Siemens Support for Resilient Supply Chains

CIMdata Commentary

Key takeaways:

- *Issues caused by the pandemic, trade relationships, regulatory pressures, Environmental, Sustainability, and Governance (ESG), and economic circumstances have transformed the topic of supply chain from a manufacturing strategy element to a hot C-level business strategy issue.*
- *Digital transformation leaders need to balance strategic goals of cost, quality, and performance with a wide variety of risks as purchased items are acquired and incorporated into finished products.*
- *Digital logistics applies the use of digital technologies to improve supply chain efficiency, resiliency, and ESG support.*
- *Siemens uses the digital logistics capabilities of the Xcelerator cloud architecture to support digital twin use cases in product design, production, and operation to ensure required materials get where they need to be at the right time while optimizing cost and speed with transparency and minimum risk.*

Introduction

A common headline and topic of conversation over the past year is "Supply Chain Issue." Manufacturers have always had supply chains, but consumers have learned about the consequences of supply chain issues over the past two or so years due to the scale of recent disruptions.[1]

A supply chain is a business strategy to get materials, components, and products from their point of origin to their point of use. An efficient supply chain approach helps companies improve their financial and time to market performance. Companies focus on their core supply chain processes and technologies, perfect them, and take advantage of partner companies (suppliers) working in a similar way. This operational method allows maximum investment to go into perfecting each supply chain participant's core processes and products leading to higher quality, lower cost, and more innovative products.

As a key component of this strategy, companies have added another core process, supply chain management (including logistics). Product developers need to specify materials and components that meet their requirements and purchasing staff must find suppliers that can deliver the specified items on time, reliably, with the required quality. While conceptually simple, the complexity is in the details.

Each supply chain is a part of the global manufacturing economy that can be thought of as a massive, distributed network. Every company develops its unique supply chain (or has one emerge) with preferred suppliers that enable delivery of their products or services to the market. Each company's supply chain is a subset of the global network.

In general, supply chains are amazing. For example, the automotive industry has perhaps the largest, most complex supply chain in existence. At each automotive OEM thousands of suppliers deliver material, components, and sub-assemblies in color sequence, just-in-time to automotive assembly lines at globally distributed facilities every day using ships, rail, and

[1] Research for this commentary was partially supported by Siemens

trucking companies. Completed vehicles are distributed to dealers using similar transport options. Keeping this network running smoothly takes enormous effort.

Coping When Things Go Wrong

The goal of supply chain organizations is to design a system that is robust enough to ensure uninterrupted production, yet reliably deliver products as needed at specified cost and quality. This strategy has a well proven business value over the years. While individual suppliers occasionally have issues and miss shipments, consumers have rarely been denied the products they want. The global disruptions that have hit supply chains over the past two or three years are unprecedented. The pandemic, the war in The Ukraine, and semiconductor shortages have each caused massive disruptions that have had measurable global economic impact.

In researching supply chain issues, three interesting examples were recently reviewed. A manufacturer who distributes in the local East European region and has a huge distribution warehouse in The Ukraine. In February the war broke, and so that warehouse is no longer accessible. The manufacturer must now scramble to find the best alternative distribution centers. The supply chain team used Microsoft Excel, the business Swiss army knife, to understand and evaluate the capacity of the distribution centers that are available locally and used their experience and expertise to determine an alternate solution. Imagine if, rather than crunching static data of marginal quality in Excel, simulation models of the distribution network that included the warehouse in The Ukraine or any other local facilities that were available, could be used to compare pallet handling capacity of the warehouses and run various real-time, what-if scenarios.

Within PLM we don't often get directly involved in demand planning, but demand is an input to manufacturing engineering and for people designing production lines, factories, and supply chains. Imagine a world where you can launch a predictive demand planning solution to better forecast demands of your customers. You are then able to simulate production according to this demand, and to ensure the availability of all necessary materials, i.e., what do we have in inventory available now (not reserved), what volumes are in-transit and will arrive on time, and what can we order at what time intervals—while looking into the future and checking against inventory levels, on-hand or in-transit, and then checking options to get the materials on time into the plant, either by standard replenishment orders or by sharing an express volume (via air freight to start production and later receiving the balance shipment as replenishment volumes by sea freight at lower cost).

Finally, imagine a world where in day-to-day operations of production we are able to, with the support of AI and other leading-edge technologies, determine the best production line configuration and sequences in real-time and to simulate new planning if any kind of changes or disruptions happen. Also, if materials are in-transit, alerts will show that a shipment will not arrive on time (as expected). A comprehensive digital twin involving supply chain simulation can help identify options to mitigate these kinds of problems. For example, if a specific part currently in transit on a ship is late, how can we get some parts into the plant on time (again, some air freight shipments, referral shipments from another plant, etc.)?

While types of disruption and potential remedies are virtually infinite, supply chain processes consist of several well-known elements that must be addressed to build and maintain the proper foundation required to address potential issues.

