Introduction

2020 was a challenging year for global supply chains, and we learned a lot about their vulnerabilities and resiliencies. Although there is cause for optimism that 2021 will prove to be a better year for the supply chain (particularly for demand), we have already seen a continuation of the turbulence of 2020.

For manufacturers, the challenges of 2020 led to a rejuvenated focus on managing supply chain risk and achieving true resiliency — as noted both in IDC survey data and in the conversations that IDC has had with companies across a broad range of subindustries. In IDC’s 2020 Supply Chain Survey, the ability to be resilient to changes in the competitive environment was identified as the top supply chain gap for companies.

Given the scale and frequency of disruptions due to the pandemic, manufacturers have largely zeroed in on addressing supply chain risk and resiliency in two ways: improving supply chain visibility and being more agile. Indeed, it has long been IDC’s view that achieving a resilient supply chain means being able to see what is happening in real time and then applying the necessary intelligence/analytics to respond to the challenge. No amount of forewarning will help if you cannot respond to what you see; conversely, agility will be less useful if you lack the ability to know where and how to react.

Visibility, particularly, is both broad and deep. It can mean the ability to see across a network of suppliers and customers, but it can also mean the insight gained by having sensors and sensor data from machines and devices to monitor performance, stability, and equipment location. That data can be captured, processed, and analyzed, with the resulting insights shared across a supply chain. While both forms of visibility are important, this paper focuses on visibility through the use of sensor data. Supply chains that collect, analyze, and disseminate data insights effectively will outperform those that do not. In the inherently more disruptive environments of 2020 and 2021, this statement seems more true than ever.
Supply and Demand Disruption

As we consider the role of supply chain resiliency and the use of sensor data, it is important to consider both supply and demand. Significant numbers of manufacturers experienced supply issues in 2020, and some of these issues continued into 2021. Factories either lost capacity due to COVID-19-related staffing constraints or closed completely. These closures were not permanent, but they were widespread enough that they affected manufacturers directly or via interruption of materials from suppliers. The pandemic has been viewed as a single, large disruption, but the reality is that it has been a series of hundreds, if not thousands, of sequential disruptions.

Although supply reliability has clearly been a challenge for many supply chains, so has the unpredictability of demand. In some cases, demand has increased, putting pressure on supply and factory capacity; in other cases, demand has declined, creating excess manufacturing capacity and inventory. Broadly, the problem is simply an increase in volatility and declines in forecast accuracy. Some companies have struggled to understand whether the demand increases they have seen are real or a consequence of consumer hoarding behaviors.

When manufacturers think about factory resiliency, it is not enough to consider supply chain issues in isolation. They must be seen in the context of demand volatility as well. The ability to use sensor data to monitor asset location and performance in order to optimize changeovers and downtime means greater capacity to deal with unpredictability, whether in supply or in demand.

Given the volatility of both demand and supply, there is an opportunity to invest in supply chain resiliency, particularly in the factory, where 70% of manufacturers say visibility is important or very important, and 80% say that agility is important or very important. Indeed, when manufacturers were asked about the key areas for improvement in their supply chains, the top 2 responses were directly related to the factory (see Figure 1). The top response focused on adopting digital technologies such as sensors and the Internet of Things (IoT) to improve the performance of manufacturing and manufacturing assets.

FIGURE 1: Focus Areas for Improvement

Q. What are the key areas of focus for improvement in your supply chain?

<table>
<thead>
<tr>
<th>Area</th>
<th>12 months (%)</th>
<th>3 years (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital manufacturing</td>
<td>36.5</td>
<td>34.8</td>
</tr>
<tr>
<td>Manufacturing execution systems</td>
<td>30.4</td>
<td>25.7</td>
</tr>
<tr>
<td>Demand planning and forecasting</td>
<td>24.1</td>
<td>26.3</td>
</tr>
<tr>
<td>Sales and operations planning</td>
<td>23.3</td>
<td>23.5</td>
</tr>
<tr>
<td>Inventory planning and optimization</td>
<td>22.8</td>
<td>22.0</td>
</tr>
</tbody>
</table>

*Source: IDC’s Supply Chain Survey, 2020*
Sensor Data in the Supply Chain

IoT and sensors are among the more disruptive technologies for manufacturers with factories or in asset-intensive industries. IoT data can be ingested, stored, and managed; insights are derived using AI capabilities; and then the insights are streamed in real time to ERP and SCM SaaS applications for better predictability and decision making. Asset-intensive companies rely on efficient utilization of fixed assets and must focus on maximizing capacity utilization to manage costs in the manufacturing process. In a world where both supply and demand are increasingly unpredictable, the use of sensor data can bring increased predictability to these priorities. The reality is that traditional asset management and maintenance processes are slow and generally ineffective, and the use of sensor data for condition-based monitoring and predictive analytics will raise the availability of critical factory assets.

