Fundamentals of the digital supply chain

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White paper

The next fundamental shift in manufacturing is occurring, and many supply chains are not prepared to capture it. The first, the industrial revolution which occurred in Britain in the late 1800s, brought together individual textile weavers under a single roof, creating the world's first-ever factory. In 1913, Henry Ford kicked off the concept of mass production when he introduced his assembly line concept in Highland Park, Mich. (which he'd actually first seen used in the agricultural sector). Since then, mass production has been the backbone of the global manufacturing world—until now.

Digital's impact on today's supply chain has only begun. Its impact cannot be underestimated. It's shaping our world in ways we once only dreamed of, and it will improve things by leaps and bounds.

Supply chain complexity requires complete awareness. Connecting to everything in real time is the single critical platform enabler. Without it, any digital supply chain will be wrought with information gaps.

And things should improve: The manufacturing industry is facing a new set of demands. Customers want customized parts in smaller batches on tighter deadlines. There are increasing cost pressures. New skill sets are being required to bring manufactured items to market. This white paper details the reasons why having insight into every part of your supply chain is so critical to this next phase of manufacturing. It discusses visibility, responsiveness and resilience and offers real-life examples of companies that are taking a creative, holistic approach to address the demands of their customers that require cutting-edge innovation. It touches upon ways in which typical supply chain managers can solve the issues they are likely to be facing in the very near future, if not now.

For most, the thought of moving their supply chains into the digital realm appears to be an extremely tall and daunting order. But it needn't be. With a few key elements in place, the typical manufacturer can usher in a new era—one that brings light to what is known as "operational dark data," or information that traditionally was unable to be analyzed on a continuous basis. Implementing a digital supply chain provides end-to-end visibility, allows right-time responsiveness and ensures maximum resilience. The first step is actually very simple: It's to understand the fundamental elements of the digital supply chain.

Awareness and visibility

Manufacturing is an intricate web, complicated by the global economy and developments like reshoring, big data and sensor technology—and that's just the tip of the iceberg. We can use these intricacies to our advantage since they provide a wealth of data that ideally will allow companies to understand their manufacturing processes on both a macro and micro level. The key elements to a successful supply chain operation include awareness and visibility, responsiveness and resilience.

Consider a desk lamp from Restoration Hardware®. For most, it's a simple lamp that turns on and off and dims if the mood is right; it looks good and it works. It was designed, sourced, manufactured, shipped and sold to many satisfied customers, the majority of whom remain happily clueless about how their lamp came to be. End of story. But for those of us in the supply chain business, that lamp represents a manufacturing triumph. We know that any little hiccup in the process can have an adverse effect on the bottom line. Did the lampshade fabric from the source in India get delayed by a monsoon?

Did the wire vendor have a production issue that resulted in product quality issues and a lower than ordered quantity? When would the retailer find out about this, and would it be able to manage this issue without incurring large costs or delays to my shipments? These complexities can keep us up at night, worrying about what could go wrong.

We can use the complexities of the manufacturing industry to our advantage. We can integrate customers, front-office and supply-chain operations, and ultimately understand our customers and operations as never before with the Internet of Things (IoT). Many people who hear the term "Internet of Things" picture a self-regulating thermostat or the possibility that someday they can control their stereo's speakers from their watches. These scenarios are becoming more commonplace; in fact, IoT Analytics recently forecast that 21.5 billion IoT devices will be connected by 2025.*

Though the IoT will impact us all on some small, personal level, the big data it produces is poised to make a tremendous impact on the business world, whether that data is hosted by the enterprise or in the cloud. It's already reshaping manufacturing supply chain strategies and enabling them in ways never previously considered. A McKinsey study cites that manufacturers are poised to generate $3.9 trillion in value by 2025 from IIoT adoption.** Companies are rightly excited about the possibilities of big data, but it's becoming clear that just analyzing terabytes of data from business processes and transactions can deliver stale facts and trailing guidance with a "rear-view mirror" view of the supply chain. You can't manage what you can't measure. And you can't fix what you can't see and understand.

By combining current, real-time activities and events with desired outcomes (think KPI performance), a manufacturer implements a practice that Software AG refers to as analytics and decisions. This enables businesses to make accurately fast decisions in a consistent manner based upon its objectives at speed, at scale and with confidence, which in turn brings context and intuitive awareness to make more intelligent business decisions. But an analytics and decisions engine only functions as well as the platform that supports it or, more importantly, the one that feeds the data to it for analysis.

Any company that wants to be agile has to embrace the means to achieve it.
At Software AG, manufacturing agility falls under analytics and decisions, which enables companies to transform real-time insights into right-time actions. Simply put, when things go wrong or opportunities arise, it's easy to know what to do next with the best, most-informed decision. With analytics and decisions, manufacturers gain greater visibility into the actual workings of their business systems and processes, and with better visibility, they gain insight upon which they can act.

