Systems Approach to Realize Smart Manufacturing

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Smart Manufacturing Internationalization Forum 2020
Agenda

- What is Smart Manufacturing and why it is needed?
- Technology Trends behind Smart Manufacturing?
- Why Systems Approach?
- Smart Manufacturing Activities in IEC
- Smart Manufacturing Activities in Japan
- Conclusion
What is Smart Manufacturing and why it is needed?
Definition of Smart Manufacturing

- Definition (Agreed by ISO and IEC)
  - Discussed between ISO SMCC (Smart Manufacturing Coordinating Committee) and IEC SyC Smart Manufacturing

Manufacturing that improves its performance aspects with integrated and intelligent use of processes and resources in cyber, physical and human spheres to create and deliver products and services, which also collaborates with other domains within enterprises’ value chains.

Note 1: Performance aspects include agility, efficiency, safety, security, sustainability or any other performance indicators identified by the enterprise.

Note 2: In addition to manufacturing, other enterprise domains can include engineering, logistics, marketing, procurement, sales or any other domains identified by the enterprise.
Why Smart Manufacturing?

- **Change of market demand**
  - From products to experience
    - Consumers enjoy experience through products
  - Mass customization
    - To produce goods and services to meet individual customer's needs with near mass production efficiency

- **Reduction of time to market**
  - Flexible manufacturing
    - To follow market change as early as possible

- **Globalization of supply chain**
  - Supply chain expands beyond enterprise and country boarder

- **Emerging technologies which are the enablers of Smart Manufacturing**
  - IIoT, AI, DLT, …
Technology Trends behind Smart Manufacturing?
Merger of IT and Automation

ERP = Enterprise Resource Planning  MES = Manufacturing Execution System  SCADA = Supervisory Control and Data Acquisition  PLC = Programmable Logic Controller  I/O = Input/Output signals  Source: IoT Analytics

From Hierarchy to Network

Today

5-layer architecture

Future

Cyber-physical system (CPS) based automation

Network of Functions
Multiple Value Chains
Digital Twin

Cyber Physical System (CPS)

Physical manufacturing equipment + Digital model

Contains all the information relating to...
- Software, informatics
- Mechanics
- Electrical, electronics
- Automation, HMI
- Safety, security
- Maintenance
- Site location, identity
- Status
- SW version
- Interfaces
- ...

The digital model is always up-to-date and is extended throughout the entire life cycle

Product design, Production planning, Production engineering, Production execution, Services
Value Chain and Digital Twin

New added value
Product Information

Cyber World

Mapping

Physical World

Production System

Physical supply chain
Existing standards

Enterprise

Cyber supply chain

New standards

Enterprise

Products

Enterprise

A

B

C

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Why Systems Approach?
Why Systems Approach?

- **Multiple technologies** are required and they are **converging**
- **Collaboration** of multiple systems are required
- **Gaps and overwraps** among existing standards (may) exist
Smart Manufacturing Activities in IEC
SyC Smart Manufacturing history

- **SG 8 Industry 4.0 – Smart Manufacturing**
  - June/2014: established based on the recommendation of ahG49

- **SEG 7 Smart Manufacturing**
  - June/2016: established based on the recommendation of SG 8

- **SyC Smart Manufacturing**
  - **Feb/2018**: established based on the recommendation of SEG 7
  - Nov/2018: 1st plenary meeting in Germany
  - May/2019: Paris meeting (no plenary)
  - Oct/2019: Shanghai plenary meeting
  - **(Future) May/2020**: Tokyo plenary meeting
Smart Manufacturing related activities in ISO/IEC

SMB: Standard Management Board
SyC: Systems Committee
SM2TF: Smart Manufacturing Standard Map Task Force
TC: Technical Committee
SM: Smart Manufacturing
SMCC: SM Coordinating Committee

TC65: Industrial-process measurement, control and automation
TC65/WG23: SM Framework and System Architecture
JWG21: SM Reference Model(s)

SC41: IoT related technologies

OF1: (SM2TF)

TC184: Automation systems and integration

JTC1

TMB: Technical Management Board
Smart Manufacturing Reference Models (JWG21)
Smart Manufacturing Standards Map (SyC SM/OF1)

More than 600 standards are listed.
SyC SM Structure

- **Officers**
  - Chair: Udo Bausch (DE)
  - Secretary: Alexander McMillan (US)
  - Technical Officer: Gennaro Ruggiero (CO)

- **Working Groups**
  - CAG1 Chair's Advisory Group; Convener: Udo Bausch (SyC SM Chair)
  - WG1 Use Cases & Supporting IT Tools; Convener: Lu Ding (CN)
  - WG2 Terminology; Convener: Maurice Wilkins (UK)
  - WG3 Navigation Tools for SyC SM; Convener: Youichi Nonaka (JP)
  - AG1 Marketing, Outreach and Communication; Convener: Yun Chao Hu (DE)
  - AhG 5 SRG Review; Convener: Alec McMillan (SyC SM Secretary)
  - OF 1 Smart Manufacturing Standards Map (SM2); Convener Udo Bausch (ISO), Joseph BRIANT (IEC)
WG Tasks

- **WG1 Use Cases & Supporting IT Tools**
  - Facilitate the **collection, storage and distribution** of SM use cases

- **WG2 Terminology**
  - Facilitate the **coordination and publication** of terminology used within SM deliverables

- **WG3 Navigation Tools for SyC SM**
  - Facilitate the **coordination and development** of supporting IT tools which will enable access to related use cases, standards and architectures within SM

- **AG1 Marketing, Outreach and Communication**
  - Facilitate to implement the tasks outlined in SyC SM/AhG 1/023-R1 meeting Report (*bidirectional communication to/from relevant entities*)

- **AhG 5 SRG Review**
  - Develop SyC SM response to the proposed SMB review of terms of reference
  - Develop SyC SM response to SMB masterplan implementation TF on subject of mapping tools

- **OF 1 Smart Manufacturing Standards Map (SM2)**
  - Define a **business case** to publish the content of the Standards Map according to this concept
  - Provide a recommendation to ISO/TMB and IEC/SMB to support the **realization and maintenance** of the Standards Map project
Navigation Tool (WG3)

To show a procedural guide with relevant international standards and harmonize existing models to guarantee openness and interoperability at each process in open eco-system development.
Relations of SyC SM Deliverables

Benefit for
- System users
- System vendors/integrators
- Standard developers

Navigation Tool (WG3)

Reference Models (JWG21)

Use Case Repository (WG1)

Standard Map (OF1)

Terminology (WG2)
Smart Manufacturing Activities in Japan
SyC SM Japan National Committee (Jan/2020)

Collaboration among Smart Manufacturing related Industry Associations. (MSTC, JEMIMA, …)
Conclusion
Conclusion

- Smart Manufacturing requires optimization across multiple systems
- Systems Approach is very effective for the standardization activities related to Smart Manufacturing
- Support and cooperation of SDOs are expected
Thank you