Transformative Horizon

Smart Manufacturing
2Q 2018

Likely Outcome:

A broad range of technologies enhances the productivity and efficiency of the global manufacturing sector at lower costs.

Transformative Technologies in the Manufacturing Sector

1 Outline of Innovation

This report provides an overview for the current and future use of transformative technologies in the manufacturing sector and the applications of each technology (Industrial Internet of Things Platforms, digital twins, edge intelligence, hyperconverged edge systems, additive manufacturing, connectivity, artificial intelligence, blockchain, collaborative robotics, smart glasses, augmented reality, and simulation software).

2 Innovation Importance

Smart manufacturing technologies continue to evolve to better solve real-world problems on the shop floor through a variety of applications such as predictive maintenance, distributed manufacturing, reconfiguration for custom orders, supply chain integration, dynamic assembly, and closed loop design.

3 Companies at Risk and Those with Opportunity?

The largest industrial automation companies have already built Industrial Internet of Things (IIoT) platforms, and the leaders have started to try to integrate the platform with other technologies, including Additive Manufacturing (AM), robotics, Augmented Reality (AR) smart glasses, and Artificial Intelligence (AI)-based simulation software. This will further stimulate the rate of innovation in this sector and directly benefit their customers. Unfortunately, most implementations require a significant amount of custom work and consulting. This brings extra costs to the vendors, who have a vested interest in helping the technology scale. Larger vendors have more managed service capabilities.

4 Potential Innovation Killers

At first, industrial automation companies saw these technologies as ways to lock in customers to their core offering: industrial equipment. However, as competitors from the Information Technology (IT) sector have figured out how to extract data from the equipment, the industrial automation companies must adapt. They still have a competitive advantage in their domain knowledge and customer relationships; so, if they do not or cannot open their platforms to more competing equipment, this will slow innovation.

5 Recommendations and Reactions

Transformative technology vendors need to follow several pieces of strategic guidance to continue to grow : (1) Open up your technology to leverage existing equipment and infrastructure. (2) Meet directly with clients' Operational Technology (OT) professionals to understand the problems they face. (3) Create a flexible partner ecosystem that can help implement technologies according to any client preferences. (4) Provide a managed service or consulting offering that helps clients succeed and reach Return on Investment (ROI).

TRANSFORMATION SNAPSHOT

Scale

> Increasing investment requires standardized IT infrastructure and hyperconverged edge systems and results in digital twins with physical-based digital simulation capabilities.

> New factories will eventually abandon assembly lines for dynamic shop floors with adaptable connected work stations.

> IIoT platforms, simulation software, collaborative robotics (cobots), and edge intelligence for predictive maintenance lead the first wave of adoption.

> AM, blockchain, and smart glasses will find increasingly important roles to play. Simulation software will close the design loop with AI.

Time

> Transformative technologies will benefit manufacturers, but vendors need to understand and adapt to end-user needs to accelerate adoption and innovation.

Transformative Horizon

Transformative Horizon (TH) reports are aimed at providing timely, deep, and actionable insight into the looming transformative innovations that will impact the markets which matter most. Potential transformative innovations that are covered by these reports include:

- A new product launch
- A new company entrance
- A significant company merger
- A new business model
- A new strategic direction for an incumbent

Rather than focusing on transitory disruptive forces, these reports are designed to give key decision makers insight into the pervasive factors that will fundamentally alter the way their market operates and how they can embrace these in order to remain relevant and healthy in the new landscape they will face.

Related Data:

- *Evolution of Sensors for Smart Factory Applications* (AN-2644)
- *Smart Manufacturing Platforms Assessment* (AN-2652)
- *Industrial Internet Connectivity Tracker* (MD-IICT-102)
- *IT/OT Convergence in Smart Manufacturing and Enterprise* (AN-2645)
- *Design, Test, and Maintain With Digital Twins* (AN-2649)
- *Enterprise 3D Printing and Distributed Manufacturing* (AN-2648)
- *Collaborative Robotics (AN-2516)*

The Innovation Horizon
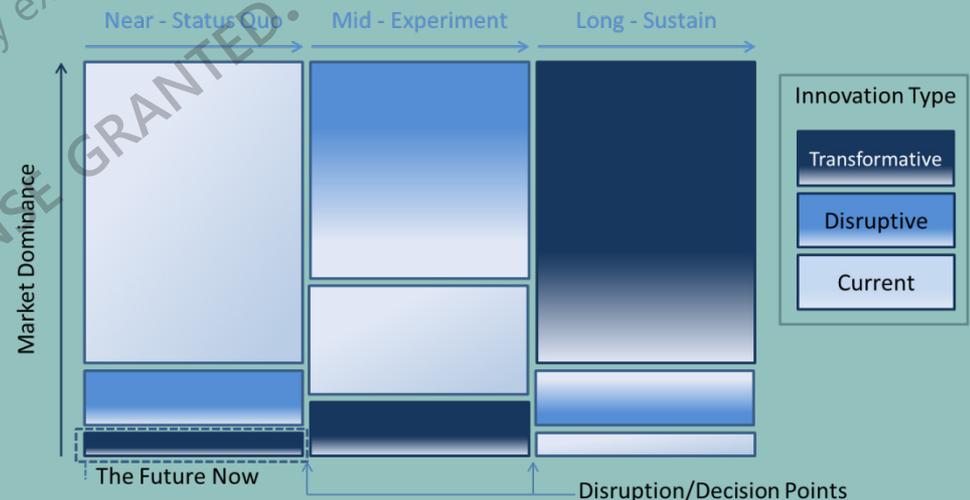
The Innovation Horizon

