BUILDING A 4.0 DIGITAL THREAD FOR SUPPLY CHAINS

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By taking a strategic and integrated approach to the adoption of multiple 4.0 technologies, manufacturing companies can create a powerful digital thread across their supply chains that allows them to share critical information across all parts of their business, including suppliers and customers.

Manufacturers face a slew of supply chain issues that have exposed systemic flaws, and analysts project that companies will still be navigating this difficult landscape in 2022 and beyond. Amid these challenges, the gulf is widening between manufacturers who previously embraced Industry 4.0 and those who have either just begun to implement an Industry 4.0 strategy or remain skeptical of its benefits. The latter group has seen an even greater uptick in issues related to demand planning, transportation and logistics, financial resiliency, product complexity and organizational structure.

A growing number of companies are preparing for the road ahead by digitizing elements of their supply chain. In fact, BDO's **2021 Industry 4.0 Survey** finds that increasing operational efficiencies across the supply chain is manufacturers' top digital priority this year. To achieve this, manufacturers are harnessing the power of Industry 4.0 solutions like enterprise resource planning (ERP), **artificial intelligence** (AI), machine learning (ML), simulation technology, Internet of Things (IoT) devices and distributed ledger technology (DLT) like blockchain.

Increasing adoption of Industry 4.0 solutions not only helps companies overcome present supply chain-related hurdles, but it also empowers them to contribute to, and benefit from, the digital thread, an initiative that taps into collective intelligence and solutions which transcend the limited view of a single person, function or entity.

To better understand the many benefits that Industry 4.0 technologies can provide, it is useful to examine how these digital supply chain tools have evolved from their traditional applications to offer targeted solutions aimed at gaining better visibility, mitigating risks and planning for multiple scenarios to increase resilience and support business continuity.

SPURRING SUPPLY CHAIN OPTIMIZATION

The following solutions are hardly new technologies for supply chains, but they are growing more widespread as companies seek to improve visibility into their suppliers' suppliers and their customers' customers. Manufacturers are expanding the push and pull of data across multiple tiers, which requires a level of sophistication only offered by the Industry 4.0 digital solution set. This information is then coupled with operational data to create a comprehensive digital thread of supply chain information.

Benefits related to enhanced visibility into departmental functions and data are a common theme throughout the following list of tools. The variety of Industry 4.0 applications, and the way these solutions interact with one another, allows manufacturers to digitize elements of the supply chain at a pace and cost that works for their unique industry sector and operation.

Of course, manufacturers should also consider how supply chain operations will continue evolving over the coming years. As the examples below illustrate, recent advances are focused on enabling a more intelligent, proactive and resilient approach to **supply chain management**. Manufacturers that stick with a more traditional approach run the risk of falling behind their peers.

ERP AS A KEY ENABLER

ERP software grants supply chain managers a 360° view of activities across functions. They can then apply these insights to integrate processes and streamline operations, enabling them to better allocate resources, improve service and reduce costs.

ERP holds the potential to streamline all phases of the supply chain from procurement to production to shipment and beyond, ultimately becoming the system of record and one source of truth. Manual tasks, such as communicating with vendors and suppliers and documenting those communications, can be automated easily using ERP.

A supply chain management ERP system can automatically plan workflow when orders are received and perform effective job scheduling. Supervisors receive real-time updates on progress and resources that help them plan delivery dates. ERP keeps production consistent with demand for timely replenishment and lean inventory.

Although other technologies are needed to achieve it, ERP is a key enabler of the digital thread. When fully realized, the digital thread can provide benefits for stakeholders across the entire supply chain by improving efficiencies, mitigating disruption and even helping companies meet sustainability goals.

UNLOCKING THE POWER OF AI

Increasingly, manufacturers are unlocking value with the power of AI through multiple applications, ranging from enhanced responsiveness to automation to analytics and beyond.

According to BDO's *Industry 4.0 Survey*, improving the customer experience is manufacturers' second most-cited overall digital priority, and 20% say customer service is their primary competitive differentiator. The pandemic made it necessary for manufacturers to be able to interact with all their customers digitally, and as a result, more manufacturers are implementing conversational AI capabilities, also known as chatbots, linked to real-time supply chain information. Chatbots and similar tools enable manufacturers to service customers' needs 24/7, without intervention from an employee.

