Deloitte. Insights

A Deloitte series on Industry 4.0, digital manufacturing enterprises, and digital supply networks

Synchronizing the digital supply network

Using artificial intelligence for supply chain planning

Deloitte Consulting LLP's Supply Chain and Manufacturing Operations practice helps companies understand and address opportunities to apply Industry 4.0 technologies in pursuit of their business objectives. Our insights into additive manufacturing, the Internet of Things, and analytics enable us to help organizations reassess their people, processes, and technologies in light of advanced manufacturing practices that are evolving every day.

CONTENTS

Growing complexity in supply chain planning

A restaurant can be a complex business to run. Anticipating demand to order the right amount of ingredients at the right time, and handling it all manually—for a business with notoriously thin margins to begin with—typically constitutes a significant challenge even in the best of times. One restaurant chain decided to take advantage of advanced technology to gain a deeper line of sight into demand, and learn to plan better. The restaurant chain used machine learning and artificial intelligence (AI) tools to analyze point-of-sale data. While this process started out largely manual, the system was able to recognize patterns in the data quickly and learn from them, enabling the restaurant to move toward a fully automated planning process. Rather than forcing planners to predict based on the information they had on hand at the moment, the restaurant chain used a seamless flow of current and historical data to begin to sense, anticipate, and even forecast demand—and plan accordingly. The restaurant's staff enjoyed reduced workloads, but the results also cascaded backward through the supply chain. Suppliers were able to plan more accurately, resulting in less waste, greater efficiency, and improved flexibility throughout the network.

SUPPLY chain planning has always been a data-rich, analytical process. But as linear supply chains evolve into interconnected digital supply networks (DSNs), powered by advanced technologies and interconnected systems, the way we think about supply chain planning could fundamentally shift. (See the sidebar "A brief look at the digital supply network" to learn more.) The increasing amount of data and intelligence made visible by connected systems, vastly more powerful computing capabilities, and the continuing maturation of AI are enabling a move toward cognitive planning—and beyond. Organizations can use intelligent technologies to make smarter planning decisions, enabling them to reduce costs, remove reliance on "tribal knowledge," gain deeper and broader insights into their supply chains, dramatically improve decision-making processes, and increase the agility of their DSN.

As with our restaurant example, these benefits can ripple outward, causing profound shifts in an organization and its DSNs. Indeed, the way companies execute, the way they organize and structure their planning capabilities, and the skills planning professionals need could all look significantly different.

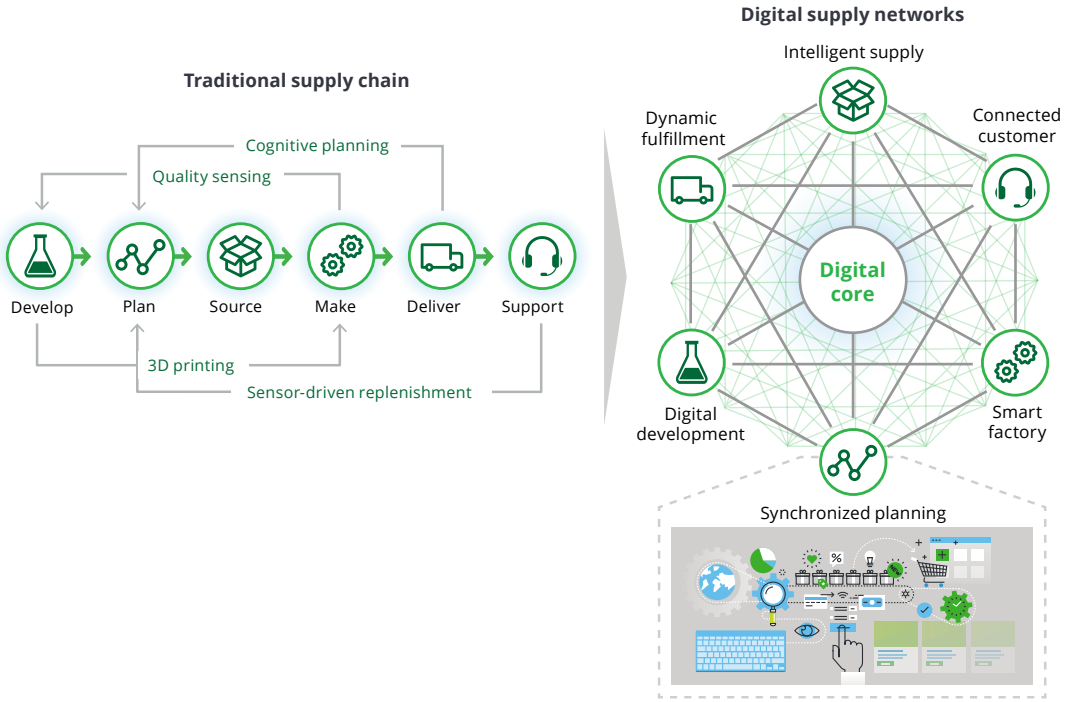
This article focuses on the environmental shifts driving the need for synchronized planning, how advanced technologies and strategic decision-making processes can support the shift, the role humans could play alongside AI, and how to begin to derive enterprise value in this new reality.