Software AG's approach to IoT and analytics offers manufacturers ultra-fast access to hundreds of terabytes of in-memory data from Hadoop®, social, real-time, enterprise, web, mobile and other sources. Continuous analytics enable them to analyze historical process and business data to compute statistical norms and identify patterns and behaviors. They can also correlate streaming data across silos to put real-time data in context and analyze current events. This allows them to detect the business impact of this rapidly-changing data—as it's changing instead of when it's presenting as a problem.

Real-time dashboards enable real-time decisions—so visual analytics provide alerts to unusual situations, allowing manufacturers to remain proactive and to take the right action at the right time. By capitalizing on process and real-time analytics as well as behavioral learning, an analytics and decisions-enabled manufacturing solution allows managers to take the "best next step." By connecting past and current data to the transformative influences of mobile, cloud, social and big data, managers gain context as the basis for intelligent action. They no longer need to log in to dozens of systems to get a single answer; instead, it's all at their fingertips.

Awareness & visibility is always having the ability to obtain the required data, regardless of its point of origin, at the right time, which is the time needed to manage exceptions and capitalize on opportunities. It is the single most critical platform that serves as the fundamental building block for innovation.

* Source: https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/

** Source: https://www.mckinsey.com/mgi/overview/in-the-news/by-2025-internet-of-things-applications-could-have-11-trillion-impact

Capitalizing on opportunities and mitigating exceptions requires real-time action, real-time insights, real-time context and a structured response that can be deviated from when needed. Right-time awareness at the process execution level and an overall understanding of how the process execution fits into the overall supply chain flow ensures practitioners make the best decisions in the quickest amount of time possible.

Awareness is one of the keys to manufacturing supply success. Software AG defines awareness as always having the ability to obtain the required data, regardless of its point of origin, at the right time, which is the time needed to manage exceptions and capitalize on opportunities. It also includes understanding the relationships between supplier tiers, production and supply chain processes, and visibility to customer demand signals. Simply put, awareness and visibility provide a critical platform that serves as a building block for innovation. This means that an Indian lampshade fabric supplier can provide data in standard message file formats, manually upload the same data via a mobile portal or provide streaming sensor data from real-time production sensors. This brings right-time awareness and visibility at the process execution level—the lampshade vendor is experiencing a monsoon that delays his process and disrupts production. By integrating all these varied relationships, the IoT makes awareness possible through real-time, end-to-end visibility into the supply chain. It is a critical enabler of obtaining real-time production performance understanding, giving manufacturers the power to identify exceptions and resolve them with minimal cost and disruption.

One example of a company that is leveraging awareness and visibility to maximum effect is GE Transportation. As detailed in the book by Karl-Heinz Streibich, "The Digital Enterprise," "GE Transportation sells locomotives to a number of railroad companies around the world. For example, Norfolk Southern Railway displays optimization opportunities at the network level. It uses GE's RailEdge Movement Planner to integrate railroad logistics with traffic control systems. This software can deliver real-time overviews of network operations from a single display. Rail operators can monitor trains using GPS, track circuits, equipment identification readers, and time-based tracking. In addition, built-in traffic management applications enable operators to manage train schedules and to respond to exceptions. Norfolk Southern estimates that every 1 mph increase in the average speed throughout their network saves an estimated $200 million in annual capital and operating expenses."

So while the lampshade fabric vendor—and possibly his suppliers—bail themselves out after the monsoon, backup vendors will be identified and ready to go, with no time lost. It is evident that data is being harvested to give us real-time information, enabling us to make confident, informed business decisions.

There are many positive repercussions of shedding light on "operational dark data." For manufacturers, increasing their visibility into the supply chain is one of the most significant steps they can take when considering the move to digital. However, with this valuable, end-to-end insight comes the next series of decisions to be made, such as how to respond if there is a supply chain issue. What is the best way to respond? Is it important to move quickly, or can the response wait? More importantly—should the response wait?

While gaining visibility into the supply chain is invaluable, it means nothing without an informed, right-time response that takes into consideration the repercussions across the entire ecosystem. At Software AG, we call this responsiveness, and it refers to the finely calibrated way in which a digital manufacturer can and should react to a supply chain anomaly.

Responsiveness

When a manufacturer has a successful digital supply chain operation, it automatically introduces awareness and visibility into its process. This seems particularly relevant when considering the intricacies of getting a common desk lamp to market—and the ability of the IoT to help corral all the tiny hiccups that could potentially impact production and, of course, the bottom line. Ideally, every part of the supply chain—from raw materials suppliers to factories to transportation providers—will collaborate about the entire process, or the partners end up pushing their individual problems onto the next point in the supply chain, increasing costs and adding time to the overall process. By proactively providing transparent data to the overall picture, every point of the supply chain becomes aware of potential issues and can act to resolve them as they occur—in a unified, seamless process.