12 – 18 MONTHS	18 MONTHS – 3yrs	3 – 5 Years	5 – 10 Years	10+ Years
Increased adoption of edge intelligence and simulation software.	AI/machine vision opportunities for quality control. Deep neural networks trained to identify imperfections	End users start to experiment with 5G-connected smart glasses.	By this time, we expect AI will design many new products across most industries.	By this time, we expect almost all non-consumable, multigenerational products to only be offered as-a-service (aaS).
Machine vision via sensor fusion of optical, infrared, and ultrasonic sensors to find faults in preprogrammed models for quality control.	AI in smart glasses will recognize the make and model of the product, detect damage, and match with correct repair manual.	End users implement 5G connected Automated Guided Vehicles (AGVs) to collect, dispatch, and deliver parts more efficiently.	Manufacturing in the United States, China, Japan, and Germany will achieve minimal unplanned downtime.	Most new factories will work dynamically, with work stations instead of assembly lines, and all assets will be connected via 5G or Data Distribution Service (DDS).
A standard platform of platforms emerges.	The manufacturing sector as a whole adopts OPC Unified Architecture (OPC UA) over Time-Sensitive Networking (TSN) for universal real-time control.	Robotics suppliers begin to offer 5G-connected mobile, collaborative robots.	Additive manufacturing will replace parts suppliers across most industries.	The first lights-out factories start operations.

PESSIMISTIC   **LIKELY**   **AGGRESSIVE**

From New Technologies to New Capabilities

① Outline of Innovation

The Fourth Industrial Revolution has turned manufacturing from a value chain-based ecosystem to a stakeholder web-based ecosystem, bringing together new technologies and compute services ranging from edge intelligence and AI to IIoT platforms and AR. The link to these technology vendors will only grow stronger as they continue to innovate at an increasingly rapid pace, meeting the core needs of the manufacturing sector.
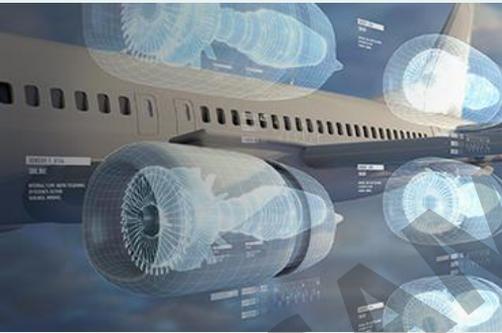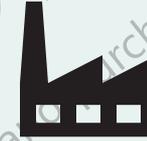
Hundreds of Internet of Things (IoT) platforms have cropped up across verticals and end markets, and smart manufacturing has its own collection of IIoT Application Enablement Platforms (AEPs). These AEPs extract data from devices and move it to applications based at the edge or in the cloud. This platform might have connectivity or device management tools. It might also act as a data orchestration system and include an app store or have app development capabilities whereby users can create and access applications that generate insights from their data. Several IIoT AEP providers have incorporated other transformative technologies such as digital twins, machine learning, blockchain, AR, and simulation software into their offering.

The end users, manufacturers, do not want to experiment with technology that could disrupt all their operations. Most want technology that they can implement easily. They will change the way their employees perform jobs with technology if it will make them more productive, but they have no desire to rip out their entire infrastructure to try something new. This means technologies that can leverage existing equipment and infrastructure, such as edge intelligence, have the most immediate opportunity.
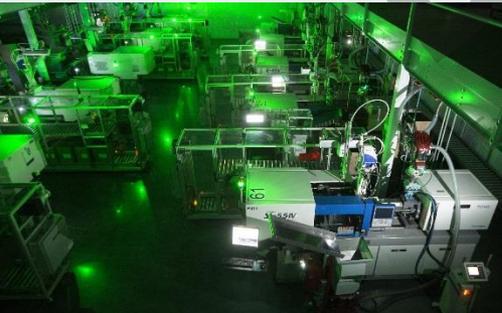
The transition toward a lights-out factory has started, but such a major disruption will require an overhaul of work forces, IT architecture, physical facilities and equipment, and full integration of dozens of new technologies, including connectivity, additive manufacturing, drones, mobile collaborative robotics, IIoT platforms, and AI.