In assessing the use cases for sensor data and the trends for integration of IoT and manufacturing, we need to look to foundational areas first and then move into the art of the possible to identify further areas for differentiation. The following examples illustrate this progression.

Asset Instrumentation — Foundational

Manufacturers can benefit from real-time awareness of asset condition through dense deployment of wireless and wired sensors.

Current situation: Some factory assets have condition reporting through sensors, but there is little centralized data management beyond historical data.

Goals: Higher levels of asset availability result in less factory downtime and lower capital appropriation spending.

Technology: Hardware — servers, storage, and IoT; software — big data/analytics/AI, cloud ERP, MES, and edge computing

Centralized Asset Monitoring and Diagnostics — Aspirational

Assets are monitored and issues are diagnosed at a central location. Maintenance resources are optimized through a tiered support structure, depending on the issue, type of asset, criticality, and so forth. There are still local maintenance personnel, but most work/tasks are managed in a centralized center.

Current situation: Each factory manages the maintenance of its assets with various levels of success. Maintenance teams have varied levels of experience/knowledge, and the departure of more expert workers often results in knowledge gaps that are not easy to fill.

Goals: Highest levels of asset availability result in less factory downtime and lower capital appropriation spending. There will also be a lower cost of maintenance delivery and a reduction in overall labor costs.

Technology: Hardware — servers, storage, and IoT; software — big data/analytics/AI, cloud ERP, MES, and edge computing
**Augmented Maintenance – Aspirational**

The use of sensor data, with augmented and virtual reality, provides maintenance technicians with relevant information and guided work instructions.

**Current situation:** Most assisted maintenance involves documented work instructions, but little information is directly integrated into maintenance technician tooling.

**Goals:** The objectives are lower time and cost to repair, longer mean time between failure (MTBF) and higher first-time fix (FTF) rates, and lower factory downtime.

**Technology:** Hardware — servers, storage, and IoT; software — big data/analytics/AI, AR/VR, cloud ERP, MES, and edge computing

For the supply chain to be resilient, there must be a continuous cycle of data. In the case of IoT, data is ingested, stored, and managed and insights are derived using AI capabilities. Then the insights are sent to ERP and SCM SaaS applications for better predictability and decision making. It’s a continuous cycle of monitoring, assessing, automating, and tracking in real time, using sensor data from devices, equipment, and transactional manufacturing systems.

Supply chains are dealing with more frequent disruptions, whether they involve supply, demand, or transportation. The supply chain now operates in an increasingly unpredictable environment due to natural disasters, talent shortages, political instability, poorly trained container ship pilots, and the impact of the pandemic. In IDC's 2020 Supply Chain Survey, respondents identified supply chain resiliency (23%) and a lack of digital competencies to transition the supply chain (18%) as the top supply chain capability gaps. The second gap is particularly interesting, in the context of using sensor data, because it means being able to respond quickly to adverse events to significantly reduce or even eliminate recovery time. Although there is a tendency when considering supply chain risk to look to major supply chain disruptions, also called "black swan" events, the day-to-day/hour-to-hour disruptions are far more problematic. Addressing the impact of these short-term/frequent disruptions is where the use of sensor data shines.

When properly utilized, sensor data can be immediately transformative. Even companies that may view their manufacturing operations and supply chains as being less mature or digitally developed can benefit from IoT. Very often a new or unfamiliar technology is used within an existing business process. In other words, integration of sensor data into manufacturing in foundational areas is the first step. This might be improvements in safety, equipment maintenance, or asset utilization. As familiarity with the capability of a technology, as well as broader digital maturity, increases, transformational use cases become more apparent. Sensor data and AI can be used to inform dynamic inventory selection and deployment, comprehensive track-and-trace activity, and manufacturing capacity flexibility.

**Benefits**

The use of sensors and the data they provide is a key factor in achieving better visibility. The role of automated data capture complements the work of human expertise in the manufacturing supply chain. Technology is not replacing people; rather, technology is supporting people. Real-time or near-real-time integration of devices and equipment into supply chain transactional systems means more predictable and reliable estimates of factory capacity, throughput, and efficiency. Sensor data also provides organizations with the opportunity to do things they could not do otherwise. Dynamic/real-time monitoring, employee productivity, production/asset allocation, and track-and-trace activity are a few examples.
Manufacturing supply chains that leverage advanced technology such as IoT should expect to achieve better visibility, agility, and efficiency. Figure 2 summarizes manufacturers' view of the power of technology. The reality is that 60% of companies expect to see their markets disrupted by competitors with superior manufacturing or supply chain capability. How organizations respond, or don’t respond, will determine which survive and which do not.

