

Basics of Industry 4.0

First came steam engine that mechanized some of the work our ancestors did. Next era was electricity, the assembly line and the birth of mass production. The third era of industry came about with the advent of computers and the beginnings of automation, when robots and machines began to replace human workers on those assembly lines.

Now we enter Industry 4.0, in which computers and automation will come together in an entirely new way, with robotics connected remotely to computer systems equipped with machine learning algorithms that can learn and control the robotics with very little input from human operators.

Industry 4.0 introduces what has been called the “smart factory,” in which cyber-physical systems monitor the physical processes of the factory and make decentralized decisions. The physical systems become Internet of Things, communicating and cooperating both with each other and with humans in real time via the wireless web.

For a factory or system to be considered Industry 4.0, it must include:

- Interoperability — machines, devices, sensors and people that connect and communicate with one another.
- Information transparency — the systems create a virtual copy of the physical world through sensor data in order to contextualize information.

- Technical assistance — both the ability of the systems to support humans in making decisions and solving problems *and* the ability to assist humans with tasks that are too difficult or unsafe for humans.
- Decentralized decision-making — the ability of cyber-physical systems to make simple decisions on their own and become as autonomous as possible.

But as with any major shift, there are challenges inherent in adopting an Industry 4.0 model:

- Data security issues are greatly increased by integrating new systems and more access to those systems. Additionally, proprietary production knowledge becomes an IT security problem as well.
- A high degree of reliability and stability are needed for successful cyber-physical communication that can be difficult to achieve and maintain.
- Maintaining the integrity of the production process with less human oversight could become a barrier.
- Loss of high-paying human jobs is always a concern when new automations are introduced.
- And avoiding technical problems that could cause expensive production outages is always a concern.

Additionally, there is a systemic lack of experience and manpower to create and implement these systems — not to mention a general reluctance from stakeholders and investors to invest heavily in new technologies.

But the benefits of an Industry 4.0 model could outweigh the concerns for many production facilities. In very dangerous

working environments, the health and safety of human workers could be improved dramatically. Supply chains could be more readily controlled when there is data at every level of the manufacturing and delivery process. Computer control could produce much more reliable and consistent productivity and output. And the results for many businesses could be increased revenues, market share, and profits.