A BRIEF LOOK AT THE DIGITAL SUPPLY NETWORK

Deloitte has explored the DSN and its profound and myriad impacts on organizations in multiple publications. In the first publication of this series, *The rise of the digital supply network*, we examined how supply chains traditionally are linear in nature, with a discrete progression of design, plan, source, make, and deliver.[1] Today, however, many supply chains are transforming from a static sequence to a dynamic, interconnected system—the DSN—that can more readily incorporate ecosystem partners and evolve to a more optimal state over time. DSNs integrate information from many different sources and locations to drive the physical act of production and distribution.[2]

Figure 1 illustrates the interconnected lattice of the DSN, with digital at the core. There is potential for interactions from each node to every other point of the network, allowing for greater connectivity among areas that previously did not exist. In this model, communications are multidirectional, creating connectivity among traditionally unconnected links in the supply chain.

Figure 1. Shift from traditional supply chain to digital supply network



Source: Deloitte analysis.

In this article, we examine how this interconnected network changes the ways in which planning is accomplished, moving from a process that is in many ways reactive and lags environmental shifts to one that is responsive, adaptive, synchronous, and driven by flows of information from across the ecosystem.

For more information, see *The rise of the digital supply network* on Deloitte Insights.

What is synchronized planning?

SYNCHRONIZED planning generally describes a state in which a constant flow of data from throughout the supply network enables organizations to accurately plan production to match actual demand. In an interconnected DSN, this filters across to other nodes, enabling suppliers, logistics, and fulfillment to more accurately plan and, ultimately, take action to provide the resources when and where they are needed. The result is a more dynamic, flexible, and efficient capability that combines traditional planning and execution.

Organizations have typically used historical data to forecast future demand; however, in the absence of a broad pool of information, planning often was somewhat based on conjecture and could not account for unexpected shifts, from demand fluctuations to weather. The dynamic and integrated nature of the DSN, however, can lead to even more complex planning demands, and what we think of today as "planning" could fundamentally change: Different business functions should be fully integrated with each other as well as with an ecosystem of suppliers, customers, inventory, and production to drive the strategic initiatives of the organization. In short, planning synchronization is important to the success of the network.

The new realities making synchronization necessary

These planning needs of the DSN have not sprung up in a vacuum. Rather, several factors are typically at work, each resulting from some form of fragmentation or atomization: of production, customer demands, technologies, and the number of stakeholders with a financial interest in decisions and actions taken by the organization. These factors include:

Fragmentation of production. Global manufacturing doesn't affect just the smart factory but also customers.[3] As production has become more interconnected and global, planners should account for the procurement and inventory demands of multiple physical locations—each specific to local fluctuations in demand and supply, as well as the local availability of inputs. This fragmentation can bring new complexities and ever more data points

Synchronized planning generally describes a state in which a constant flow of data from throughout the supply network enables organizations to accurately plan production to match actual demand.

to consider and adapt to, and can strain traditional planning to the breaking point.

The result: To address this challenge, organizations should become more agile, using data to create better models that can more accurately predict and respond to fine-grained changes in demand. To achieve the needed level of insight, companies will need to aggregate plant- or warehouse-level data from one location with those of other facilities to develop a more holistic understanding of what is being produced and stored, and where.[4] This can, in turn, be integrated with data inputs from suppliers serving each facility, customer data, and information about the functioning of assets. Only then can companies have enough visibility of production and supply to be able to rapidly respond to requests from customers. It is important to note, however, that it is also critical to ensure there are clear definitions and integrity around the data, so that it can provide consistent insights.

Shifting consumer expectations. Across all industries, customers seem to increasingly expect more individualized products and services, whether it be a personalized soda can, a drug formulated to each patient's individual biochemistry, or large equipment built specifically fit to purpose. Most

WHICH TECHNOLOGIES POWER SYNCHRONIZED PLANNING?

While environmental shifts suggest the imperative for synchronized planning is growing, most supply chain organizations simply aren't there yet. Thus, companies that start using advanced technologies in their supply chain planning can gain an early competitive advantage. Below, we explore several advanced technologies that are enabling synchronized planning capabilities.

