Industry 4.0
Optimization

Industry 4.0 defined

The digital age has moved into manufacturing and is starting to have a large impact. Whether it's robotics, tools, sensors or information of things technology that keeps track of everything in an automated way.

Industry 4.0 is defined as "a name for the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things, cloud computing and cognitive computing. Industry 4.0 creates what has been called a smart factory". In North America, Industry 4.0 is better known as Industrial Internet of Things (IIoT).

Optimization is the watchword for Industry 4.0, emphasizing the role that big data analytics will play.

At the very core Industry 4.0 includes the (partial) transfer of autonomy and autonomous decisions to cyber-physical systems and machines, leveraging information systems. We're seeing a transition from having machines with computers in isolation to machines with on-board computers that are communicating or being controlled from other computers.

The industrial transformation of manufacturing goes beyond the factory, let alone the smart factory. The Industry 4.0 vision encompasses more than automation and data exchange in manufacturing technologies as 1) it stretches beyond technologies and 2) looks at the end-to-end chain, including, for instance, warehousing, logistics, recycling, energy and so forth.

The smart factory is the keystone of the fourth industrial revolution. It's often represented as the aggregate of all the Industry 4.0 technologies: cyber-physical systems—physical assets connected to digital twins—the Industrial Internet of Things (IIoT), data analytics, additive manufacturing and artificial intelligence.

First Revolution: Mechanization

The first industrial revolution originated between 1760 and 1840 representing the transition from skilled artisans making goods by hand to (relatively) unskilled workers using machines powered by a water wheel or steam engine. The transition was most prevalent in the textile industry, but the effects of the first industrial revolution were eventually felt in almost every aspect of daily life.

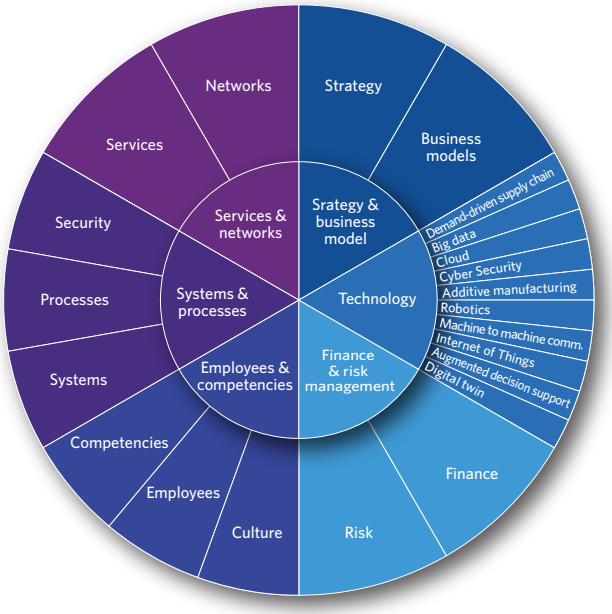
Second Revolution: Mass Production

The second industrial revolution took place from about 1870 to 1914 and the beginning of World War I. Unlike the first industrial revolution, which was characterized by the advent of new technologies, the second industrial revolution had more to do with improving existing technologies and the synergies between them. For example, electricity replaced water and steam as the primary power source in factories. The second industrial revolution also marked the beginning of the assembly line, interchangeable parts and, with them, mass production.

Third Revolution: Computerization

The third industrial revolution, like the first, saw the introduction of disruptive new technologies—in this case, automation and the computer. These advancements brought about monumental changes to manufacturing, enabling levels of precision (industrial robots) and accuracy (Computer Numerical Controls (CNCs), never before seen on the shop floor. The beginning can be traced to the early 1960s, which saw the introduction of the first industrial robot "Unimate" at GM's plant and first commercial CNCs.

Applifast - The Industry - The Transformation



At Applifast, we are committed to turning Industry 4.0 into products and services that deliver maximum benefit to our customers and partners. From reduced downtimes, to more flexible production processes with lower costs, Industry 4.0 has the potential to transform the performance of your manufacturing operation.

Industry 4.0 is driven by four identifiable technology trends.

1. The astonishing rise in data volumes, computational power, and connectivity, especially new low-power wide-area networks;
2. The emergence of analytics and business-intelligence capabilities;
3. New forms of human-machine interaction such as touch interfaces, augmented-reality systems and wearables;
4. Improvements in transferring digital instructions to the physical world, such as advanced robotics and 3D printing machines.