Awareness and visibility are the fundamental building blocks to gaining insight into the data that's required at the right time; they are also critical to understanding the correlations between supplier tiers, production and customer demand. This is becoming more important, since the supply chain process itself has become squeezed to the nth degree, leaving next to no room for error or oversight. Becoming aware of and responsive to issues in a timely manner is absolutely critical. But there is a difference between becoming aware of an exception immediately and acting upon it immediately. A crucial, yet often overlooked function of responsiveness is ensuring that an organization and its partners are responding in the right time and not throwing maximum resources at every issue.

Consider a software company that uses a piece of technology that allows high-speed algorithmic stock traders to move in and out of a stock in thousandths of a second. In that type of an environment, every transaction needs stupefyingly fast analysis and response. Very few supply chains require that level of responsiveness—though perhaps production operations might, in some cases—but if there is a supply chain dilemma, it takes more than a second to make a decision. Right-time responsiveness is made possible by consistently and collaboratively responding to issues with suppliers and partners, even without manual requests or constant manual tracking. While this prospect sounds impractical and even cumbersome, technology makes it much simpler.

Imagine being able to identify opportunities and exceptions before their impact was felt—before loss was a certainty. Sharing real-time performance and context data (i.e., the same time and the same data) with internal and external partners puts everyone on the same page. Think of the expensive situations that could be avoided with a responsiveness piece built into a supply chain model. Responsiveness is the ability of an enterprise and its partners to react to exceptions and opportunities in a unified, consistent and collaborative manner that delights customers and reduces supply chain costs. Most importantly, this occurs without the use of multiple phone calls, emails or contacts to ensure "everyone is on the same page." Not too long ago, this was inconceivable. With the IoT in the mix, however, this becomes not only possible but also a compelling and productive approach to managing data. Real-time sensor data—providing information like location data, temperature and production yield—creates a level of granularity that is fundamental to outstanding performance. This offers an almost preternatural sense for identifying exactly what's going on, where and how to mitigate the impact. The beauty of this scenario is that it can be applied to any number of industries.

One company really capitalizing on the responsiveness enabled by the IoT is a leading maritime and nautical service provider that supplies information and communication technologies services to virtually all segments of the maritime logistics market. Its customers have requested faster response times and more reliable information over a wider geographical area, prompting the company to deploy Software AG's streaming analytics platform. This system leverages the IoT by providing subscription-based, messaged updates about specific ships (which have been equipped with sensor technology) based on virtual zones drawn around any location. The second a monitored ship enters or exits a zone, the subscriber receives details by email or text. An XML message can also be submitted to an operational system or invoke a web service, which in turn supports the shipping clients in optimizing their operational processes. This allowed them to oversee the accurate and continuous flow of information, enabling their clients to plan activities and processes as efficiently as possible.

This achieved some nice results: They saw a 200 percent increase in the number of messages per second that were handled in real time, making them more effective in client decision making. They realized cost savings and strategic differentiation through rapid development of innovative service offerings, and they were able to gather full shipping movement details and relate them to clients in real time. Perhaps most importantly, leveraging the power of the IoT allowed this shipping company to quickly develop and market new maritime logistics products, giving them a huge strategic advantage.

Shipping is just one part of the manufacturing industry using the IoT to become as responsive and agile throughout the enterprise and to every partner as possible. Its impact goes way beyond shipping and manufacturing, however. In fact, the IoT is widely perceived as the foundation for the concept of the fourth industrial revolution, where new technologies decentralize production control and shift manufacturing processes in ways we don't fully grasp yet. If manufacturers can see their universe down to the granular level, they'll be able to make real-time decisions at the right time—decisions that are instant, consistent and that align with enterprise objectives and customer requirements.

Software AG offers Cumulocity IoT, a market-leading IoT platform that leverages streaming and predictive analytics in the cloud or on the edge. Real-time insights can be derived from this data in motion to give a competitive edge to agile organizations that want to act on these insights before they lose their value. Cumulocity IoT enables organizations to exploit perishable insights—now! The platform enables you to make informed decisions quickly and at scale by integrating real-time analytics and decisioning into your organization's transaction-executing systems.

The beauty of such a platform is that by rapidly correlating, aggregating and detecting patterns across large volumes of fast-moving data from multiple sources, it allows businesses to analyze and act on high-volume business operations and customer interactions in real time. It synthesizes the operational dark data to inform decisionmakers to a very powerful degree, giving them end-to-end supply chain visibility as well as insight to enable clear, right-time reactions. Ultimately, by implementing a streaming analytics and intelligent automated system, organizations can rapidly deploy and evolve scalable, real-time solutions in information-intensive, time-critical industries.

