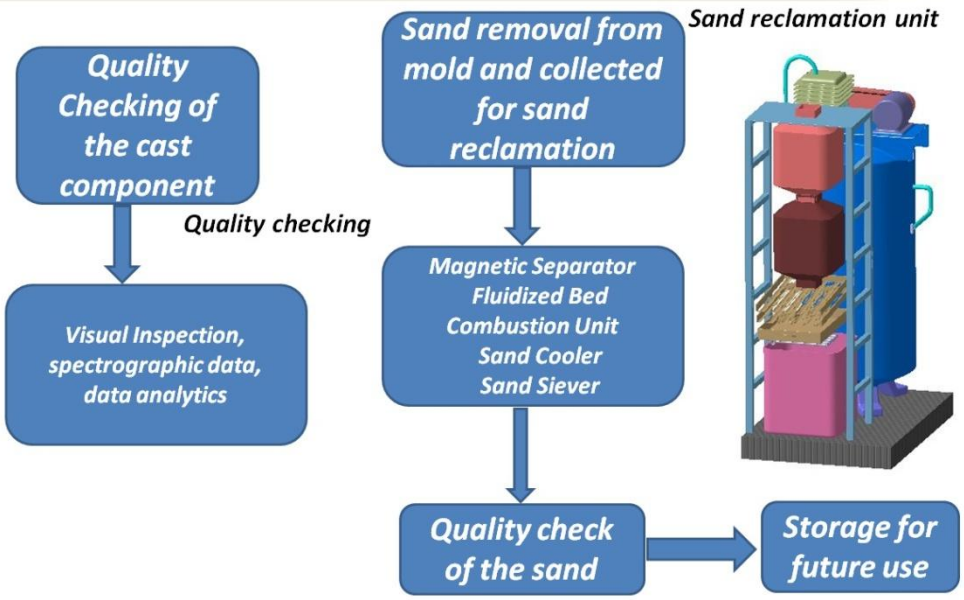
Process Flow Chart

Melting & Pouring Unit → Heating the furnace, melting the material in the crucible

Particle add-on unit
Stirring unit
Vacuum unit
→ Add-on options → Bottom pouring

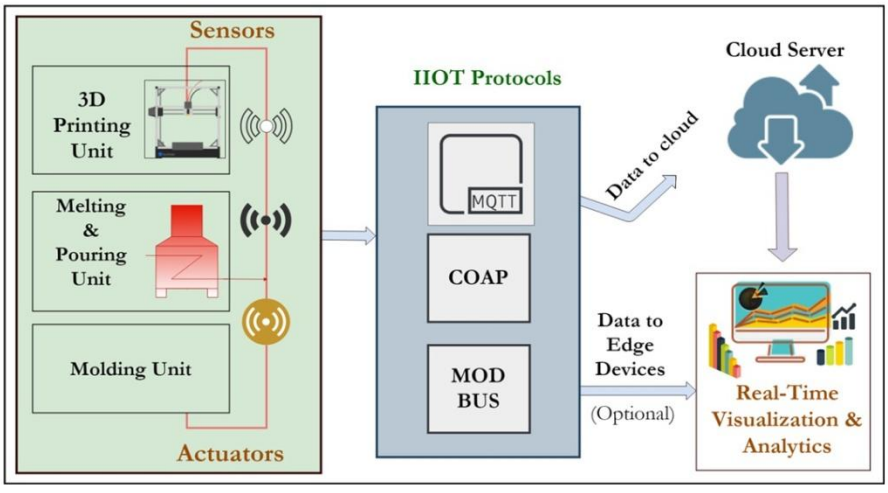
Cast component removed after solidification and cooling

