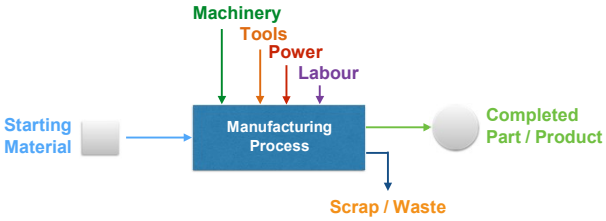
Smart Manufacturing

1

Manufacturing



Manufacturing as a **Technological Process**

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Manufacturing Production

All Manned Stations with Manual Operations

- Manual material handling
- Verbal instructions
- Visual inspection
- Paper information
- Manual tool & operations
- Quality - person dependent

CHALLENGES

Productivity **Decision**
Skill **Variety** **Fatigue** **Quality**
Safety **Traceability**

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Industrial Revolutions

Produce More to meet Societies need in the defined **time** frame

Technological developments improved quality of life

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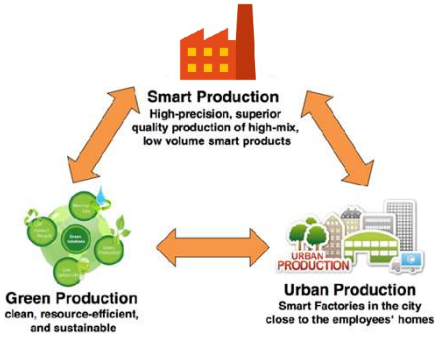
Smart Manufacturing

Smart, Green, and Urban Production



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Smart Manufacturing

Ability to **evolve** and **grow** along with **challenging** needs of the organization

- Shifting customer demands
- Expansion into new markets
- Development of new products & services
- More predictive & responsive approach to operations and maintenance
- Incorporation of new processes / technologies
- Near real time changes to production

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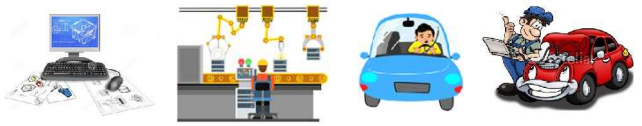
Smart Manufacturing

Smart manufacturing will **transform** how products are



Designed	Manufactured	User	Serviced
• Collaborative Design • Generative Design • CAE	• Autonomous operations • Data driven manufacturing • Flexible Manufacturing • Real-time changes	• Consumer Data • Remote monitoring • Remote diagnosis	• Fault diagnosis • AR guided maintenance • Part failure data • Improvement suggestion

Manufacturing with Intelligence

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Smart Manufacturing Technologies

IIoT | RFID | Augmented Reality | Cyber Physical System

3D Printing with Multi-material capability | Collaborative Robots (Cobots) | Network Security | Industrial Safety

Smart Sensors | Computer Vision | Manufacturing Analytics | Digital Twin

Predictive Maintenance | Edge Computing | Manufacturing Execution System

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Customised Manufacturing

Source: Adidas

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Smart Manufacturing

Economic Potential

Ability to
Accelerate **Corporate** **Decision-making**
and **Adaptation** processes

Agility

Ability to implement **changes**
in the company in **Real-time**

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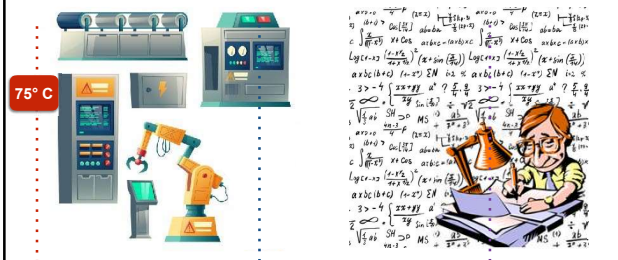
Adaptation

3:50



11:15 AM Insight Latency 12:05 PM Analysis Latency 1:35 PM

Event | Insight | Analysis

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Adaptation

Decision Latency 2:45 PM Action Latency 3:15 PM

Measures Approved | Measures Take Effect

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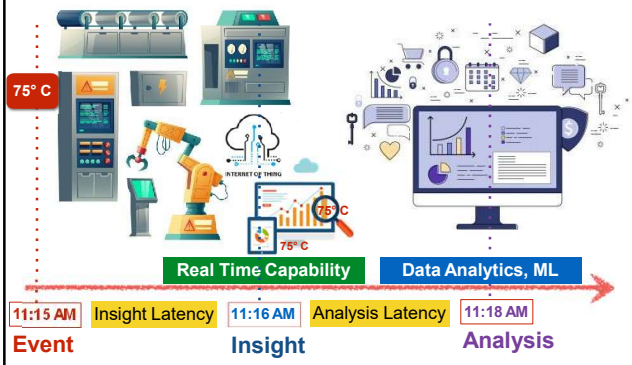
Adaptation