But AI isn't all talk. It can also reduce the risk of human error related to repetitive manual processes, and it can lead to impactful insights for business operations. AI sifts through large amounts of disparate information to identify patterns that can be easily overlooked using legacy methods. For example, AI can correctly forecast a product's decline and end-of-life on a sales channel. It can also foresee the growth of a new product's market. Thanks to AI, supply chains are no longer driven by simple reactive intelligence. They can be guided by predictive, flexible and ongoing learning systems that enable better decisions for continuous improvement.

One real-world example of the power of AI in supply chains is in the warehouse space. An AI-enabled warehouse management system proved to be more innovative in the pick, pack and ship process for online orders. The company's warehouse featured a 3D grid structure and a central system that received information on orders and then sent a message to robots via 4G, prompting them to pick the requested products. The AI-controlled and coordinated a fleet of robots through an air traffic control system for seamless collection and delivery to assigned packing stations for order assembly. This smart solution allowed the company to process significantly more orders per week with a higher level of accuracy than their non-AI-powered systems previously allowed.

In the next decade, we could reach a stage where supply chains are almost entirely managed by AI tools with a dynamic, adaptive approach to logistics, pricing, maintenance and more, thereby freeing up workforce resources for more high-value tasks.

HARNESSING MACHINE LEARNING

While AI facilitates the smart execution of tasks by machines and computers, **machine learning** (ML) is designed for those machines to learn and adapt over time. ML has a wide range of supply chain applications, including inventory management, warehouse management, logistics, transportation planning, location tracking, delivery estimates, production improvements and fraud detection.

With minimal human intervention, ML software explores data to identify patterns and create a model. As the model evolves, the system grows smarter (hence the learning aspect) and operates according to actual outcomes. Outcome probability becomes more precise, resulting in more strategic use of resources and less time allocated to manage risk.

Computer vision (CV) is one ML application designed to enhance several aspects of inventory management. Manufacturers rely on CV to count and classify items upon arrival. CV helps detect any visible damage to packages and categorizes what it sees accordingly to automatically paint a real-time picture of inventory.

Companies are also using ML to combine structured data with unstructured data pulled from news feeds and social media. ML technology scours sources to identify events or even indicators of events that might disrupt the supply chain and demand forecasting. If the timing is right, these insights can inform managers' decisions so they can adjust operations, such as using an alternate supplier, managing a customer's expectations or adjusting planned inventory levels. As ML capabilities improve, the range of applications will continue to expand.

INCREASING VISIBILITY WITH SIMULATION

Simulations of routine processes and operations can show supply chain managers where the most significant structural bottlenecks exist and how much additional capacity is needed. Full visibility into the production process allows managers to see in real time if the supply chain aligns with their day-to-day needs and experiment with adjustments in the virtual world. Simulations limit time spent on the testing phase and can reduce wasted resources. For these reasons, it is commonly used in the automotive sector.

For example, consider a car manufacturer that offers multiple options for body type, trim, paint color and detailing. There could be hundreds or even thousands of possible combinations just for the same model. With a build-to-forecast production schedule that has long lead times and locates cars across a network of hundreds of dealerships, delivering the right car to the right customer at the right time can pose a significant challenge. However, a simulation can demonstrate that using a single distribution center would drastically reduce delivery times compared to relying on decentralized inventory from dealer stocks, which would improve customer satisfaction and increase sales.

Simulation technology can also help proactively assess and define the impact of everyday supply chain risks and, more importantly, bolster a company's response to unforeseen events, which has become the norm in today's world. At a time when agility and resilience are top of mind, simulation technology answers the question: "What if?" Manufacturers are using simulation technology to model the impact of events such as border and port closures, labor shortages, production line downtime, raw material deficits, natural disasters and similar scenarios. This data can then inform incident response and business continuity plans.

Simulation technology can also be used with augmented reality (AR) and virtual reality (VR). In the future, manufacturers might rely more heavily on a combination of these three tools to demonstrate products in entirely new ways. For instance, manufacturers could not only showcase what a product could look like in a factory via AR/VR, but they could employ a simulation to show specifically how a new part or process would work and impact operations.

REAL-TIME INSIGHTS FROM IOT

Communication is key to an efficient supply chain, and any delay harms efficiency. This is true for communication between members of different departments and for communication between different supply chain technologies. IoT devices and sensors can provide many advantages.