Process Flow Chart



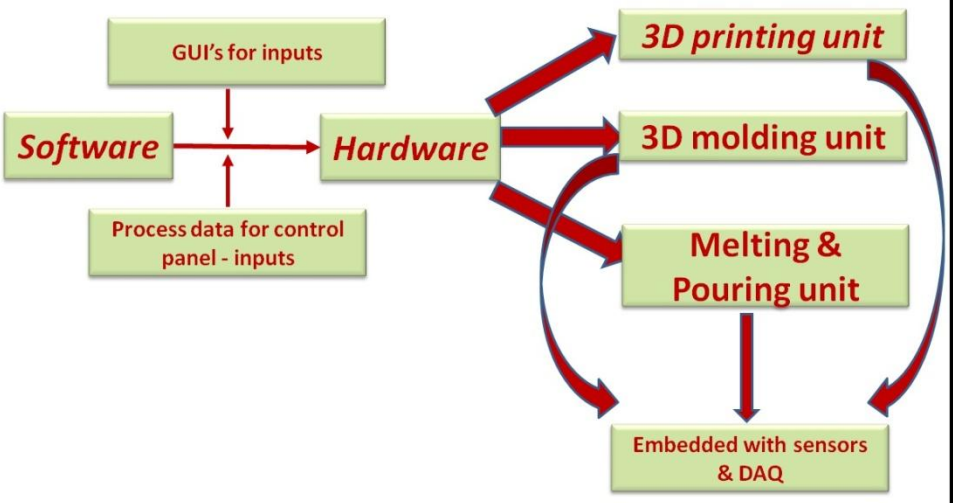
Cast component ready for use if there are no defects or rejected

SMART Foundry – IOT based SF Platform

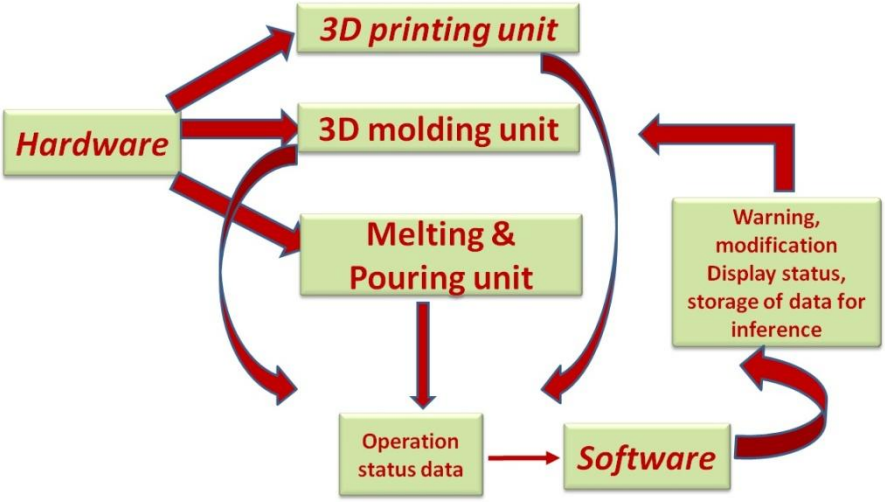


- IOT based SF Platform for *sensing and streaming of data for all the hardware units*