Artificial intelligence. Often associated with machine learning and cognitive computing technologies, AI enables supply chain monitoring systems to learn complex patterns, collapsing tactical planning and execution while automating much of the decision-making in DSNs. This enables a shift from purely history-based forecasting to one that can effectively predict reorders and forecast demand. Businesses are now no longer chasing the supply chain bullwhip; instead, they can order the right products ahead of time, even shaping customer demand through price incentives, substitutions, or other means.[6]

Internet of Things (IoT). By connecting assets, systems, and processes across the DSN, the IoT can allow organizations to gain full network visibility in real time. Having a real-time picture of the physical world not only provides information at the individual product level but also networkwide visibility of inventory flowing continuously end to end. These flows of data lay the foundation for manufacturers to fundamentally shift their relationship with the supply base.[7] In the new ecosystem, planning can increasingly move away from forecasting, and instead rely on real-time information flows from node to node across the network.[8]

Blockchain. In combination with the IoT, blockchain—a secure, distributed digital ledger system that records transactions—has the potential to be a key enabling technology to unlock a seamless network. Using smart contracts, orders can be placed with vendors automatically based on predefined criteria. As downstream utilization data shows an upcoming spike in demand, the system would automatically adjust, shifting capacity and procuring materials as necessary. As goods move, the IoT can provide real-time availability, intelligence, and the ability to execute financial exchange at the same time. By using the distributed ledger inherent in blockchain, the need for reconciliation and approvals is eliminated.[9]

Smart contracts, AI supply chain management, and other capabilities enable a revolution in business planning. By applying machine learning to tackle near-term demand-to-supply imbalances and trigger automated responses, for example, companies can maximize service while minimizing costs. What started as demand sense and response (automatically adjusting forecast based on order patterns) has now expanded to predictive analytics on both the demand and supply side to proactively detect future service issues, identify the potential source of future imbalances, and highlight or trigger the optimal corrective action. This approach combines planning and execution, highlighting issues before they become the "fire" of the day.

customers also expect these customized goods at a faster pace, and engage with companies across multiple channels on their path to purchase.[5] This shift to a "unit of one" could fundamentally change what it means to predict demand, driving the need for advanced planning capabilities to predict demand, as well as a need for cross-channel customer engagement.

The result: To address this forecasting challenge, many organizations are starting to harness utilization and consumption data, both now widely available given the rapid growth of connected devices, social media platforms, and other data inputs. As a result, marketing, sales, and planning departments can operate with more complete, granular market-level data. With this level of information, companies can achieve the accuracy needed to support the demands of personalization.

Greater cost pressures. Higher pressures all around—on margins, from investors, along with higher levels of industry consolidation—appear to be driving the need to deliver lower-cost planning capabilities and optimize costs across the DSN.

The result: Companies can use financial and operations data from across their various locations and suppliers, cost fluctuations of various inputs, and other sources to develop a more holistic picture of their financial positions throughout the network. This can enable organizations to find opportunities to leverage lower-cost options or prepare for unexpected market fluctuations where possible.

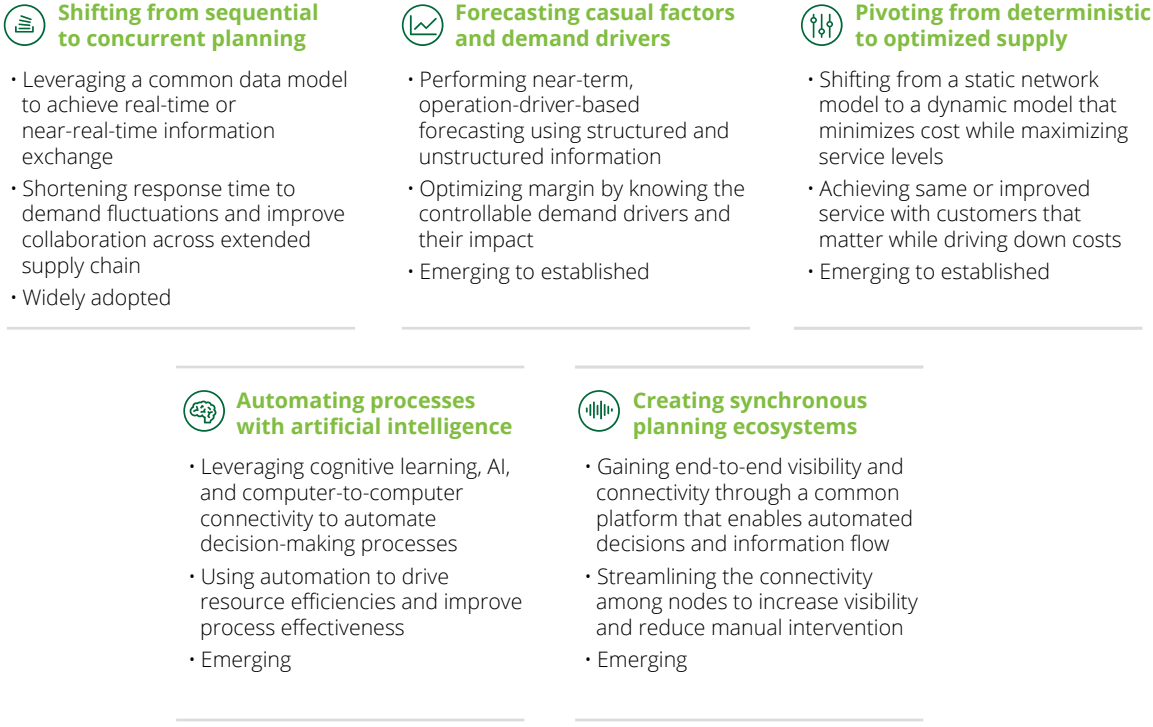
New technologies and data sources. Advanced technologies, more powerful computing capabilities, and a wealth of data from connected systems and external data sources allow organizations to streamline operations, anticipate market shifts, improve service, and encourage growth. (See the sidebar "What are the technologies that power synchronized planning?" to learn more about the specific technologies that drive this shift.)

