Overview

Over the last ten years, smart manufacturing—powered by the Internet of Things (IoT) and digitalization—has become a key part of the competitiveness discussion in the United States. The conversation is multifaceted—comprising business, technology, workforce, and organizational practices and forcing the restructuring of highly-compartmentalized value and supply chain enterprises.

The proliferation of IoT has meant the extension of Internet connectivity into physical devices and everyday objects. “Smart” signifies the transformation of U.S. manufacturing resulting from the upending of traditional business, organizational, operating, and market structures in the manufacturing sector by the availability of data and by new economic opportunity presented with data that are exploited in previously inconceivable ways—known as “digitalization”.

The United States has invested and is continuing to invest in Manufacturing USA Institutes that address key aspects of digitalization from robotics to 3D printing to biofabrication. Importantly, the effective use of secure data, modeling and time across supply chains creates significant new economic, market and social opportunities. This is particularly true when paired with the right technology, to achieve full business potential for new consumer demands.

Over these same ten years, dramatic global shifts and rising interests in manufacturing digitalization have threatened America’s place as a global manufacturing superpower. Ascendant and increasingly advanced industrial activity across Europe and Asia have buffeted America’s competitiveness when it comes to digital technology, investment and innovation. These shifts are accelerating change in consumer demand. New global manufacturing and market growth opportunities—powered by next generation digital technologies, 3D printing, next generation IT hardware and firmware, 5G, advanced sensors, controls and modeling, including AI and machine learning—are all expected to exploit data and information in unprecedented breadth and a previously inconceivable scale. The now steady march of digitalization is both accommodating and upending legacy manufacturing business structures and markets with shifts toward partnership structures. Combined with globalization and
increasing imperative to protect and wisely use energy and material resources, these factors should serve as a wake-up call for change by U.S. companies, universities, governments, and workers.

The June 4th dialogue will bring together a diverse set of expertise to ask:

- What do industry executives, federal and state governments, and university leaders need to know about smart manufacturing and digitalization in order to make informed policy, business, and educational decisions?
- What are the roadblocks standing in the way of the smart manufacturing/manufacturing transformation?
- Are there examples of replicable smart manufacturing best practices?
- How can policymakers and industry ensure that digitalization does not outpace security in the form of cyber threats from state and unaffiliated actors?
- Is there a need to rethink talent, workforce training and education and entrepreneurship as elements of an overall cultural shift to a data driven, innovation driven economy that can be an outcome of digitalization?
- Is the U.S. and its manufacturing base adequately prioritizing smart manufacturing investment and market priority to keep pace with consumer and global market demand and advanced digital technology, investment, and innovation around the globe?

The “Smart” in Smart Manufacturing

Addressing the scope and pace at which manufacturing digitalization and U.S. competitiveness are changing necessitates a close look at technology investment, global markets and economic and market drivers for physical location, workforce needs and sources of energy. Questions inevitably arise regarding U.S. and global strategies, policies, investment and security, which are compounded by regulatory, tax, IP and security trends. If not addressed, these forces of change can negatively affect economic viability, competitiveness and market growth. But, at the same time, America faces a promising frontier of digitalization which, by definition, is about changing how manufacturing is done today.

- Smart manufacturing is creating substantial new economic investment opportunities with radically increased supply chain productivity; far better product design with process and machine precision for more and higher value products manufactured better, faster, cheaper; and fundamentally improved and safer operating performance due to profoundly better use of human, control and automation capabilities.
- Cybersecurity, material qualification and product validation must be aligned with the business, economic and market opportunities of restructured, digitalized manufacturing enterprise supply chains.
- There is a generational re-emergence of advanced and highly productive global manufacturing capacity and opportunity on U.S. soil resulting from new advanced manufacturing technologies and digitalization.
- The increasing abundance of and ability to more productively use innovative, sustainable, affordable and domestically-sourced energy while continuing to recognize the need for
reducing global consumption of both energy and materials offers a huge opportunity for making them both economic and competitiveness advantages.

