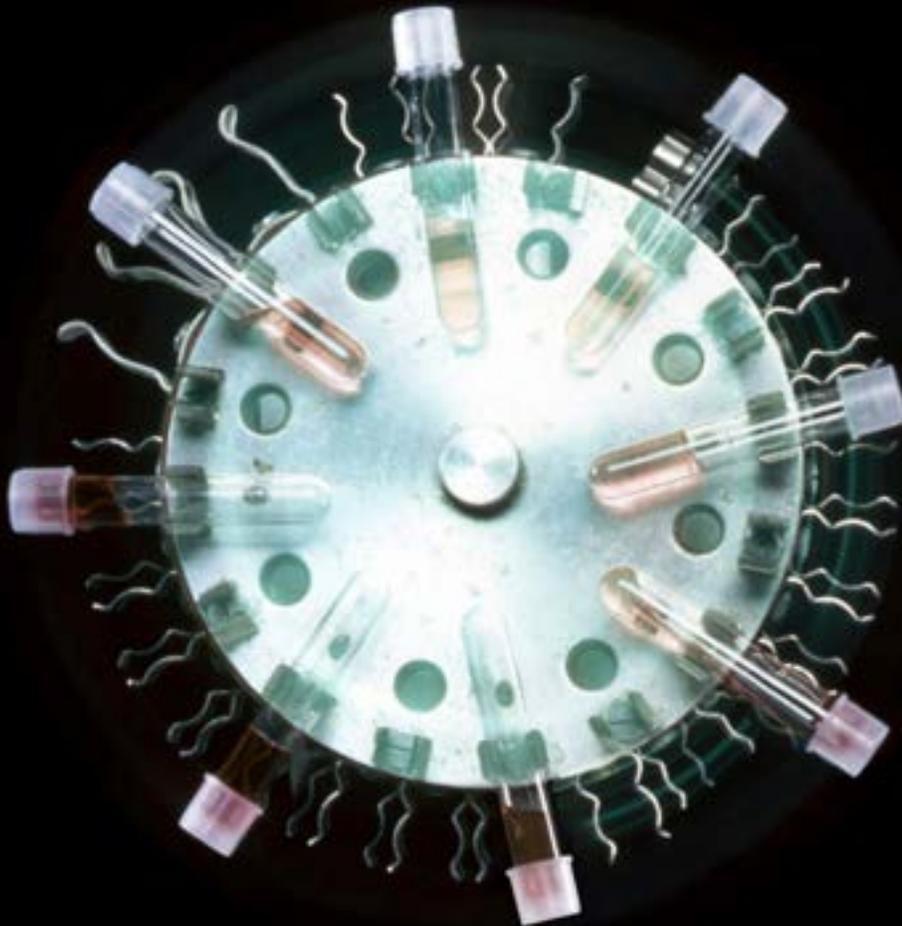


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Giving health care providers a digital edge:
The case for digital supply networks

Executive summary

The digital revolution is rapidly and fundamentally changing the way individuals and organizations transact business—including the importance business of providing health care. Physicians, hospitals, and health systems are taking steps to keep up with digitally connected consumers' expectations for superior, high-touch patient experiences; yet, for many cost-constrained providers, investing in broad digital transformation to enable seamless, integrated health care is more dream than reality.

Digitizing the supply chain offers a cost-effective opportunity for health care providers to deliver the right product to the right patient at the right time—to use technological advances to improve data flow and analytics, provider-patient connectedness, asset tracking, and regulatory

compliance. This paper examines the drivers, components, and steps that leading organizations should consider in their move to a digital supply network, or DSN.