The result: The advent of sophisticated new technologies also represents a tremendous opportunity for organizations to possibly harness multiple advanced technologies to link together data from across their DSNs, aggregate and analyze vast amounts of information, and advance planning capabilities.

The evolution of planning in the DSN-powered age

WHILE the rapid pace of environmental shifts may push companies to adopt synchronized planning, it may be difficult for them to fully synchronize the planning process all at once. Rather, they can consider the process of moving toward synchronized planning as a journey with multiple facets of increasing sophistication. (See figure 2 for an overview of these facets.)

Figure 2. The evolution of synchronous planning



Source: Deloitte analysis.

Shift from sequential to concurrent planning. The first major shift to synchronous planning is typically simple multialgorithmic forecasting. In an interconnected, always-on environment, demand planning can generally no longer function as an isolated business activity conducted monthly. The speed of decision-making is simply too fast to allow for that. Rather, it needs to become a living process with constant inputs to allow for faster operational decision-making.

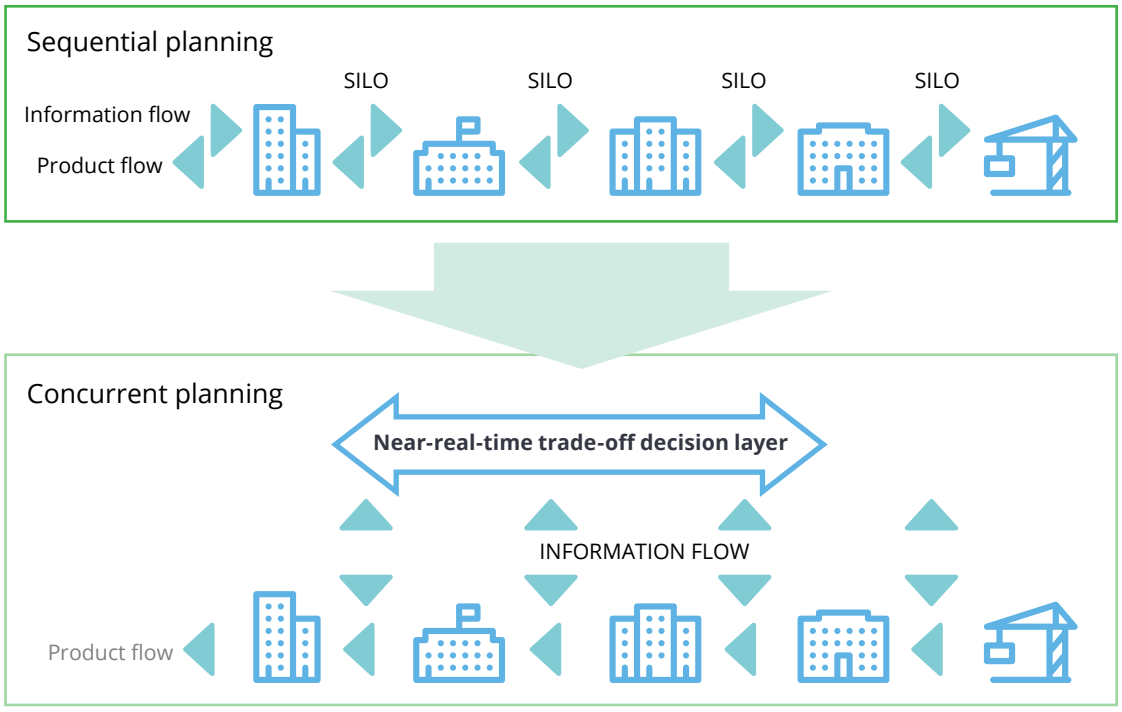
Concurrent planning provides a process to continually monitor DSN performance and collaborate across the extended network, allowing for near real-time adjustments to planning across vertical and horizontal elements of the DSN, shortening response times through information symmetry (see figure 3). Ultimately, this allows for faster, more informed strategic decisions.