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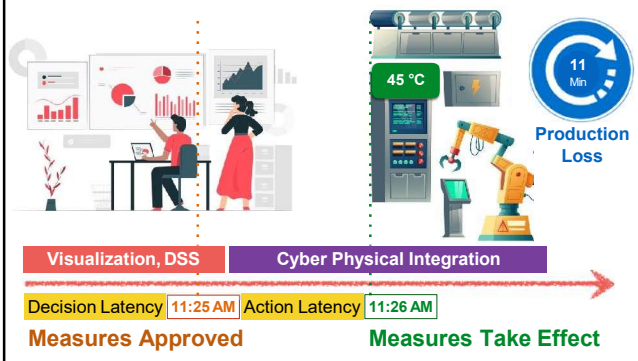
Adaptation



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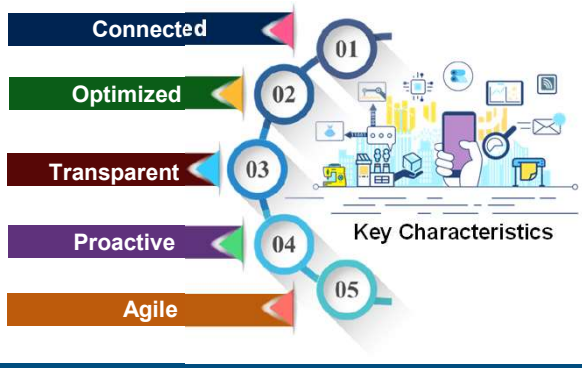
Smart Manufacturing



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Smart Manufacturing

Connected

Continuous pull location based **data** with **sensors**

Real time data-enabling **collaboration**

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Smart Manufacturing

Optimized

Reliable, predictable production capacity

Increased asset **uptime** and production efficiency

Automated production and material handling with minimal human interventions

Minimized **cost** of quality & production

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Smart Manufacturing

Transparent

- **Live metrics** and tools to support quick and consistent decision making

- Real-time linkages to customer **demand forecasts**

- **Transparent** customer order tracking

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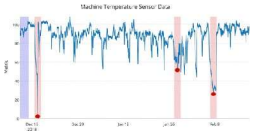
Smart Manufacturing

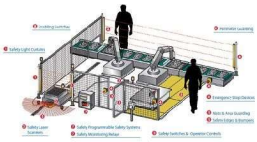
Proactive



- **Predictive** anomaly identification and resolution

- Automated **restocking** & **replenishment**

- Early identification of supplier **quality** issues

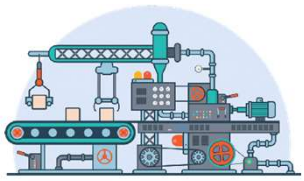


- Real-time **safety** monitoring

Smart Manufacturing

Agile

- **Flexible** and adaptable scheduling and changeovers



- Implementation of **product changes** to see impact in real time

- **Configurable** factory layouts and equipment

Smart Manufacturing

Rexroth
Bosch Group

Video Source: Bosch Rexroth

Challenges vs Technologies

Higher % Rejections
Lack of operations insight
Process variations
Extensive Rework

Low OEE
Unstructured information
Sub-optimal Process control
Long setup and production time

Unprecedented downtime
Un/Semi-skilled manpower
Machine Maintenance
Delayed Decision Making

Real Time Information
Data Visualisation
Data Analysis
Remote Maintenance
Smart Machine Interface
Augmented Reality
AI & Machine Learning
Additive Manufacturing
Collaborative Robots
Machine Vision

Smart Sensors

Need of smart sensors

Physical World → Smart Sensors → **Digital Insights**

By arming managers with **real-time information** about their **inventory**, **machinery**, and **purchased materials**,

Smart sensors create **visibility** across the supply chain and fuel **analytics** that can be used to understand and anticipate **demand**, **optimize sourcing**, and drive **high-value** manufacturing **decisions**.

Smart Sensors

Recent Developments

Analytics Tools — Extracting **insights** from sensor-created data is getting **easier** as **analytics** tools continue to improve.

Big Data — Handling and storing large, complex data sets is becoming more **manageable** through **Big data platforms**.

Real Time Processing — Tools enable **processing** and **analysis** of data on a **real-time** or a near-real-time basis, driving **timely decision making** and **action**.

New Algorithms — Algorithms continue to advance, expanding the **capability** to **predict** and **prescribe** courses of **action**.