Logistics & Supply Chain
KEY INSIGHT
The industrial internet of things (IIoT) refers to all of the hardware that’s collecting, sharing, and using data within industrial settings. Some of what’s being collected is metadata, which describes the data that’s being generated.

EXAMPLES
In an industrial setting, sensors, switches, and connected devices generate a tremendous amount of data. That data can be mined, refined, and analyzed for cost savings, greater efficiencies, and even new product development. For example, Palo Alto, California–based Maana extracts metadata to optimize a company’s processes by revealing previously unknown relationships. Austin, Texas–based SparkCognition uses metadata for predictive maintenance applications in energy, gas, and utilities.

DISRUPTIVE IMPACT
There is no unified approach for how to handle metadata in manufacturing and other IIoT settings—and at the moment, not all systems and devices are interoperable. The metadata itself could help solve that problem, by identifying communication protocols that would facilitate the exchange of data throughout a network. Metadata will make it easier for businesses to organize the data generated from all of their connected machinery within the IIoT. Advances in artificial intelligence will offer deeper levels of insight into process automation.

EMERGING PLAYERS
• Maana
• Plataine
• Augury
• ThetaRay
• SparkCognition

Capturing IIoT Metadata

Sensors, switches, and connected machines generate lots of data.
Automating the Supply Chain

**KEY INSIGHT**

Mobile automation in the supply chain is a quickly maturing market. While this means greater efficiencies and cost savings for businesses, it also portends job losses for workers who operate warehouse equipment.

**EXAMPLES**

Autonomous mobile robots (AMRs) and autonomous guided vehicles (AGVs) will become more commonplace, which will bring cost savings and efficiencies for businesses. A new class of autonomous robots and vehicles running on AI-powered logistics systems is coming. In a warehouse setting, autonomous mobile robots assign global tasks, set paths, and optimize tasks like picking. Berkshire Grey is an AI-powered automated system that picks, packs, sorts, and transports products autonomously to fulfillment centers, resulting in a 75% reduction in direct human labor.

**DISRUPTIVE IMPACT**

The robotics industry will drastically transform the supply chain. Some researchers anticipate that 6 million mobile robots will be shipped within the next decade, shifting every sector of the global economy.

**EMERGING PLAYERS**

- Amazon Robotics
- Robotic Industries Association
- Mobile Industrial Robots

Berkshire Grey raised $263 million in new funding last year.
KEY INSIGHT
Pressure from investors, customers, and governments—in addition to extreme weather events and trade tensions—demands new efforts to build sustainable supply chains.

EXAMPLES
The U.N. Global Compact encourages companies to make sustainability a priority from the top of the organization down into supply chains. India, Indonesia, and China have mandated reporting of sustainability practices, and they will begin publishing their findings. Levi Strauss & Co. partnered with the International Finance Corp. to provide lower interest rates for vendors that have sustainability practices in place.

DISRUPTIVE IMPACT
As buying power shifts from Gen X and Millennials to Gen Z, supply chain sustainability will become more important—younger consumers repeatedly say they prefer brands that support environmental causes. Investors are taking note: In an Oxford University Said Business School study of 70 senior executives at 43 global institutional investing firms, including the world’s three biggest asset managers (BlackRock, Vanguard, and State Street), sustainability was a key priority for 2021 and beyond.

EMERGING PLAYERS
• Sustainability Accounting Standards Board
• Global Reporting Initiative
• U.N. Sustainable Development Goals

Sustainability in the supply chain is a primary driving force in business.
Rethinking the Cold Chain

KEY INSIGHT
Cold chains are temperature-controlled supply chains—critical for goods such as medications, produce, and frozen foods.

EXAMPLES
Last year the cold chain was in the national spotlight, because the most promising COVID-19 vaccines from Pfizer-BioNTech and Moderna required an ultracold transportation system. If the temperature fluctuates or the cold storage fails, it could render doses ineffective. The cold chain is how your local grocery store can sell sushi made from raw tuna and salmon farmed halfway around the world. The reason we can enjoy ice cream in the heat of the summer is the cold chain: a complicated system of storing and transporting food and medicine in exactly the right temperature range during the trek from farm to factory to store. But in some areas of the world, the cold chain has contributed to climate change.

DISRUPTIVE IMPACT
We put an enormous amount of trust in the cold chain to protect the food and medicines we ingest. Companies are beginning to look at new sustainability opportunities to improve the cold chain. One area of interest is artificial intelligence in the cloud, which can help monitor temperatures and can also optimize travel routes. New packaging materials insulate food and medicine, keeping both at low temperatures without having to refrigerate entire trucks. Climate change could result in new regulations that limit how the cold chain works, but new kinds of intelligent packaging and automated transportation systems mean new business opportunities.

EMERGING PLAYERS
- QCMedchain
- StaTwig
- Smashtag Chill
- Solar Freeze
- NelumBox

Many COVID-19 vaccines require a stable cold chain.
Additive Manufacturing

Key Insight
Additive manufacturing is a process by which materials are deposited layer by layer as objects are printed.

Examples
3D additive manufacturing has moved from the fringe to the mainstream, offering new opportunities in medical and biosciences, manufacturing, and art. LaserFactory, a project from MIT’s Computer Science and Artificial Intelligence Lab, uses silver conductive ink to attach circuits together and print circuit boards. Soon, “one size fits all” will take on a whole new meaning. Chinese researchers successfully printed ceramics capable of transforming over time in response to stimuli such as heat and light. It’s a process known as 4D printing, and the practical applications are boundless. Imagine a heat shield that suddenly materializes during a fire, or a garden that plants itself when the ground has warmed to precisely the ideal temperature for each seed.

Disruptive Impact
If you’re thinking of the “Star Trek” replicator, you’re not far off. Researchers are working toward scanning and producing objects in seconds—over time, this technology will be used in surgical centers to rapidly print replacement valves and joints using your own biomatter as models. We don’t yet have international product liability and intellectual property standards, norms, and regulations that govern additive manufacturing and printing. A regulatory framework built to protect designers, patents, corporations, and individuals is likely on the horizon.

Emerging Players
- Autodesk
- Formlabs
- Apis Cor

Could a brick ever behave like a human cell and evolve, replicate (and) assemble organically with others? Could the objects we now build out of concrete and steel ever be as adaptable, intelligent, and multifunctional as those grown from the earth?

— Paola Antonelli, Museum of Modern Art curator and director of MoMA R&D