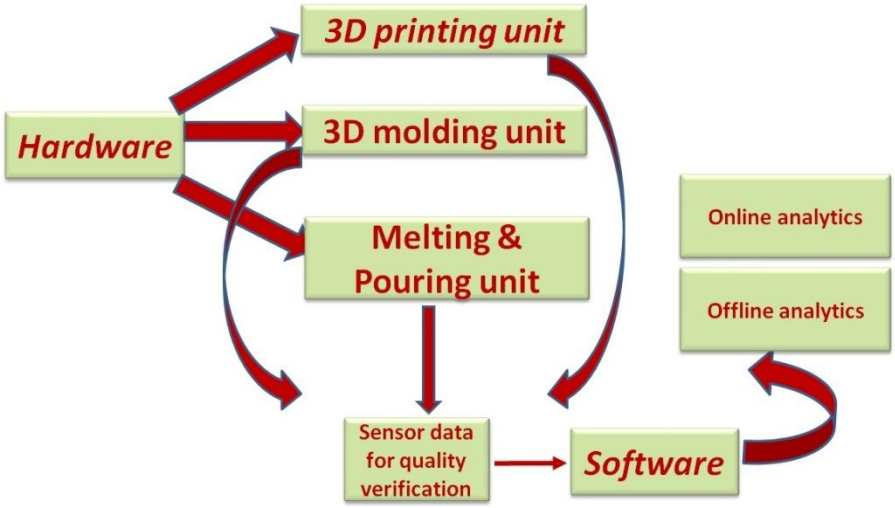
SMART Foundry – Data flow Diagram



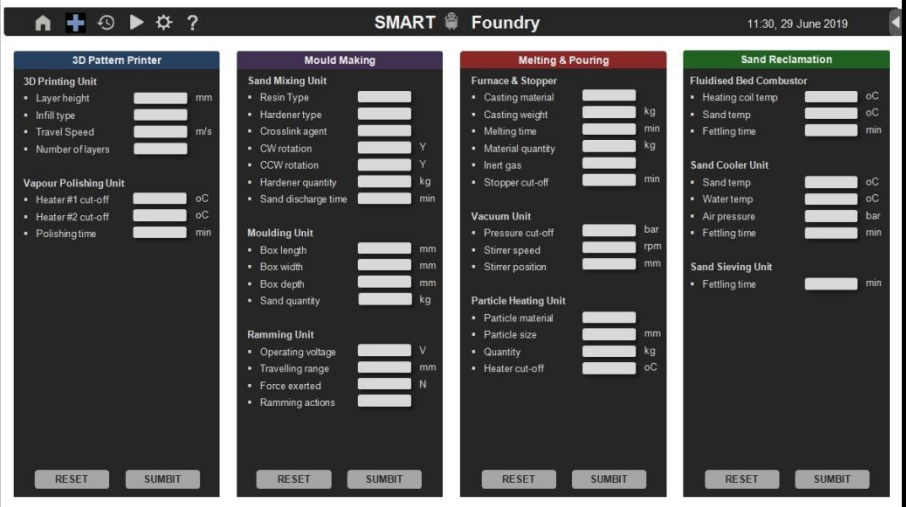
SMART Foundry – Data flow Diagram



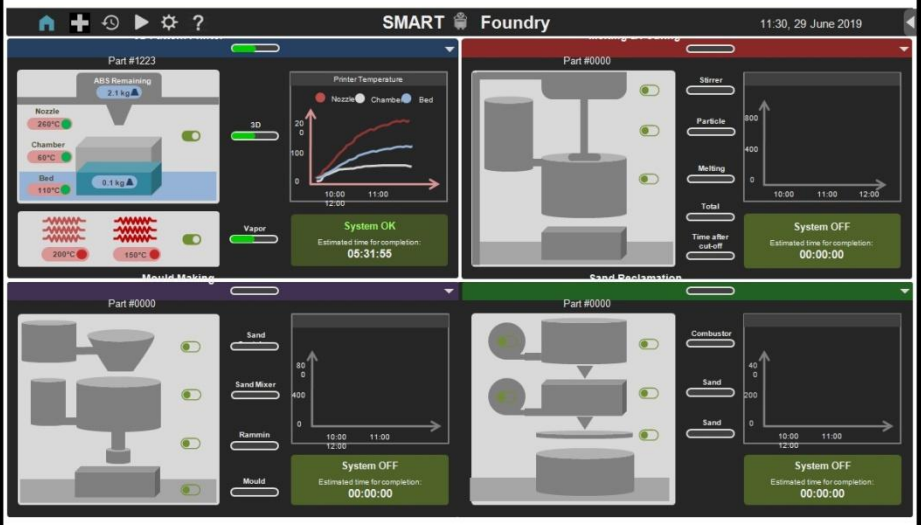
SMART Foundry –Data flow Diagram



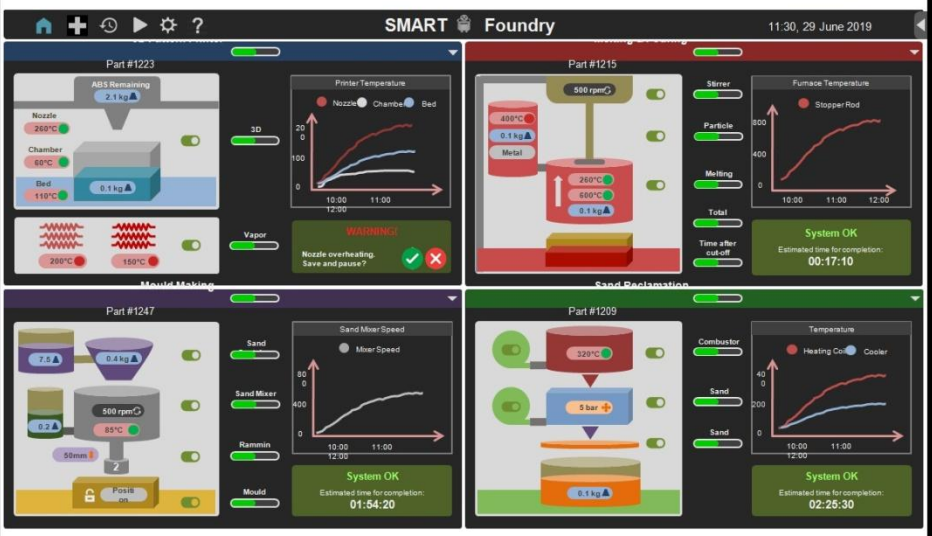
SF DASH BOARD



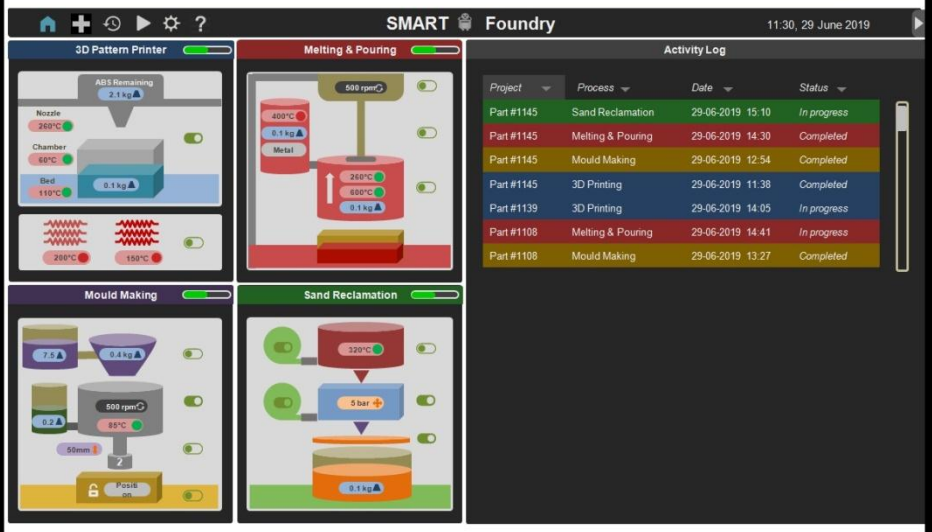
SF DASH BOARD



SF DASH BOARD

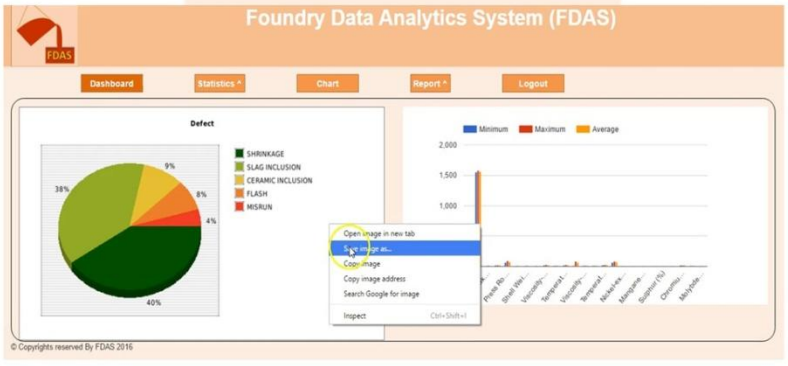


SF DASH BOARD



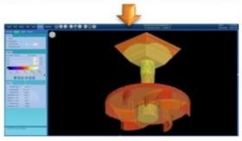
SMART Foundry – Offline data analytics

FOUNDRY DATA ANALYTICS ENGINE

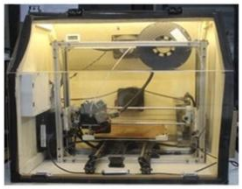


Project Significance and Impact

- Unique inter-disciplinary multi-institutional translational R&D project
