***SM systems characterization*** chaired by Dennis Brandl ([dnbrandl@brlconsulting.com](mailto:dnbrandl@brlconsulting.com)), MESA/BR&L Consulting and Marco Macchi ([marco.macchi@polimi.it](mailto:marco.macchi@polimi.it)), Politecnico di Milano, Department of Management, Economics and Industrial Engineering.

**FOREWORD**

With the introduction of the Smart Manufacturing (SM) concept, manufacturers are faced with a plethora of technologies that envision different ways to improve their manufacturing systems. Smart Manufacturing Systems Characterization (SMSC) enables unbiased models, tools, norms or guidelines to understand and analyze their systems and environment, to the final aim of prioritizing the investments in the new technologies; this, in turn, helps building an approach whose purpose is to support the identification of opportunities for improvement of the manufacturing systems through SM technologies.

As overall assumption, the manufacturers need to adopt a progressive introduction of the SM applications, systems, and hardware based on a composability of different technologies. Thus, the SMSC is an essential driver: the introduction of new technologies depends on understanding the actual readiness of the manufacturer to deploy the new technologies in its manufacturing system(s); this should be assessed/re-assessed to master the maturation process towards SM. In particular, SMSC methods are focused on the assessment of manufacturer’s capabilities, capacities, and readiness level to implement SM technologies and applications. Therefore, during the workshop, we will look at all these aspects with a specific focus on the technology maturity, process maturity, organizational maturity, personnel capability and maturity, which can be used to determine what aspects must be improved to effectively apply SM applications, systems, and hardware.

The vision of the group is to come up with a method for assessing a manufacturing system and its management practices, to identify the improvement opportunities and to recommend the SM technologies and standards for adoption by manufacturers. This will allow different outcomes, such as: i) to define a quantifiable measure/measurement process in order to drive the adoption of SM or, at least, to provide a proof of business value of SM; ii) to identify the steps required to be ready for SM; iii) to increase the efficiency and effectiveness of justifying, architecting/designing of SM systems in a manufacturing company.

**WORKSHOP ORGANIZATION: PURPOSE AND CRITERIA**

The purpose of the workshop is to focus on assessing a manufacturer’s capability, and readiness to implement SM. To this end, models, methods, standards, and guidelines will be discussed with the final objective to provide the instruments to assess the digital readiness of a company in terms of maturity and capability levels to develop SM.

The workshop is built based on the following criteria:

1. multiple viewpoints on SMSC, relying on the needs of manufacturers (for an assessment of their digital readiness) and the capabilities provided by SM concepts, technologies and standards;
2. an operational view of standards and technologies, driven by the SMSC as a mechanism to prioritize their usages;
3. the combined use of scientific knowledge and state of practices on maturity models, methods and/or standards as they are currently applied in manufacturing, to enable sharing criteria and principles for SMSC, with the final aim to envision a framework and a roadmap for future developments.

**WORKSHOP AGENDA AND EXPECTED OUTCOMES**

*Day 1*

Day 1 will focus on models, methods and/or standards for assessing the readiness of companies to implement SM.

The scope of the work will be built on the inspiring definition of SM as “the use of information and information technology to continuously improve manufacturing performance through all involved life cycles” (IEC SC65E AHG1), and will consider the wide variety of SM applications, ranging from factory/asset life cycle to product life cycle.

At the end of Day 1, a shared understanding of SMSC is expected. Two features will be particularly addressed in this day: i) SMSC as a “driver” that can be used to facilitate the introduction of the SM concepts, and related technologies and standards, in a company; ii) SMSC as a means usable to determine what must be done in a company prior to implementing SM concepts.

Overall, the goal of Day 1 deliverable will be to define the types of capability, maturity and readiness levels that make up a SM environment.

*Day 2*

Day 2 will focus on putting together the different types of capability, maturity, and readiness levels into a unified framework, specifying the models, methods and/or standards that can be applied for their assessment.

To gain a knowledge in practice, some selected maturity models / methods will be presented and adopted in tutorials. Owing to such a knowledge in practice, further features will emerge, allowing to ease the development of the framework.

Overall, the goal of Day 2 deliverable is to provide a framework that companies can apply in the SM journey, and one in which different company elements (IT, process, business, organization, etc.) can see how it applies to their departments.

**SMSC Workshop Agenda**

**Monday April 10**

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| **1:00-5:30**  **1:00-1:30** | ***Session 1st day***  ***Overview of SMSC to Date – Report out on SMSC, as a result of previous workshops***  Dennis Brandl and Marco Macchi |
| **1:30- 3:15** | ***Presentation 1 – SMSC as a “driver” to facilitate the introduction of the SM concepts, and related technologies and standards, in a company***  The session will allow to reflect on the use of SMSC as a “driver” to move the maturation process towards SM. It will enable to share the feature of SMSC as facilitator of improvements of the manufacturing systems through SM technologies and standards.  **Presentation Moderator:** TBD  **Presenters:** TBD |
| **3:30- 5:00** | ***Panel 1 – Understanding what must be done in a company prior to implementing SM concepts***  The session will allow to reflect on the requisites for the introduction of SM concept and technologies. SMSC will be used to this end, to determine what must be done in a company prior to implementing SM.  **Panel Moderator:** TBD  **Panelists:** TBD |
| **5:00-5:30** | ***Recap of Day 1- Discussion of Day 2 Expectations*** |

**Tuesday April 11**

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| **8:30-3:45**  **8:30-9:00** | ***Session 2nd day***  ***Overview of selected SMSC methods***  The session will provide a quick presentation of some selected SMSC methods; it will allow to reflect on the determination of the correct Readiness, Capability, or Maturity Level method to use.  **Presentation Moderator:** TBD  **Presenters:** TBD |
| **9:00- 11:30** | ***Tutorial 1 – Practicing SMSC methods and reflecting on the lessons learnt from practice***  The session will provide a practical session in order to get experience from the use of selected SMSC methods; it will allow to reflect, in practice, on the determination of the correct Readiness, Capability, or Maturity Level method to use, and on the different dimensions of analysis that should be considered for characterization.  **Presentation Moderator:** TBD  **Presenters:** TBD |
| **1:00- 3:30** | ***Recap / Moving forward discussions (building a Framework for SMSC and road-mapping its development)***  **Panel Moderator:** TBD  **Panelists:** TBD |