- Financial, clinical, and operational issues are driving the need for health care provider DSNs. Challenges include optimizing cost; reducing unnecessary variation; enhancing patient care, delivery and engagement; and addressing new value-creation priorities.
- By implementing a DSN, hospitals and health systems can gain a clinical and operational edge. Organizations should start by digitizing the core, a process of connecting data elements across the patient care spectrum to enable a supply chain that is smarter, faster, and more responsive.
- The next step is to consider implementation of a control tower. This scalable, adaptable, and centralized hub uses people, processes, and technology to compile and exploit supply chain data, execute dynamic business models, and employ analytics to support executive decision-making.
- DSNs are critical to the ability of health care providers to improve care delivery, enhance the patient experience, and deliver more business value. When coupled with innovations such as machine learning, process automation, and data analytics, organizations can use a DSN to move health care provision from reactive to proactive and preventive to predictive.



Introduction

Today's always-connected consumers want instant access to their health information and expect superior, high-touch experiences across all interactions with and among their health care providers. Physicians, hospitals, and health systems are taking steps to keep up with consumers' digital expectations—electronic medical records (EMRs), for example, have nearly made paper files obsolete and are enabling patient records to be shared and housed virtually; and telemedicine is helping to make physician-patient meetings more convenient and affordable. Yet for many cost-constrained providers, investing in broad digital transformation to enable seamless, integrated health care seems to be more dream than reality.

Digitizing the supply chain offers a cost-effective opportunity for health care providers to deliver the right product to the right patient at the right time—to use technology advances to improve data flow and analytics, provider-patient connectedness, asset tracking, and regulatory compliance. In this paper, we describe some of the issues driving health care providers' need for digital supply networks; examine how digitizing core functions and implementing a DSN control tower can help improve provider operations across the patient care spectrum; and why DSN implementation, as part of a broader digital transformation, can help providers gain a clinical and operational edge.



Digital supply network, defined

Supply chains traditionally are linear in nature, with a discrete progression of design, plan, source, make, and deliver. Today, however, many supply chains are transforming from a static sequence to a dynamic, interconnected system that can more readily incorporate ecosystem partners—health care providers, life sciences companies, and others—and evolve to a more optimal state over time. This shift from linear, sequential supply chain operations to an interconnected, open system of supply operations could lay the foundation for how organizations compete in the future.

We call this interconnected, open system a *digital supply network* (DSN). DSNs integrate information from many different sources and locations to drive the physical act of production and distribution.¹ The result can be a virtual world, which mirrors and informs the physical world. By leveraging both the traditional and the new, such as sensor-based data sets, DSNs enable integrated views of the supply chain network and rapid use-case-appropriate latency responses to changing situations.

Source: The rise of the digital supply network: Industry 4.0 enables the digital transformation of supply chains, Deloitte University Press, 2016

Drivers for health care provider digital supply networks

Financial, clinical, and operational issues are driving health care providers' need for digital supply networks (DSNs). These challenges include optimizing costs, reducing unnecessary variation; enhancing patient care, delivery and engagement; and addressing evolving value-creation priorities.

Optimizing costs: Payment model changes emanating from health care reform, rising costs and shrinking margins—annual operating expenses for US nonprofit hospitals grew 7.5 percent in 2016 while operating revenue grew only 6.6 percent²—and the health care industry's transition from a focus on volume to value, are driving providers to look for new ways to manage resources and reduce enterprise-wide

costs. For example, supply obsolescence costs the health care industry an estimated \$5 billion annually;³ this equates to throwing away approximately four percent worth of total supply expenses each year.^{4,5} Using data analytics around spend management and utilization can help to minimize and/or eliminate redundancy in the health care supply chain (such as management expenses, obsolescence costs, and inefficient sourcing processes) and provide an opportunity to optimize costs—from as much as \$30 million to \$150 million (two percent to 10 percent) in total supply chain cost savings, depending on the size of the at health system.⁶

Reducing unnecessary variation: Hospitals that reduce unnecessary variation may improve care quality and outcomes.

Hospitals rely on vast pools of data for decision-making. However, much of the data collection, cleansing, and subsequent analysis is done manually, which takes considerable employee time and increases the potential for unnecessary variation and errors—a critical issue in terms of patient safety. Research has shown that medical errors—from surgical complications that go unrecognized to mix-ups with the dosage or types of medications patients receive—are the third-leading cause of death in the country, accounting for over 250,000 fatalities annually.⁷ By digitizing common processes, hospitals may reduce the likelihood of poor outcomes. An example would be automated physician order sets that recommended medications and lab tests for the physician given a particular patient diagnosis and the approved or contracted hospital formulary of medications and tests.