- Involves IIT, NIT, Govt & Private Institutes, CSIR Labs and SMEs
- Integration of novel software and hardware products
- Demonstrate smart and sustainable manufacturing
- Suitable for training and entrepreneurship



3D CAD and Simulation



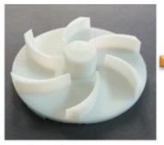
3D Printing

Melting + Pouring

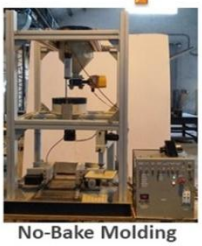
25-year old
25 sq. m space
25 lakh budget

CAD to first part: Less than 8 hours

Less than 5% cost of Metal 3D Print



Plastic Pattern



No-Bake Molding

Cast Part

SMART FOUNDRY beyond 2020 – IIOT Enabled

Casting Design & Methoding
(SS @ Trivandurm)

Board
(BR @ Mumbai)

Regularities
(@ New Delhi)

Process Data Analytics
Pre-production - (EJ @ Triv.)
Post production: (AS @ Gj)

Cloud

Sand Reclaimer & Quality Manager
(VS @ Kollhapur)

3D Printing of Pattern
(SS @ Trivandurm)

Mold Making
(CMERI @ Durgapur)

Melting casting
(Mayur @ Anand)

SMART FOUNDRY – SHOWCASING – IFC Gandhinagar-2018

SMART FOUNDRY – SHOWCASING – Rajkot – Workshop on smart manufacturing & Industry 4.0 – CMTI

PPT 4: Embracing Industry 4.0

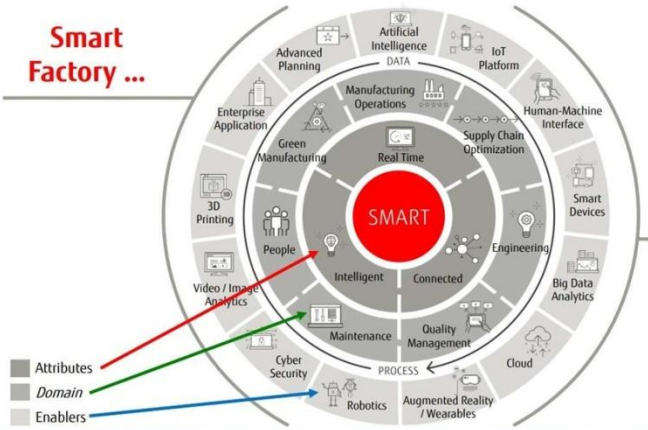
Purnendu Sinha, PhD, FIE

Embracing Industry 4.0

Purnendu Sinha, PhD, FIE
Tata Group Technology & Innovation Office
psinha@tata.com

The views expressed in this presentation are solely those of the author.