This shift is already widely accepted by many organizations, and often requires full integration across the different business functions to drive the strategic initiatives of the organization.

Forecast causal factors and demand drivers. Organizations can perform near-term forecasting, a still-emerging but established approach, using structured and unstructured data available throughout their networks. Deloitte has examined the value of leveraging structured and unstructured data from legacy systems to get started on the journey to DSN adoption;[10] data can similarly be used to help optimize margins and gain a better understanding of demand drivers.

In this case, predictive modeling can be used to optimize cost efficiency and customer service. This can allow organizations to dramatically improve forecast accuracy at both the strategic and

Figure 3. The shift from sequential to concurrent planning is enabled by new technologies



Source: Deloitte analysis.

operational levels, enhance strategic pricing, improve forecast for new products, converge multiple forecasting models into common insights platforms, shape demand to drive optimization in the DSN, and automate response to market conditions via machine learning algorithms.

Pivot from deterministic to optimized supply. Because DSNs are "living" systems, planning itself begins to shift from a static to a dynamic approach, finding opportunities to minimize cost for inputs while still maximizing the ability to meet demands. Utilizing real-time demand, cost, and capacity information, organizations can optimize their supply plans, transportation, and inventory. This can result in improved service with fewer inefficiencies in terms of logistics and distribution: minimized transportation, storage, procurement, and production costs; improved fleet utilization; rebalanced distribution to demand centers; reduced freight expediting costs; and optimized inventory levels.

Automate processes with AI. Still often considered an emerging area, this represents the objective for many organizations who wish to make the move to a "lights-out" planning function in which advanced technologies power autonomous planning capabilities. Here, organizations can enable a machine to replicate human actions and judgment by leveraging cognitive technologies on top of existing current assets and applications. Use of AI to automate planning processes can make them more scalable and flexible, with analyses performed with a high degree of accuracy, in real or near-real time.

Although organizations can use AI and other relevant cognitive technologies to drive more responsive, predictive planning, it is important to note that human interaction with these systems will remain critical to a more intuitive, agile planning process. (See the sidebar "Talent in the age of synchronized planning.")

TALENT IN THE AGE OF SYNCHRONIZED PLANNING

Determining the best team structure for the future may prove challenging for supply chain executives—if they limit their references to current roles and responsibilities. However, the talent model for companies that adopt synchronous planning may look radically different. A move toward synchronous planning capabilities would change the responsibilities of workers and therefore the required skills, tasks, and roles of those workers. In the near future, almost all work could involve people working alongside technology or robots with whom they are not currently working today.

Deloitte has explored the ways in which work could change with the rise of the DSN. In *The digital supply network meets the future of work*, we examined a four-tier framework that envisions the ways in which human workers may adopt, adapt to, work alongside, and manage advanced technologies.[11] As with many smart technologies, many envision a day when AI and robots could replace planners. But humans may remain essential to the planning process—though their roles will likely change.

Planning has always been rooted in analytical insights and reaction. While the network planner of the future may need a different skill set than today, the skills may not be fundamentally different. Roles may evolve to focus more on achieving strategic imperatives through analytical insights and preaction; routine or repetitive tasks may be taken over by robotic process automation, cognitive analysis engines, or a combination of the two. While technology can contribute a significant proportion of the analytical "thinking" in many supply chain tasks, individuals may find themselves increasingly called upon to exercise their quintessentially human traits: communication, empathy, intuition, and the ability to contextualize, interpret, or question data.[12] This could introduce new capabilities to the workforce as human workers offload repetitive tasks or become "augmented" with digital capabilities to handle complex ones.[13] However, humans and machines working together in such close proximity could require workers to learn new skills and new ways of operating.[14]

continued

continued

Historically, many planners used tools without understanding why the tools made a recommendation. They would overlay their experiential knowledge and rules of thumb to make decisions. These decisions may not always have been optimal, but the workers knew how they arrived at them.[15] The potential gap for most companies isn't that machine learning or advanced algorithms don't work, but that their workforce doesn't fully understand how to use the technologies or how they generate a specific recommendation.[16] This makes using so-called "black-box" AI very difficult for workers.[17] When the system not only makes recommendations but also executes most of the decisions, workers' ability to understand why a recommendation or decision was executed becomes vitally important. Mark Riedl, director of the Entertainment Intelligence Lab at the Georgia Institute of Technology in Atlanta, calls this rationalization, which he designed to help everyday people better understand the robots that could soon be helping them with everyday tasks. "If we can't ask [why robots] do something and get a reasonable response back, people will [reject the robot's help]."[18]