Supply Chain Processes

Proper architecture, design, and implementation of supply chain processes is critical to providing supply chain professionals with the visibility they need to address disruptions. Key elements of a supply chain strategy include:

- Supplier management–The overall process used to manage data and processes related to the interaction between an organization and its suppliers, which can include requests for proposal, information, or quotation (RFP, RFI, RFQ), supplier qualification, supplier quality management functions, overall supplier performance, and transactional data.
- Sourcing and redundancy–The process of managing RFI/RFP/RFQ, early sourcing, dual/multi-site sourcing, and strategic sourcing.
- Quality–The processes, such as audits, that ensure the supplier complies with regulatory and specified requirements, provides tracking, reporting, and traceability, and root cause analysis and corrective and preventative actions when quality issues occur.
- Logistics–Processes that enable a set of functions that determine an optimized distribution of material and product based on factors such as transportation capacity, warehouse capacity, transportation times, etc.
- Integration–This process includes the enablement of electronic data sharing, so information flows are synchronized to eliminate obstacles in information sharing in support of improved decision making while respecting data security.
- Reporting–The process of capturing, analyzing, and delivering information to stakeholders to enable the organization to make better supply chain-related business decisions more quickly.

Digital Logistics

As with all aspects of modern business, logistics is being digitalized, connected to digital threads, and even incorporated into digital twin strategies. Customer orders need to be delivered by the best (e.g., fastest, most efficient, and cost effective) means possible, and can require using multiple modes of transportation–air, sea, rail, and a variety of trucking and local delivery options are used depending on product size, quantity, frequency, perishability, and many other parameters. Planning software is often used to guide companies in the best delivery strategy for a given set of parameters.

Once products are loaded for their journey from their point of manufacture or distribution center, customers and suppliers want to keep track of shipments so they are not surprised by delays or other issues. To carry out this task, manufacturers and shippers are adopting RFID and IoT to provide data on what is really happening within the distribution process. Connecting this data into the extended enterprise digital thread enables fast reaction and even proactive activities to ensure delivery happens as planned.

One area in which CIMdata has seen a lot of activity is the creation of digital twins of transportation systems and important devices such as tractor-trailers, rail cars, and pallets. Connecting these devices using telematics and IoT solutions provides shippers and manufacturers with the real-time data needed to manage the logistical flow of products along the distribution path. Beyond just reporting status, sensors on products or packaging can capture critical data such as exposure to environmental conditions, such as extreme temperature or a shock event (pallet drop, etc.), that could cause damage. Data from logistics

operations enables the supply chain team to populate digital twins (sometimes called Supply Chain Control Tower) that can be used to predict the effects of supply chain changes or risks. Using this type of scenario modeling enables the design of more robust logistical systems.

Siemens Digital Logistics Solution

The Xcelerator portfolio from Siemens includes digital logistics capabilities via the AX4 and SCS solution brands. By connecting design, manufacturing and distribution, companies can enable greater transparency across their supply chains. Design and manufacturing decisions can be improved via visibility into logistics so that better part and sub-assembly decisions are made, minimizing cost and risk. By providing easy access to data in Xcelerator, companies can run a variety of scenarios to ensure optimal supply chain decisions are made.

ESG, the requirement to meeting customer expectations for ethical and sustainable operations, is a critical and growing necessity in supply chain reporting. For many products, the distribution process is a significant element of the ESG score. Decisions made up front during design and planning can impact logistics and therefore ESG scores. For example, material choice, supplier location, kitting concepts, and packaging affect weight and density (e.g., how many units fit on a pallet), thus impacting CO_2 generation. Being able to run transportation scenarios during product development improves engineering design and manufacturing process decisions that impact transportation and distribution requirements. Beyond ESG, cost is a critical parameter to be minimized and the ability to run transportation scenarios during planning enables cost avoidance and overall execution excellence.

Perhaps the most interesting scenario addressable by digital logistics is disruption. Once an end-to-end plan is being executed, what happens when something goes wrong? Being able to model alternatives and avoid a trial-and-error approach is a dramatically more efficient method to identify and addressing disruptions. With data managed by Xcelerator's cloud architecture, it becomes possible to try out many more alternatives such as "can the product be manufactured differently (or in a different location) so it can take advantage of an alternative supplier or transportation route?"

Enterprises want end-to-end logistics processes with full transparency on cost, lead time, and CO_2 emissions to enable fact-based decisions before committing to freight routes. Connecting to the digital thread to access up-to-date product and manufacturing information improves logistics decision quality. RFID and other IoT sensors (e.g., temperature, acceleration) supplies data during transportation to the manufacturer or end user that can be critical to the performance or quality of products. If a product was dropped or exposed to a temperature extreme, it may not perform as it is supposed to. Reporting this data can close the loop and kick off proper contingency activities to ensure manufacturer or end user satisfaction.

Conclusion

Supply chains are a critical element of most businesses. Ensuring materials, parts, sub-assemblies, and finished products move across the lifecycle efficiently while providing the needed transparency for all relevant decisions (product performance, cost, delivery, quality, regulatory, ESG, etc.) is a requirement in today's competitive world.

Beyond the basic requirements, supply chains must be resilient, that is, they must withstand and work around major disruptions. Having a digital logistics solution linked to the rest of a digital enterprise connects an important element to the end-to-end digital thread. When a disruption happens, there are usually multiple solutions with different cost, quality, and timing

impacts. Having the tools to provide high quality logistics information to decision makers is critical to solving the issues.

The digital logistics solutions as part of the Siemens Xcelerator portfolio helps enable proper logistics planning and execution and is fully connected to the digital thread created by Xcelerator's cloud architecture. Beyond planning, its modeling capabilities provide the tools needed to address supply chain disruptions helping logistics professionals react efficiently and effectively. Companies that need to incorporate efficient logistics into their digital thread to support transportation planning and execution should review the digital logistics solutions from Siemens.

About CIMdata

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