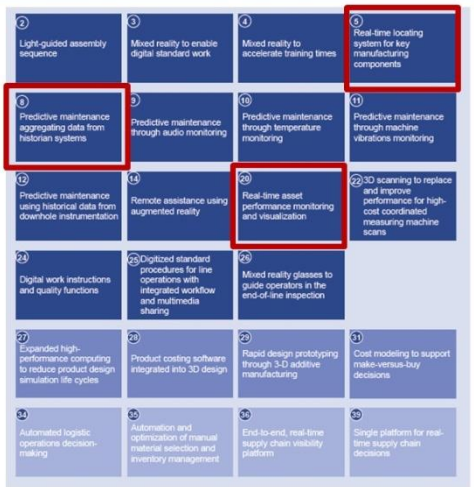
Technologies Foundational in Industry4.0



... is a journey to gain actionable intelligence and optimize operational effectiveness continuously in an interconnected value chain

What new technology does is create new opportunities to do a job that customers want done.

WEF Lighthouse-Factories - Use Cases Pursued

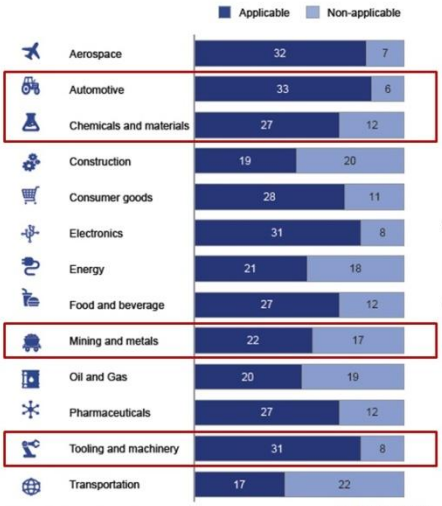


Agility and responsiveness

Resource productivity and efficiency

Source: World Economic Forum and McKinsey

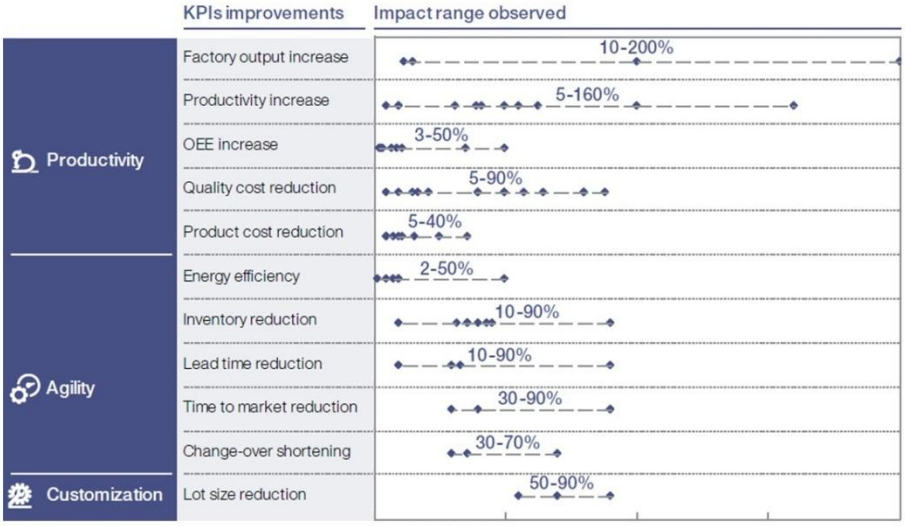
Use cases by industry and cross-industry applicability



Over 80% of use cases are applicable in other industries besides the one from their example, thus indicating an opportunity for cross-industry collaboration in use-case exchange and development.

Source: World Economic Forum and McKinsey

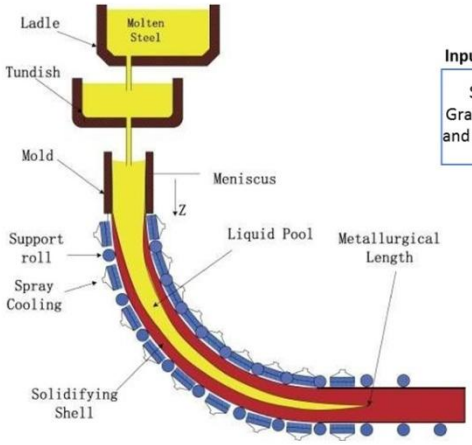
The Benefits of Industry 4.0 are Real!