Additionally, a connected community that is transparent from end to end means that workers should also be able to work beyond their immediate teams, with stakeholders throughout the supply network: suppliers, partners in different channels and geographical locations, and customers. Thus, a familiarity with cross-functional roles will become vital as planners move into a synchronized future.[19]

Create synchronous planning ecosystems. Beyond using advanced technologies to drive planning within their own "four walls" of the company, organizations can expand these capabilities throughout their ecosystem, among suppliers, sellers, and logistics partners. Put simply, a synchronous planning ecosystem connects the end-to-end supply chain to a consumer-driven supply network, using automated decisions and sharing a single version of consumer demand in order to synchronize demand and supply across every node in the network—in near-real time.

Much as the benefits of a learning, flexible planning process rippled outward throughout the supply chain in our restaurant example, organizations leveraging more complex DSNs can extend their capabilities to gain end-to-end visibility and connectivity throughout the ecosystem. They can do so by creating a common platform that enables automated decisions and information flow, streamlining the connectivity among DSN nodes to increase visibility and reduce manual intervention.

New avenues for value: Outcomes of synchronized planning

THE potential benefits of synchronized planning do not end at the door of the warehouse or even one company. Rather, the benefits can migrate back through the DSN, allowing stakeholders to hold less in inventory, respond to demand faster, reduce risk, and better meet customer needs. In fact, there are several outcomes that companies can realize, depending on their particular business needs:

Redefined business value. Not only can synchronized planning reduce costs and improve asset efficiency, it can enable growth in strategic markets and speed up the order-to-cash process. Smart products connected to a DSN offer new opportunities as they capture data and insights that can be monetized across the network.[20] Synchronous planning can help improve the cost basis in three areas: reduced overhead, cheaper raw materials and inventory holding cost, and continuous optimization to reduce disruptions.

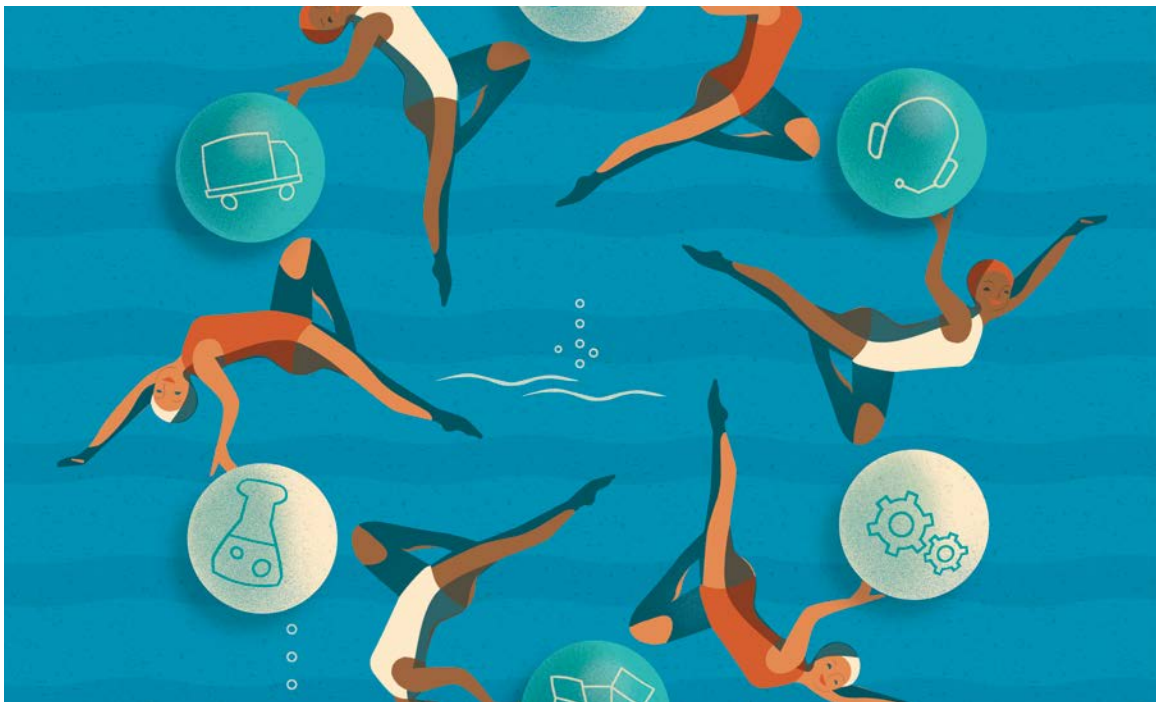
- With respect to *reduced overhead*, the use of AI and cognitive analysis engines to perform and execute most of the analytical "thinking" in many supply chain planning activities can reduce the need for many heavily focused supply chain professionals to a few supply chain generalists who are more competent in analytics.
- Further, digital advances can help identify *substitute materials* or connect the purchasing engine to alternate lower-cost sources across the entire network in near-real time. Increased visibility and monitoring can decrease the *holding cost of inventory* to the network as forecasts are improved and service levels increase, decreasing the need for safety stock.
- Additionally, continuous monitoring and optimizing of the network flow can help to *reduce disruptions*—and, therefore, cost. For example, sensors on trucks and pallets can identify when materials have been exposed to damaging shocks or out-of-tolerance temperatures. With this information, deliveries can be rerouted and substitute material planned immediately—avoiding downtime and the need for lengthy root cause analysis.