Prior to COVID-19, just-in-time supply chains were a popular inventory management system, as they minimize loss and deliver goods as they're needed. But the pandemic exposed the vulnerabilities of this approach, since many manufacturers couldn't respond quickly to abrupt changes in available supply.

IoT technology can help manufacturers transition away from just-in-time supply chains without incurring the expense of overstocking. IoT can lead to a range of benefits, such as increasing the efficiency of warehouse processes, streamlining inventory management and even improving employee safety. For example, real-time location trackers allow on-site employees to easily locate goods. Drones are another IoT tool that help warehouses track products in a safe manner. The wide range of inventory layout in a huge warehouse is difficult for staff to scan through, especially when items are stored on the topmost shelf. Drones can quickly and easily navigate the entire warehouse to scan for these items, minimizing the risk of slip-and-fall accidents.

IoT devices outfitted with GPS and environmental-tracking capabilities enable supply chain managers to authenticate not only the location of goods but their speed of movement and storage conditions. One of the most widely used IoT supply chain solutions gathers data on the temperature inside vehicles, measuring pressure, humidity and other factors that could compromise a product's integrity. If conditions are less than ideal, it triggers an automatic condition adjustment. As the number of IoT-connected devices used in manufacturing grows substantially each year, the benefits and efficiencies will only continue to increase.

EMBRACING BLOCKCHAIN

Manufacturers that previously dismissed blockchain technology, initially developed to support bitcoin transactions, as a fad are now reconsidering. In fact, distributed ledger technology has been around for many years, and leveraging blockchain can dramatically improve the security, accuracy and processing of enterprise information.

Blockchain has been widely adopted by manufacturers looking to meet rising regulatory, investor and consumer demands for provenance information. Prior to joining a partnership or adding a new supplier, companies conduct thorough due diligence to ensure their prospective partner or vendor won't expose them to unnecessary risks. They need to ensure the products received meet required standards, which include origin tracking that has become an increasingly strong focus for the agriculture, food and lumber industries.

It is also important to protect against vendor cybersecurity risks to ensure proper data protection. Blockchain allows for compliance rules to be hard-coded into the infrastructure that handles transactions and enables easy monitoring and verification of these transactions. Whereas legacy processes store transaction records in siloed databases, blockchain records each transaction in an immutable ledger shared between multiple institutions.

Blockchain also supports the use of other supply chain technologies and offers greater transparency for financial, maintenance and delivery information. As all non-digital supply chains rely heavily upon third-party logistics providers for raw materials, sub-assemblies and delivery of finished products to customers, the use of blockchain is accelerating to provide greater visibility and reliability for real-time tracking of materials over land, air and sea. This visibility provides critical input to make the best decisions possible.

Smart contracts are another growing use for blockchain. For example, IoT sensors can indicate when a machine needs routine maintenance and then a service request can be automatically generated along with a smart contract for the necessary work. Once completed, the payment and maintenance history can be verified and added to the blockchain record.

THE DIGITAL THREAD: MOVING THE NEEDLE

The digital thread is a communication framework achieved through a confluence of technologies and information sharing across all parts of a business, inclusive of suppliers and customers. As the adoption of Industry 4.0 solutions expands, companies that lag behind with innovation can be at a significant disadvantage. Though some companies may delay upgrading elements of their supply chain for many reasons, inclusive of cost, complexity and organization readiness, those upgrades will only become more expensive over time, and every day represents a missed opportunity. Technology evolves at a rapid pace, particularly with solutions developed for a complex sector such as supply chain management, so it's critical to take a strategic and proactive approach to adoption.

It's important for supply chain managers to pause and reflect on how much the world and global supply chains have changed over the past 18 months. Recent events have challenged traditional thinking around inventory management and cost management. Priorities have shifted to resilience, agility and exceeding customer expectations. Digital supply chain solutions play a prominent and evolving role in this transition.

Adopting just one of the Industry 4.0 tools outlined above has the potential to optimize numerous elements of the supply chain, and implementing multiple tools in a strategic, integrated manner can be even more impactful for the enterprise and, ultimately, to the customer experience. Companies exploring the spectrum of available technology should do so through the lens of solving the challenges at hand and creating visibility across the extended supply chain, inclusive of customers and suppliers. It's also prudent to have a long-term view and consider how embracing innovative supply chain management today can deliver widespread benefits for the years to come.

A version of this article originally ran in the October 2021 edition of the *Manufacturing Leadership Journal*.

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