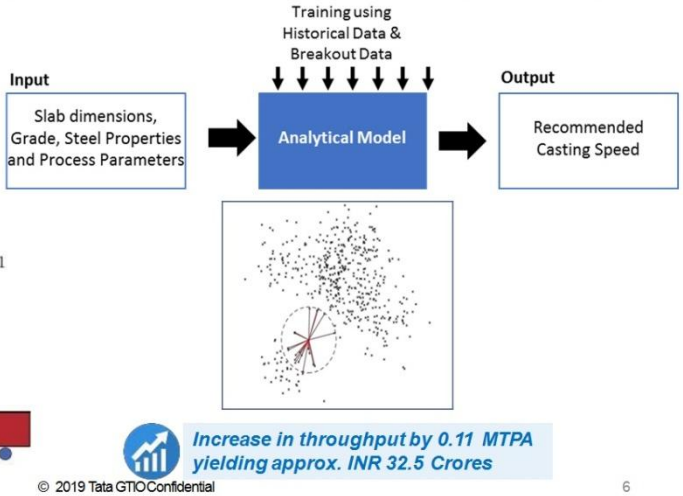


Source: World Economic Forum and McKinsey

Steel Manufacturing: Casting Speed Optimization

Recommend maximum/optimum casting speed without impacting reliability





Increase in throughput by 0.11 MTPA yielding approx. INR 32.5 Crores

Escaping Pilot Purgatory

- ✓ Approach the opportunity **"bottom-line value backwards"** – rather than technology forward
- ✓ Form the **comprehensive target-state technology stack** that is scalable
- ✓ **Drive the transformation from the top** and communicate results and success stories
- ✓ Approach digital holistically with a **clear vision** and develop a **phased road map**
- ✓ Build and lead a **focused ecosystem of technology partners**
- ✓ **Get ahead of the capability gap** and build the culture to sustain it

SOURCE: McKinsey

Concluding Remarks

- Digitization is enabling new business and revenue models that may be difficult to support without rapidly embracing new technologies.
- Boost operational efficiency
  - New levels of visibility acrossprocesses
  - Identify bottlenecks and inefficiencies
  - Translate these insights to actions

Thank You…

Annexure 4: Photos of Industry 4.0


technologyCentre
EEPCINDIA
ENGINEERING THE FUTURE
AWARENESS PROGRAMME
ON INDUSTRY 4.0
Indian engineering


technologyCentre
EEPCINDIA
ENGINEERING THE FUTURE
AWARENESS PROGRAMME
ON INDUSTRY 4.0
Indian engineering
EEPCINDIA


EEPCINDIA
AWARENESS PROGRAMME
ON INDUSTRY 4.0


EEPCINDIA
AWARENESS PROGRAMME
ON INDUSTRY 4.0


EEPCINDIA
ENGINEERING THE FUTURE
technologyCentre
AWARENESS PROGRAMME
ON INDUSTRY 4.0
Indian engineering


technologyCentre
AWARENESS PROGRAMME
ON INDUSTRY 4.0
Indian engineering


technologycentre
AWARENESS PROGRAMME
ON INDUSTRY 4.0


technologyCentre
AWARENESS PROGRAMME
ON INDUSTRY 4.0


technologyCentre
EEPCINDIA
ENGINEERING THE FUTURE
AWARENESS PROGRAMME
ON INDUSTRY 4.0
Indian
engineering


technologyCentre
EEPCINDIA
AWARENESS PROGRAMME
ON INDUSTRY 4.0
Indian engineering


technologyCentre
AWARENESS PROGRAMME
ON INDUSTRY 4.0
Indian engineering