When these enablers come together, Industry 4.0 has the potential to deliver some incredible advances in factory environments. Examples include machines which can predict failures and trigger maintenance processes autonomously or self-organized logistics which react to unexpected changes in production.

Industry 4.0 is a game-changer, across industrial settings. The digitalization and interconnection of manufacturing will change the way that goods are made and distributed, and how products are serviced and refined.

PRODUCTIVITY

Improved quality and cost reduction call for comprehensive control of the entire process and each individual operation within the process. Companies using process control systems, intelligent tools and other IT systems can ensure that each individual work step, such as the tightening of a bolt, is completed correctly with the desired torque specs. In addition, these systems can ensure that each operation is carried out in the correct sequence - using the machines, tools, programs and specifications defined by the design, assembly planning and scheduling departments in order to ensure optimum product quality.

DATA MANAGEMENT

Intelligent data management is being used strategically to reduce costs. Data generated by sensors can be used for monitoring each individual workpiece in the production process, allowing any errors to be detected and eliminated at an early stage. Self-correcting technologies allow real-time adaptation of the production process. The data can be collected, documented and analyzed to identify and eliminate minor recurrent problems at an early stage and immediately optimize the process. The quality structure improves customer confidence and satisfaction, reducing complaints and unproductive reworking. This helps a company to reduce operating expenses and improve competitiveness in the industry.

PREDICTIVE MAINTENANCE

Equipment is embedded with sensors that are capable of flagging the machine's operator when specific tolerance deficiencies are detected. This detection allows users to schedule maintenance at ideal times and avoid costly non-planned maintenance or down-time.

Maintenance and service intervals can be strategically managed resulting in efficient work flow and reduced down time.

POSITIONING AND LOCALIZATION

In-house GPS on the production line boosts productivity. The production line is orchestrated - at all times, each active element is aware of the position of the other elements and what element reasonably should be integrated in the production process at the present or predetermined time.

AUTOMATION

Intelligent software can control assembly processes in such a way that all employees can work efficiently without errors even if they are using a work station for the first time or are unfamiliar with the latest product variant. Collaborative robots (cobots) equipped with sensors are programmed for hand-in-hand cooperation with people can deviate from their program at any time whenever the situation requires resulting in better quality, lower reject rates and higher productivity.

COMPANY CULTURE

Studies show the most difficult aspect for organizations to change on the route to smarter factories is their internal culture. For Industry 4.0 to reach its full potential, businesses need to establish one undisputed source of performance data, and give all decision makers the ability to receive data in real time. During this transition, manufacturers will need to rely on their trusted partners like Applifast to provide expertise and direction to reach their Industry 4.0 goals. As more technology gets introduced to the manufacturing environment, the companies with solutions in place for controlling smart devices and collecting big data will seamlessly advance production. Those organizations without a clear direction for smart manufacturing will struggle to keep up with technology and manage the ever-increasing volume of data being produced.

STRATEGY - TAKING THE FIRST STEP

The Objective: Highly flexible individualized and resource friendly mass production. In North America, the potential of Industry 4.0 is huge. The challenge now is to define strategy and to implement change.

Applifast is working closely with industry leaders, sourcing out the best solutions to integrate into a manufacturer's work flow so that they can make the transition and ultimately excel well ahead of their competition becoming more efficient, less wasteful and increasing production volumes and profitability.

Your industry is progressing forward - are you?

Applifast's manufacturing industries are currently signaling growing demand for process control to further improve the quality control of production processes at the same time as reducing operating expenses. The industry, being an innovation driver, is already implementing changes in the fields of automation, data interchange and production technologies. Safety-critical tightening is already monitored and analyzed; the data recorded is used for process optimization. Any production deviations are signaled to tightening experts who can act to faulty components or assembly processes in a proactive way.

Digitalization plays a key role in the documentation of tightening processes, allowing experts to optimize production processes and provide information on all the individual components of the vehicle at any time - right down to the last bolt or gasket, with precise information on installation times and tools. Sensor-controlled collaborative robots (cobots) provide assembly workers with support in terms of precision and ergonomics. These cobots work hand-in-hand with people, making their work easier, improving assembly results and boosting productivity.

4 steps to a smart factory

Manufacturing is complicated, there's no way around that. It's the complexity in processes, materials, components and supply chains that drive much of the variability in quality, and have dramatic impacts on productivity, and it's the resulting drain on profitability that incentives manu-facturers to revolutionize their factories. Making this transition from a legacy factory where so much is unknown to a smart factory is nothing less that a paradigm shift both technically and in terms of the people involved, so in this short blog we'll discuss 4 important steps, as we see them, to making the transition to a smart factory.

