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## Technology Enablers for Smart Supply Chain Management

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### Abstract

*Globalization has led to increasingly interconnected supply chains systems. Moreover, the current pandemic has led to more complex, uncertain, and vulnerable supply chains. Their sensitivity to even small errors or lack of accurate plans can have major consequences in terms of product availability, schedules, pricing, revenue, and wellbeing for mankind. This paper discusses potential solutions to five supply chain challenges, that need to be overcome in order to minimize these negative outcomes. Smart Supply Chain System (SSCS) and the Internet of Things (IoT) are proposed.*

Keywords: Technology Enablers, Smart Supply Chain Management

### Introduction

Supply chain management (SCM) focuses on providing a given customer the demanded items at the contracted price, at the right volume, place, time, and the expected quality level. Meeting these goals all the time is a daunting task for any company. Five supply chain challenges with potential solutions are identified. All are critically important and must be addressed simultaneously. Together, they comprise what is called the Chief Supply Chain officer agenda. These results are based on conversations with nearly 400 supply chain executives worldwide as reported by IBM and are summarized here.

#### A. Cost containment

Greater flexibility should be obtained to cope with cost volatility with smarter cost containment strategies, risks should be managed collaboratively along the end-to-end supply chain, customer input should penetrate the supply chain through more immersive customer experiences, and the global supply chain should be integrated and optimized intelligently (4). “The supply chain will ultimately be measured based on its ability to produce bottom line results, such as EBIT and cost to serve.

Supply chain executives rank cost containment as their number one responsibility to the business, far ahead of enterprise growth and product and service innovation. this intense focus on controlling costs is also quite evident in their activities and programs; two out of the top three types of initiatives are aimed at improving efficiency. These are also the areas where executives have

realized the most past success. however, what used to be a methodical, continuous improvement process has turned frenetic. Shocks to integral costs, rapid wage inflation in previously low-cost labor markets, spikes in commodity prices, or even sudden credit freezes, are becoming more common.

Supply chain executives find themselves reacting to whatever the cost issue of the day happens to be. escalating fuel prices, for example, send executives scrambling to reevaluate distribution strategies, engage third party logistics providers more extensively, or even share loads with competitors. when fuel prices fall, distribution and transportation methods become laxer as companies emphasize service over cost – reverting to smaller, more frequent shipments and faster modes. Shifts in costs and other operational fundamentals are happening so quickly that conventional supply chain strategies and design techniques can't keep up. new designs are outdated before executives can implement them.

## B. Visibility

The degree of information visibility is more likely to maximize benefits. “When we talk about supply chain visibility, it does not simply mean visibility into your supply chain and your shipments. It means visibility among partners, which enables collaborative decision making closer to the customer. This is both a science (managing the technology) and an art (using the information and metrics for competitive advantage).” As reported by one executive surveyed.

At a time when, generally speaking, information is abundant and connectivity is more feasible than ever, supply chain executives still rank visibility as their greatest management challenge. Although more information is available, proportionally less is being effectively captured, managed, analyzed, and made available to people who need it.

Despite its top billing on the issue list, visibility and the collaboration required to get information and make decisions with it is not attracting much attention in terms of activities and programs. Supply chain executives are focused more on strategy alignment, continuous process improvement, and cost reduction. Driving integration and visibility of information inside their organizations rank fourth on their priority list, and external visibility falls even lower in seventh place. Making matters worse, the majority of those who have tried to improve external visibility describe their efforts as largely ineffective, making external visibility projects the least effective of all initiatives executives have undertaken. Not surprisingly, organizational silos are the biggest barrier. But they were shocked so many executives reported that their organizations are too busy to share information or simply do not believe collaborative decision making is that important.

More than half of all supply chain executives have implemented practices aimed at improving visibility, such as continuous replenishment and inventory management with customers. But less than 20 percent are pursuing these practices extensively. In contrast, leaders of top supply chains are much more focused on improving visibility. twice as many report extensive implementations of collaborative planning with suppliers and vendor managed inventory (VMI). And more than 60 percent of the top supply chains have implemented all the practices discussed in interviews.

### C. Risk Management

Risk management emerged as supply chain executives' second largest challenge, a surprisingly high ranking. This sentiment was built from thousands of recall headlines and a deepening realization that globalization and greater supply chain interdependence have not only elevated risk but also made it more difficult to manage. Among the respondents, 69 percent formally monitor risk, but only 31 percent manage performance and risk together. executives cite the lack of standardized processes, insufficient data, and inadequate technologies as the chief stumbling blocks preventing effective risk management.

More than two thirds of supply chain executives have programs in place to monitor compliance. But top supply chains are taking risk management a step further incorporating it into their plans and using it to monitor and act on disruptive events.

### D. Customer intimacy

Rising customer demands ranks as the third highest supply chain challenge, and two out of every three companies struggle to accurately identify customer needs. however, despite the obvious need for customer interaction, companies tend to focus more on their suppliers than their customers. eighty percent of design products jointly with their suppliers, but only 68 percent do so with customers. even in supply chain planning, with all the demand driven hype, only 53 percent of companies include customer input, while 63 percent invite supplier participation.