Greater asset efficiency is also typically a byproduct of synchronous planning. The sharing economy can make better use of high-cost and under-capacity assets.

Improved asset efficiencies. Greater asset efficiency is also typically a byproduct of synchronous planning. The sharing economy can make better use of high-cost and under-capacity assets. For example, a company that only operates two shifts per day could sell its third shift to another company. Furthermore, automated inventory management can dramatically increase supply chain efficiency.

Streamlined payment processes. A potential outcome—and benefit—of synchronous planning is the ability to speed up the order-to-cash process. With the ability to track and trace products in near-real time, delivery completion can be confirmed immediately. This allows for instantaneous invoice issuing and faster payment collection. Today, many Fortune 500 companies have hundreds of millions of dollars tied up in clunky invoice processes; synchronous planning can help to unlock and put that money to work. By applying technologies like blockchain and smart contracts, efficiencies and immutable trust can be rendered to streamline payment processes.

Growing universal applicability. Synchronous planning can become more beneficial as DSNs grow more complex and extend across the globe. Specifically, it can assist in fast-moving or complex networks, networks that are fragmented or have many partners, and emerging economies with low digitization. Indeed, multinational corporations can have a distinct need for coordinated information flow and decision-making globally; synchronized planning can enable them to work more effectively with supply chain partners. In emerging economies in particular, companies often find themselves with immature supply chain synchronization capabilities. Yet they may be reluctant to invest heavily to build that capability for many reasons. As AI takes hold in the planning space, the need to develop in-market talent could be dramatically reduced, paving the way to accelerated sophistication in emerging markets.



Getting started with a planning capability for the DSN

THE digital revolution and the emergence of advanced AI, blockchain, and other technological capabilities create incredible opportunities for the optimization and synchronization of business processes, dramatically improving business planning speed and effectiveness. Even today's most cutting-edge firms have likely only skimmed the surface of the potential that these technologies offer. As organizations look to a future in which business processes and planning could be managed almost entirely by the highly capable "minds" of machines across a growing interconnected network of DSNs, it's important to take a step back and understand how to get started today.

Start with manageable challenges. Not all problems are created equal. Organizations may be able to see the end state of truly synchronous planning they'd like to achieve but may be unsure how to get started in a manageable way. Focusing on discrete tasks such as deployment planning can be a good first step, moving goods to satisfy a target in a much easier way.

Grow from there as the results ripple outward. Moving to a fully autonomous, AI-driven planning function across the entire ecosystem of suppliers and stakeholders will not happen overnight. Rather than starting at the endpoint, organizations can look to scale upwards in terms of sophistication, which, in turn, can be enabled by the data they continue to pull in from across their networks.

Synchronous planning can be a powerful competitive weapon that could add value across an entire enterprise. As organizations continue their journey toward a fully realized DSN, the ability to plan for and meet shifts in demand will become increasingly critical.

