

Industry 4.0: What's Next?

By Andrea Maria Zanchettin 

For the first time in the history of manufacturing, the fourth industrial revolution has not been centered on a specific technology. Steam and electrical powers were the two major contributions of the first and second eras, respectively. Digital controllers and automation constituted the main advancements of the third. As per Industry 4.0, there is not a single technology. Connectivity and digital systems were already in place before the term *Industry 4.0* was first mentioned. Digital and connected manufacturing arrived at the exact time when these technologies were mature enough to be combined with modern data processing techniques in a way to extract a reasonable value.

DIGITALIZATION

With the pervasive introduction of connectivity and digitalization at the shop floor, every single asset is connected and is capable of producing big amounts of data. Differently from other digital businesses, in manufacturing however, data are not necessarily a value: data are just data. Hence, the goal is not just to produce data, but to make the best use of

them. Data can be exploited to synchronize and register the behavior of digital twins of every single asset or even of the shop floor. Behind the obvious utility of digital twins for predictive maintenance, the optimization of time and energy or, in general, of limited resources is crucial to generate value by reducing any kind of waste. With the term

waste I am here referring to any kind of unprofitable material (scraps) or activity (*muda*).

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roboticists call “dirty, dull, and dangerous” jobs. They are indeed the brain of the factory, leaving robots to act as arms. Machines and algorithms are mature technologies that can be adopted to empower and support human workers (both physically and intellectually), rather than replacing them. Think about collaborative robotics applications, in

which a robot is meant to support the human, or artificial intelligence algorithms specifically designed to support human decisions.

EASE OF USE

Finally, from a nontechnological perspective, Industry 4.0 is aiming at “robotizing the craftsmanship.” Mass production is no longer mainstream and small and medium-sized enterprises are looking at technologies to contain costs in very flexible and dynamic markets. “Mass customization” is the new motto, which translates to the increasing quest for intuitive interfaces and quick reprogrammability of robots. It is quite curious to read the formal definition of “industrial robot” from the International Organization of Standardization (ISO) 8373 that one of the features that differentiates machines from robots is that the latter are reprogrammable. Which is indeed true but, honestly, I have never seen customers actually exploiting this possibility. For a long time, one robot meant one task. On the other hand, robot manufacturers are starting to offer simplified methods for programming industrial robots.

More information about relevant technical committees can be found at <https://www.ieee-ras.org/collaborative-automation-for-flexible-manufacturing>, <https://www.ieee-ras.org/digital-manufacturing-and-human-centered-automation>, and <https://www.ieee-ras.org/human-robot-interaction-coordination>.