Although technology has made it more feasible than ever to incorporate customer input, working directly with customers remains the least common supply chain planning practice. Demand planning at one out of every five companies ignores customers entirely. Because customer interaction seems costly and time consuming, some companies just don't bother. But as the pressure to be more profitable grows, supply chains won't be able to afford the excess inventory, lost sales, and missed innovation opportunities caused by inadequate customer collaboration.

### E. Globalization

Given the growing interdependence among economies worldwide, it's no surprise that globalization ranks as a top supply chain challenge. Many companies are encountering issues with global sourcing, including unreliable delivery (65 percent), longer lead times (61 percent), and poor quality (61 percent).

So far, however, the financial advantages of globalization of their markets and operations outweigh these negatives. nearly 40 percent of supply chain executives report improved margins. yet this bump in profits is not necessarily tied to lower costs. More than one third of executives are experiencing increased costs, likely because of global sourcing challenges. Instead, these higher profits seem linked to sales increases. These findings suggest globalization has contributed more to revenue growth than efficiency.

## Smart Supply Chain System (SSCS)

A smart supply chain system is both self-organizing and self-optimizing. Data from connected sensors in the factory can be integrated with data on user preferences, weather, and other systems information. A smart system can for example predict a bottleneck arising from an abnormal weather event. Pre-empting this type of event can be used to streamline the system and prevent waste from excess production, leading to leaner manufacturing.

The digital and physical infrastructures of our world are converging, thanks to the falling price and rising reliability of sensor technologies, and networks. Practically any activity or process can now be measured. Objects can communicate and collaborate directly, without human intervention. Entire systems can be connected. Not just supply chains with other supply chains, but also with financial markets, electric power grids, and systems that monitor environmental conditions including weather, road, and environmental conditions in real time.

Information from these systems can be used by a smart supply chain to not only correct the chain upstream and downstream but ultimately predict likely outcomes to optimize the entire system. The evolution from decision support to decision delegation and, ultimately, to a predictive capability requires a smart supply chain with three core characteristics:

### 1. Instrumented

Supply chain information that was previously created by people will increasingly be generated by sensors, RFID tags, meters, actuators, GPS, and other devices and systems. In terms of visibility, supply chains not only will be able to 'see' more events but also witness them as they occur. They will rely less on labor-based tracking and monitoring, as objects like shipping containers, trucks, products, and parts report on themselves. Dashboards on devices perhaps not yet invented will display the real time status of plans, commitments, sources of supply, pipeline inventories, and consumer requirements.

### 2. Interconnected

Smarter supply chains will take advantage of unprecedented levels of interaction. Not only with customers, suppliers, and its systems in general but also among objects that are monitoring or even flowing through the supply chain. Besides creating a more holistic view of the supply chain, this extensive interconnectivity will also facilitate collaboration on a massive scale. Worldwide networks of supply chains will be able to plan and make decisions collectively.

### 3. Intelligent

To assist executives in evaluating tradeoffs, intelligent systems will assess myriad constraints and alternatives, allowing decision makers to simulate various courses of action. A smarter supply chain will also be capable of learning and making some decisions by

itself, without human involvement. for example, it might reconfigure supply chain networks when disruptions occur. it could acquire rights to use physical assets like production capacity, distribution facilities, and transportation fleets on demand through virtual exchanges. this intelligence will be used not only to make real time decisions but also to predict the future. equipped with sophisticated modeling and simulation capabilities, the smarter supply chain will move past sense and respond to predict and act.

## **IoT and Supply Chain**

The Internet of Things (IoT) is a collection of interconnected physical devices that can monitor, report on, and send and exchange data. IoT devices are typically connected to computer systems via data or Wi-Fi networks. IoT devices use sensors to measure specific aspects of the world around them, including location, temperature, humidity, light levels, movement, handling, speed of movement, and other environmental factors. IoT devices come in many form factors including RFID chips, smart devices, and mobile sensors.

In supply chain systems, Internet of Things technologies are an effective way to track and authenticate products and shipments using GPS and other systems. IOT allows integration with smart factories, smart transportation systems, smart storage and distribution centers to insure system's optimization.

## **Conclusion**

Smarter supply chains will be inherently flexible. they will be composed of an interconnected network of suppliers, contract manufacturers, and service providers that can be tapped on demand as conditions change. to leverage resources optimally, the supply chain of the future employs intelligent modeling capabilities. Simulations allow supply chain managers to see the cost, service level, time, and quality impacts of the alternatives being considered.

As executives chart the future course of their supply chains, they will have several simultaneous objectives: they must align their supply chain strategies with rapidly changing business strategies. then, to execute those strategies, they'll need to innovate and make the supply chain more sustainable, flexible, and responsive through increased instrumentation, interconnection, and intelligence. this transition to the Smarter Supply Chain of the future must be seamless, without operational interruptions or performance slips. It is a strategic balancing act one that requires a C level leader

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