LEADERSHIP VISION

In the preliminary stage most people tend to react the same way. "It's really great, but we're not anywhere close to being ready for that." This is a mindset that, although not unique to manufacturing, is most destructive in manufacturing. They don't understand the amount of clarity, data, visibility, etc. they are missing and what that insight can provide. How the use of that data can be trans-formative to the operation. They can't see past their own organizational weaknesses to have a vision of the future. It's these companies that are accepting paper routers, and data collection using a pencil. They acknowledge that the little data they do collect will just end up in a cabinet somewhere, never to be seen again. The real question here is why. Why would this be acceptable? At the highest level, it's simply leadership. These organizations needs leadership that sees the potential of the team and the operation. A leader that truly understands that doing nothing is a decision in and of itself, and that it's the wrong decision if you want to be competitive in the decades to come.

SOFTWARE INTEGRATION

Once a trans-formative leader makes the decision to begin the journey to a smart factory, and all of the planning, road mapping, benchmarking, etc. is established, the first logical step is to integrate software solutions that allow for digital communication and data capture. Most manufacturers, even those still highly dependent upon paper and manual processes, have numerous software solutions that all serve different purposes and most times each application operates in it's own little world. Integrating those application, or bringing in newer systems that allow for integration can be a massive step in the right direction. Today, there's no reason why your ERP, LMS, QMS and MES applications don't talk to each other. Connecting your ERP and MES applications will facilitate a paperless shop floor where employees access digital work instructions, perform and record measurements electronically, and access copious amounts of performance data. Likewise, integrating your MES and QMS system can trigger automated corrective actions and improve quality. Digital solutions can also simplify things like document management, version control, access restriction and will dramatically enhance traceability and accountability. This will likely require investments in modern software solutions and additional hardware, but a well done ROI analysis will quickly resolve concerns about the value of these investments.

INTELLIGENT MACHINES

When the software applications that control and manage your operation are modernized and integrated, it's time to take a closer look at your equipment, tools, sensors, etc. keeping in mind of course that modern shop floor software solutions also have the ability to interface with machines. Ideally, your machines will have the ability to communicate across the network with the MES so that OEE, machine settings & data, Andon and other components can be triggered, recorded and tracked automatically. Connecting to this Industrial Internet of Things is a significant step to fully merging your physical machines with your cyber systems. With the addition of fully connected machines, Engineers and Managers will have visibility to data that will be instrumental to improving efficiency, and maximizing production schedules. Maintenance teams will gain insights into why machines go down and be better able to predict and prevent unscheduled downtime. Operators will be able to focus more on running the machines and less on recording data.

INTEGRATE THE PEOPLE

Looking at your newly modernized factory, you may think you're done. Far from it. People will continue to play an instrumental role in the smart factory, albeit a different role than in the past. In legacy factories, people have fairly straight forward jobs in the operation but generally they trigger machines to do work. Although oversimplified, they essentially load machines, set up machines, assemble products, move inventory and fix things that break, among other tasks. The point is that the people are operating as an independent part of the operation. Much of the operational knowledge is stored in their brains, and typically none of that stored information is really the same from person to person. The operation really depends on the people to make decisions. When a machine sounds "weird", call Cindy and she'll fix it. If that part measures out of specification, the operator stops the machine, fills out a sheet of paper and pages Jim to disposition the nonconforming part. These scenarios are real situations that occur in factories everyday. Integrating the people into the smart factory means their interaction with everything changes. Operators may still set up the equipment, but they'll do it from the MES application following digital work instructions, but the machine will stop automatically because the vibration sensor triggers it to stop. When it stops, the machine talks to the MES application and creates the maintenance ticket which automatically sends a message to the technician. When the technician responds, she will follow digital troubleshooting instructions that dynamically help her make decisions on the root cause of the failure and recommend solutions. People are still critical, but their role is substantially different.

The message here is that if your operation is somewhere in this life cycle, you're probably on your way. There's a lot of work ahead of you, but if the decision on the front end has been made to make the transition to a smart factory, then the hardest part is done. That's not to say the rest is easy, only that having the right industry partners and people in place to see beyond these 4 big barriers is critical and for so many companies proves to be too difficult. For these companies, they'll continue to plug away, trying to make small incremental improvements, grabbing that low hanging fruit while the truly trans-formative companies reach the ripest fruit at the top of the tree. Let Applifast be your step ladder to enable you to reach the bountiful harvest your company has worked hard for and deserves.