In smart manufacturing, data, anything digital that can be networked, orchestrated, and analyzed, modeling, which includes all forms of using, building from, and generating data to take automated or human action, and time, which defines the operational benefit of an action to the physical manufacturing enterprise, are symbiotic. Data has become the new currency; time is value; modeling extracts the value; and smart manufacturing orchestrates the generation, application and distribution of intelligence. It opens the door to operational interrogation and prediction and creates new ways of involving smart workers for action at the right time. “Smart” intersects strongly with digital product design and the digital thread, process intensification and distributed modularization, robotics operations, and life-cycle energy consumption in materials production.

The potential economic, competitive and environmental opportunity created by smart manufacturing is enormous. For example, the Clean Energy Smart Manufacturing Innovation Institute (CESMII) has consistently seen gains across industrial segments of 15%-20%. Even with a conservative market adoption rate of less than 10%, smart manufacturing can add over $175 billion in revenue in the U.S. over a 10-year horizon just in energy savings; money that can be reinvested to produce over one million jobs. Additionally, the smart manufacturing technology and service provider sector would grow adding over 5,000 jobs. With more rapid and expanded adoption of “smart”, and the integrated digitalization of new process and product technologies, the economic impact could be substantially multiplied and accelerated.

The reality, though, is that “smart” U.S. manufacturing is highly constrained and slowed. Innovation and entrepreneurship are curtailed. IoT and the increasing numbers of automation, sensor, robot, machine and process platforms add local value, but are significantly increasing factory and supply chain complexity, making data difficult to access and use. Predictive analytics, operational interrogation and advanced diagnostics—critical pathways to spurring economic benefits—are severely constrained by a lack of access to good data. The tools and expertise to produce good data are often too expensive and complex for most U.S. companies to even consider. Cybersecurity and IP protection are increasingly large and looming barriers as the complexities with data grow. Data access in supply chain operations is far too fragmented; making supply chain optimization a highly complex, risky and expensive challenge. And academia, with a huge technology capability and as stewards of a large future workforce pipeline, struggles with involvement, relevancy, access to data, tech transfer and connecting solutions and problems.

Stated more provocatively, smart manufacturing depends on factory and supply chain data; there are more and more devices; larger amounts of data are being collected; little data are good and useful; access to data is increasing in complexity; new cloud and platform technologies trap data and exacerbate complexity; markets still value complexity and infrastructure, not simplicity and operational value; data complexities are increasing security, product and physical operational risks; workforce and training are expanding the need for everyone to have skills in consuming and using data; complexity, cost and workforce put digitalization out of reach for most manufacturers.
Democratization of Smart

Democratization of “smart” business, technology, operational and workforce data, and of modeling practices underpins the success of smart manufacturing and the realization of the full economic and social benefits of digitalization. Smart manufacturing solutions are vital for all manufacturers and all sizes of plants. There is the need to enable the frictionless movement of information – data & context, among real-time operations and the people and systems that can create value for every organization.

However, democratization is a grand challenge transformation opportunity. If achieved, legacy business and operational structures that are siloed, vertical and compartmentalized will give way to horizontal, flexible and agile B2B supply chain business opportunities. U.S. manufacturing and global markets will realign. Business and economic opportunities will shift from data isolation strategies to selective data interoperability associate with business partnerships. Manufacturing operations will rebalance for data-centric automation and smart worker productivity. Longstanding separations between OT and IT will break down as convergence and vendor platform infrastructure siloes shift toward open interoperability. Software application markets will drive operational value of an application not infrastructure value. Innovation and implementation for manufacturing product and operational value will be substantially freed up and accelerated.

Every stakeholder is affected by the democratization of information. Executives from small, medium and large manufacturers; operations, supply chain and IT leadership; the workforce and the workforce pipeline; IT and OT system integrators; OT application, platform and infrastructure vendors; IT application, platform and infrastructure vendors; machine and process equipment builders; research, education and training institutions and non-government organizations; commercial and government-sponsored research and development; national laboratories; and Manufacturing USA Institutes and other public-private partnerships all stand to gain.

June 4th Dialogue

The dialogue will bring together a diverse group of stakeholders to focus on the democratization of smart manufacturing innovation as a practical necessity for the future of U.S. manufacturing. Participants will work together to put a collective vocabulary, voice, and priority on U.S. manufacturing digitalization, and smart democratization and innovation.