

Industry 4.0: A Maturity Model

Volume 2 Issue 6, June 2023

Our May 2023 newsletter described the big players of Industry 4.0. In this newsletter, we will look at a maturity model for Industry 4.0.

Maturity Model

Most managers who hear about Industry 4.0 for the first time wonder how they can help to achieve their organization become a smart factory. A maturity model can help them to assess where their organizations stand at a current time and describe a process to achieve a future desired goal. A maturity model is a framework to measure the maturity of an organization, i.e., to measure the ability of an organization to improve. Some firms establish their own maturity models while others follow a model designed by specialized institutions such as Project Management Institute (PMI), International Standards Organization (ISO), Capability Maturity Model Integration (CMMI) Institute.

Based on prior research by various scholars, Santos and Martinho¹ have proposed five dimensions that include organizational culture and strategy, company workforce, existing technologies in place, current processes, and the products offered by the organization. Based on the assessed level of the five dimensions in an organization, the level of Industry 4.0 maturity of the organization can be determined.

Organizational Strategy and Culture

Organizational culture plays an important role in a company's endeavors. The evolution toward Industry 4.0 requires an innovative culture that seeks continuous improvement as well as the quest to become a smart factory. Organizational strategy includes how much investment have been made or planned, how innovation is managed or planned for action, how much resources have been committed or planned to be committed, and how much collaboration with companies in their value chain have been achieved.

Workforce

The workforce of a company with the skills, experience, and knowledge of technologies involving Industry 4.0 is a dimension that no organization can ignore. The evolution of an organization toward Industry 4.0 depends on how much their employees are open to innovation and change, how well they are skilled and knowledgeable, and how autonomous and flexible they are made to feel.

Technologies

The level of a company's technology structure also determines the level of its Industry 4.0 maturity. We have focused on the technologies that enable an organization to be a smart factory in the previous newsletters. The evolution of an organization toward Industry 4.0 is dependent on how much of forefront technology, smart systems, and intelligent automation have been accomplished.

Processes

Organizations aspiring to be smart factories must include active processes to utilize cloud computing, to be secure with respect to all its assets, and include the technologies that are essential to becoming a smart factory. The evolution of an organization toward Industry 4.0 depends on how much smart processes have been incorporated in all the activities of the organization.

Reference:

¹ Santos, R.G. & Martinho, J.L. An Industry 4.0 maturity model proposal. *Journal of Manufacturing Technology Management*, 31(5), 1023-1043.

Practical Insight

Siemens

Siemens AG is a German multinational conglomerate and the largest industrial manufacturing company in Europe. The company is known for automation, medical imaging, laboratory diagnostics, and energy solutions. Siemens manufactures Programmable Logic Controllers (PLC) in Amberg, Germany, which is regarded as a model for Industry 4.0.



Here, 75% of the entire operations are automated and controlled by robots. Artificial Intelligence, Edge industrial computing, and cloud solutions help the company to realize an impressive 99.9999% quality standard.

Regardless of the high level of automation at this facility, many critical decisions about the production process are made by the workers. For example, an electronics technician supervising a test station for assembled printed circuit boards from his computer, can monitor the plant's value chain. This is possible since each circuit board has its own unique barcode that lets it communicate with the production machines. More than 1,000 scanners document all of the board's steps through the manufacturing process in real time and record product details such as soldering temperature, placement data, and test results.

Siemens has set an example of digital manufacturing that has become a part of the company to be more sustainable in the future.

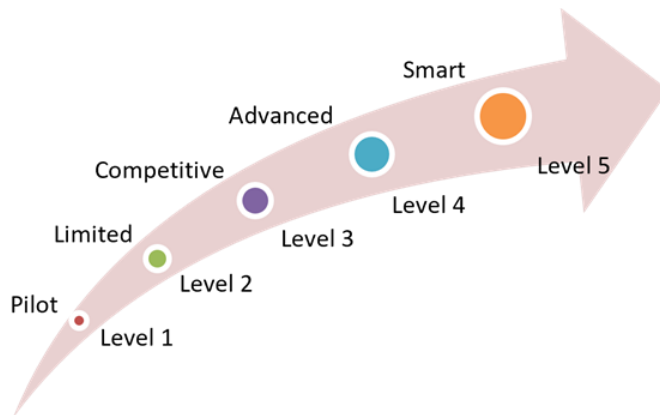
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Products

The products, both goods and services, of a company should have the capability to be agile in their configurations. The evolution of an organization toward Industry 4.0 depends on to what degree product data analysis through the utilization phase has been accomplished, how much smart capabilities have been embedded in the products, and how much integration of systems have been implemented inside the enterprise.

The assessment of the five dimensions in an organization can be used to determine the industry 4.0 maturity of that organization. Santos and Martinho¹ have proposed a five level Industry 4.0 maturity model as shown in the figure.



Level 1: Pilot

A company is at a Pilot level when the company is aware of Industry 4.0 principles. The activities of this level of organization include planning to start piloting or developing some of the essential capabilities of the five dimensions. For example, an organization at this level would have plans to have an organizational structure inclined towards innovation and incorporation of new technologies or may have plans to acquire resources to incorporate new technologies.

Level 2: Limited

A company is at a Limited level if the implementation of the plans to acquire the essential capabilities of the five dimensions. For example, an organization at this level would have initiated to hire employees or consultants to incorporate new technologies or at the initial stages to implement the necessary technology infrastructure for smart factory.

Level 3: Competitive

A company is at this level is in the midst of the implementation to acquire the essential capabilities of the five dimensions. For example, an organization at this level would have improved its competitive edge. For example, this level of company would have improved their technology infrastructure such their offerings and processes have improved over their competition.

Level 4: Advanced

A company at this level has an advanced position in terms of the smart factory with clear economic returns from its investments toward Industry 4.0 efforts. The company has implemented many of the essential capabilities of the five dimensions and is reaping benefits from them. For example, an organization at this level would have most of the smart processes and technologies in place as well as some smart goods and services.

Level 5: Smart

At this level, an organization has reached the final level of smart factory and has implemented all the five dimensions of Industry 4.0. From this point onwards, the organization can focus on continuous improvement of its technologies, processes, and products. The company has a center of excellence to coordinate its ongoing Industry 4.0 activities.

Practical Insight

MOOG EUROPE Auto Parts

MOOG Europe Auto Parts, the manufacturer of steering, suspension, wheel end bearings, and repair kits has fully embraced the Industry 4.0 revolution.

Using IoT to interconnect machines, sensors, and other devices, all manufacturing and assembly operations deliver a safer, more durable new generation of steering and suspension parts.

"This vast network allows devices to share data in real time and enables both the machines and their human operators to continuously analyze data and take appropriate actions to solve problems and make other adjustments to ensure efficiency, consistency and most important, higher quality."

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