ENDNOTES

1. Adam Mussomeli, Stephen Laaper, and Doug Gish, *The rise of the digital supply network: Industry 4.0 enables the digital transformation of supply chains*, Deloitte University Press, December 1, 2016.
2. Mark Cotteleer and Brenna Sniderman, *Forces of change: Industry 4.0*, Deloitte Insights, December 2017.
3. Rick Burke et al., *The smart factory: Responsive, adaptive, connected manufacturing*, Deloitte University Press, August 31, 2017.
4. Aaron Parrott and Lane Warshaw, *Industry 4.0 and the digital twin: Manufacturing meets its match*, Deloitte University Press, May 12, 2017.
5. Claudia Linnhoff-Popien, Ralf Schneider, and Michael Zaddach, *Digital Marketplaces Unleashed* (Heidelberg: Springer, 2017), pp 19–26.
6. Deloitte Insights, *Cognitive technologies: A technical primer*, February 6, 2018.
7. Michael Raynor and Mark Cotteleer, "The more things change: Value creation, value capture, and the Internet of Things," *Deloitte Review* 17, Deloitte Insights, July 27, 2015.
8. Deloitte Insights, *The Internet of Things: A technical primer*, February 8, 2018.
9. Deloitte Insights, *Blockchain: A technical primer*, February 6, 2018.
10. John Ferraioli and Rick Burke, *Drowning in data, but starving for insights: Starting the digital supply network journey with legacy systems*, Deloitte Insights, April 11, 2018.
11. Adam Mussomeli et al., *The digital supply network meets the future of work: People, machines, and a new era of collaboration*, Deloitte Insights, December 18, 2017.
12. Angus Knowles-Cutler and Harvey Lewis, *Talent for survival: Essential skills for humans working in the machine age*, Deloitte, 2016.
13. Jim Guszcza, "Smarter together: Why artificial intelligence needs human-centered design," *Deloitte Review* 22, January 22, 2018.
14. Mussomeli et al., *The digital supply network meets the future of work*.
15. Mark Cotteleer, Maria Ibanez, and Geri Gibbons, "The answer is 9,142: Understanding the influence of disruption risk on inventory decision making," *Deloitte Review* 14, January 17, 2014.
16. Ben Schreck et al., "Getting value from machine learning isn't about fancier algorithms—It's about making it easier to use," *Harvard Business Review*, March 6, 2018.
17. Mussomeli, Laaper, and Gish, *The rise of the digital supply network*.
18. Paul Voosen, "How AI detectives are cracking open the black box of deep learning," *Science*, July 6, 2017.
19. Anthony Stephan, Martin Kamen, and Catherine Bannister, "Tech fluency: A foundation of future careers," *Deloitte Review* 21, Deloitte University Press, July 31, 2017.
20. Jeff Hood, Alan Brady, and Raj Dhanasri, *Industry 4.0 engages customers: The digital manufacturing enterprise powers the customer life cycle*, Deloitte University Press, December 2016.

ABOUT THE AUTHORS

TIM GAUS

Tim Gaus is a principal with Deloitte Consulting LLP. He brings almost 20 years of supply chain experience with a focus on value chain optimization in the retail, agricultural, and consumer packaged goods industry. He has led multiple projects in supply chain strategy, inventory optimization, and operational excellence, among others, for domestic and multinational corporations across a variety of industries.

KEN OLSEN

Ken Olsen is a managing director with Deloitte Consulting LLP, where he is the global lead for the Supply Chain Planning Market offering. He has over 20 years of consulting experience helping clients across industries transform their supply chains end to end, including current state capability assessments, future state vision development, process design, organizational and operating model structures, and analytical solutions.

MIKE DELOSO

Mike Deloso is a managing director with Deloitte Consulting LLP, where he is the global lead for Supply Chain Planning in Life Sciences. With over 35 years of experience at several Fortune 100 companies, he has helped clients transform their supply chain organizations through innovative supply chain strategies, integrated to enterprise goals and imperatives, and executed across end-to-end supply chains.

ACKNOWLEDGMENTS

The authors would like to thank **Kevin Maggitti** and **Mark Joanow** of Deloitte Consulting LLP, as well as **Brenna Sniderman** and **Joe Mariani** of Deloitte Services LP.

CONTACTS

Adam Mussomeli
Digital Supply Networks leader
Principal
Deloitte Consulting LLP
+1 203 905 2646
amussomeli@deloitte.com

Stephen Laaper
Digital Supply Networks leader
Principal
Deloitte Consulting LLP
+1 312 513 7900
slaaper@deloitte.com

Tim Gaus
Principal
Deloitte Consulting LLP
+1 312 486 2895
tgaus@deloitte.com

ABOUT DELOITTE'S CENTER FOR INTEGRATED RESEARCH

Deloitte's Center for Integrated Research focuses on developing fresh perspectives on critical business issues that cut across industry and function, from the rapid change of emerging technologies to the consistent factor of human behavior. We uncover deep, rigorously justified insights and look at transformative topics in new ways, delivering new thinking in a variety of formats, such as research articles, short videos, or in-person workshops.

Sign up for Deloitte Insights updates at www.deloitte.com/insights.

Follow @DeloitteInsight

Contributors
Editorial: Aditi Rao, Rupesh Bhat, Blythe Hurley
Creative: Kevin Weier
Promotion: Shraddha Sachdev
Artwork: Orlando Hoetzel

About Deloitte Insights
Deloitte Insights publishes original articles, reports and periodicals that provide insights for businesses, the public sector and NGOs. Our goal is to draw upon research and experience from throughout our professional services organization, and that of coauthors in academia and business, to advance the conversation on a broad spectrum of topics of interest to executives and government leaders.

Deloitte Insights is an imprint of Deloitte Development LLC.