Manufacturing is an almost ideal industry for the benefits of such a powerful, insightful and informative platform. Companies in this sector tend to conduct "rear-view mirror" analysis which often makes them miss potential opportunities or threats. Using streaming analytics, business leaders to receive up-to-the-minute information and analysis. When managers are empowered to make right-time decisions, they can act with resilience—meaning that they are ensuring the most positive outcome possible for all involved within the enterprise.

Resilience

There is a growing need for manufacturers to increase their awareness of and responsiveness to the digital supply chain to remain competitive, particularly when our world is increasingly complex, global and inter-reliant. It takes a lot of effort to make the changes necessary to become digital, and one of the most important factors for success is the ability to be resilient. Resilience ensures that enterprises can effectively manage any exception or requested change, while improving net margin, without sacrificing the improvements to customer satisfaction or revenue growth. It means they're agile and savvy and that they're not paralyzed by disruptions. And believe it or not, resilience doesn't have to be hard to implement or achieve.

With workflow disruptions almost a given for the typical manufacturer, supply chains have a clear need for risk assessment and mitigation. Though minor disruptions are frequent, they often result in scrambling, which adversely impacts performance. On the other hand, major disruptions like hurricanes or fires can have negative, long-term supply chain impact, contributing to the loss of millions of dollars. Neither scenario is ideal, yet neither can be avoided fully. The answer is to become an organization that is agile and resilient.

Consider the example of the Indian silk manufacturer who supplies fabric to the sourcer for Restoration Hardware to make a lampshade. While a monsoon in India may not have a direct impact on the shores of the U.S., it's probably worrying not only the silk manufacturer but also the sourcer, who is likely biting his nails thinking about the various options and their outcomes to his business and bottom line. With end-to-end awareness of his supply chain, he will be able to respond intelligently and with resilience.

Having visibility into the supply chain helps to mitigate risks like the effects of a monsoon in India. This is especially true considering the impact of not responding properly, which can lead to expediting costs, lost sales and market share, excess inventory and increased labor. But the effect of disruptions—whether major or minor—can be mitigated using technology like the IoT, which increases manufacturers' resilience—their ability to bounce back with minimal detrimental impact.

There are three simple guidelines to really understand resilience within the world of manufacturing. First, it's important for manufacturers to identify internal changes (e.g., order completion times, facility functionality and planned network changes), understand their impact and quickly adjust to them without incurring a negative cost or impacting customer satisfaction. Second, identify external changes (e.g., customer requests and supplier performance), then understand the potential impact of these changes and quickly adjust to them without a negative cost or customer satisfaction impact. Finally, the third guideline is to easily educate enterprise associates on supply-chain resiliency and functionality processes as well as business impacts to maintain consistency and continuity.

Starting off on the path to resilience can be done incrementally; it needn't be a huge or complex undertaking. In fact, it's preferable to start with a small, controlled focus while thinking big.

Resilience ensures that enterprises can effectively manage any exception or requested change, while improving net margin, without sacrificing the improvements to customer satisfaction or revenue growth. It's being agile enough to not paralyzed by disruptions by understanding quickly and responding quicker.

About the author

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Take for example Electrolux®, a Stockholm-based multinational household and professional appliances manufacturer with 58,000 employees in more than 60 countries. The company's big challenge was to support new growth without adding cost. Electrolux logistics professionals wanted to ensure on-time delivery, so they examined three critical junctures of their supply chain. First, the company determined whether the order was placed with adequate lead time. If it wasn't, it was able to identify and act on this issue immediately. Second, Electrolux simply wanted to know if the network-optimized planned delivery date matched the customer requested delivery date. If these dates didn't align, the company was able to take immediate action to resolve this issue. Finally, Electrolux focused purely on customer service. If the entire process went off without a hitch but the shipment departed late at the eleventh hour, Electrolux contacted the customer about the delay so the customer would not wait for an appliance order when it was not going to show up. This simple monitoring provided Electrolux with the ability to identify three specific issues and then take immediate corrective action ensuring that the customer was never the first communicator of an exception. Becoming resilient means that a manufacturer can identify problems in real time and act on them before their customers feel an impact. It means they can identify and understand the leading indicators that drive performance success to manage issues before they occur. Resilience, however, means nothing without also having visibility and responsiveness already built in and being able to clearly discern the intricacies of the supply chain.

Keeping the production process on track is challenging enough. Far more difficult is accessing the insight embedded in all those transactions—insights about sales opportunities, delinquent payments and incorrect orders that could reduce costs and improve effectiveness. By taking control of their supply chains, manufacturers gain visibility and can understand and comprehensively manage their entire supply process from sourcing through product receipt. They can identify and automatically adjust for bill of material changes, regulation changes, marketing changes, procurement operations, supplier actions or any external event. Embracing the entire process increases agility.

The influence of digital is looming large and it should be embraced. It provides a tremendous advantage when applied correctly, and ultimately, can create disruptive new business opportunities.

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