FIGURE 2: Global Supply Chain — The Power of Digital Technology

Q. What have been the main benefits to adopting technology within your supply chain?

- Greater supply chain visibility
- Faster for new products
- New business opportunities
- Faster (supports an agile supply chain) for existing products
- Easier access to providers

(n = 816)

Source: IDC's Supply Chain Survey, 2020

**Considering Oracle and PwC**

PwC and Oracle have collaborated to provide a connected platform. IoT is pre-integrated with Oracle's SaaS portfolio and with Oracle Integration Cloud for when third-party applications need to be integrated. This enables tracking, monitoring, and automating. Near-real-time integration is achieved between devices and equipment as well as with transactional manufacturing systems. This leads to higher efficiency, greater productivity, and an improved ability to forecast and plan to optimize business against customer demand and supply constraints.

Oracle improves usability and efficiency — while reducing human error — by automating core processes and providing guided actions for users of intelligent applications. Insights and agility are delivered by optimizing business processes across multiple systems including manufacturing, maintenance, logistics, and human resources with its integrated IoT Intelligent Applications. Built-in predictive analytics and integrations with supply chain management, enterprise resource planning, human capital management, and customer experience help drive better business outcomes across organizations. These applications use data from connected devices and systems to provide visibility, insights, and efficiencies using prebuilt applications, embedded analytics, a SaaS delivery model, and a wide range of use cases including smart manufacturing, connected assets, connected logistics, connected customer service, and workplace safety.
PwC’s strategy is designed to drive success in the market with three main differentiating components:

1. **People.** PwC’s Oracle consultants offer deep supply chain knowledge and experience with a clear understanding of the impact and implications of technology. Many consultants come from supply chain leadership positions in industry. They know how to extract value and help clients achieve a positive ROI. "Transformation" is a core part of the PwC DNA.

2. **Innovation and automation.** PwC’s industry-specific model systems and point solutions allow the company to have an 80% client-ready solution within the first month of the program. It uses this to free up effort to iterate designs that give clients competitive advantage and deliver results quickly. PwC brings integrated solutions to every engagement as well as expertise across adjacent functions (finance, tax, front-office automation).

3. **Adoption.** Success in the cloud is dependent on user adoption and standardization. PwC’s Business, Experience, Technology (BXT) approach to Oracle engagements allows the company to focus on the different personas and drive end-user adoption to create value.

Manufacturers in industries such as consumer goods, heavy machinery, energy, and life sciences should consider PwC when looking to collaborate with an external firm with a focus on systems implementation and strategic consulting that can help drive Oracle SCM value and supply chain transformation on a global scale.

**Challenges**

Although both Oracle and PwC bring substantial knowledge, capability, and credibility to the IoT, analytics, and AI spaces, the supply chain solution market is crowded, and maintaining credibility means continuing to push the envelope in terms of what is possible. Indeed, moving from use cases that are aspirational to use cases that are pragmatic and possible will be an important element of competitive advantage and a way to continue to show leadership.

**Conclusion**

For manufacturers, the challenges of 2020 led to a rejuvenated focus on managing supply chain risk and achieving true resiliency. The ability to be resilient to changes in the competitive environment was identified as the top supply chain gap for companies in IDC’s 2020 Supply Chain Survey.

In this paper, we have made the argument that when manufacturers think about factory resiliency, it is not enough to consider supply issues in isolation. They must also be considered in the context of demand volatility. The ability to use sensor data to monitor asset location and performance signals a greater capacity to deal with unpredictability, whether supply or demand.

The ability to connect sensor data, ERP, and advanced analytics/AI on a single platform means a step change in the integration of devices, equipment, and transactional manufacturing. Asset-intensive companies rely on efficient utilization of fixed assets and must focus on maximizing capacity utilization to meet their business obligations. In a world where both supply and demand are increasingly unpredictable, the continuous streaming of sensor data can bring increased process and operational predictability and raise the availability of critical factory assets. The resilient future supply chain clearly uses data and the insights derived from that data to drive efficiency and effectiveness. Supply chains that use data effectively will outperform those that do not.
About the Analyst

**Simon Ellis, Program Vice President, Supply Chain Strategies**

As a program vice president, Simon Ellis is responsible for providing research, analysis, and guidance on key business and IT issues for manufacturers. He currently leads the Supply Chain Strategies practices at IDC Manufacturing Insights, one of IDC's industry research companies that address the current market gap by providing fact-based research and analysis on best practices and the use of information technology to assist clients in improving their capabilities in critical process areas. Within the Supply Chain practice, Mr. Ellis is directly responsible for the research in the Supply Chain Planning Strategies practice while also managing the Supply Chain Execution Strategies practice.

MESSAGE FROM THE SPONSOR

PwC's Digital Operations integrated solution supports strategy through deployment of connected supply chains with key digital solutions built on Oracle Cloud. Digital supply chain represents a paradigm shift from functional silos to a more connected ecosystem and enables companies to integrate visibility with planning and execution across the end-to-end value chain, making it easy to reflect changes in revenue, cost, profitability and margin due to demand and supply change. Learn more here.

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IDC Custom Solutions

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