Another reason to use digital technologies to reduce unnecessary variation: non-standardized products from multiple manufacturers and distributors can significantly increase supply chain expenses in the form of higher distribution costs, larger stocked inventory, and larger procurement teams. Tools such as machine learning and process automation can streamline redundant, transactional tasks and provide accurate, repeatable, and standardized processes that help reduce variation and errors, and free-up employees to engage in higher-value activities. Process automation in purchase order verification, for instance, could eliminate the transactional nature of various supply chain functions and reduce the possibility of human error when manually validating that the purchase order price equals the contracted price.

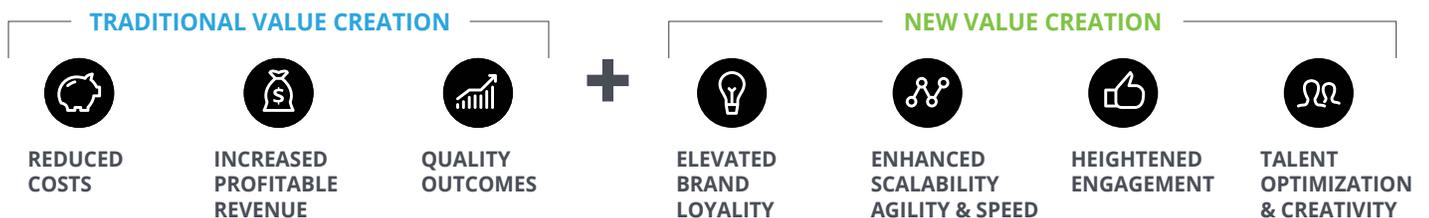
Enhancing patient care, delivery, and engagement: Not only does having an efficient supply chain save hospitals money, it can lead to higher patient satisfaction by redirecting staff time to patient care. Some physicians and nurses currently spend up to 20 percent of their time on supply chain tasks, such as locating products. Efficient supply chains can improve the patient experience by increasing their time spent with medical caregivers, reducing waiting times, and lowering the number of rescheduled appointments due to expired or unavailable products, thus creating a more seamless visit for the patient.⁸

Addressing new value-creation priorities: Traditional health care provider value creation has centered on achieving certain patient delivery and financial outcomes. However, new focus areas such as brand loyalty, operating agility, and resource engagement and management are commanding more executive attention (Figure 1). Capturing value across this broad spectrum calls for analyzing current processes—including supply chain management—and considering fundamental operating model changes to spur clinical and business innovation.

One digital technology that is expected to influence provider value-creation decisions and increase the need for digital supply networks is telemedicine. Eighty-four percent of [C-suite executives] believe that the development of telemedicine services is either very important or important to their organizations.⁹ As telemedicine moves beyond hosting virtual physician-patient visits to enabling complex, post-surgical care and chronic disease management in nontraditional settings including patients' homes,¹⁰ hospitals likely will need to alter their supply chain practices; for example, by providing wearable devices to track patient outcomes and delivering specialty prescriptions and medical equipment to patients' residence. Another example is augmented reality (AR) logistics, which would enable a health care provider warehouse technician to receive hands-free, on-the-spot remote task guidance and virtual training at the time of a workflow issue.

DSNs are critical to the ability of health care providers to improve care delivery, enhance the patient experience, and deliver more business value. The rest of this paper examines the drivers, components, and steps that leading organizations should consider in their move to a DSN.

Figure 1. Health care provider value-creation focus



The digital core: Heart of a DSN

For health care providers beginning their DSN transformation at ground zero, a key to unlocking value is to start by digitizing the core, a process by which hospitals and health systems improve operations from the inside out and connect data elements across the patient care spectrum.

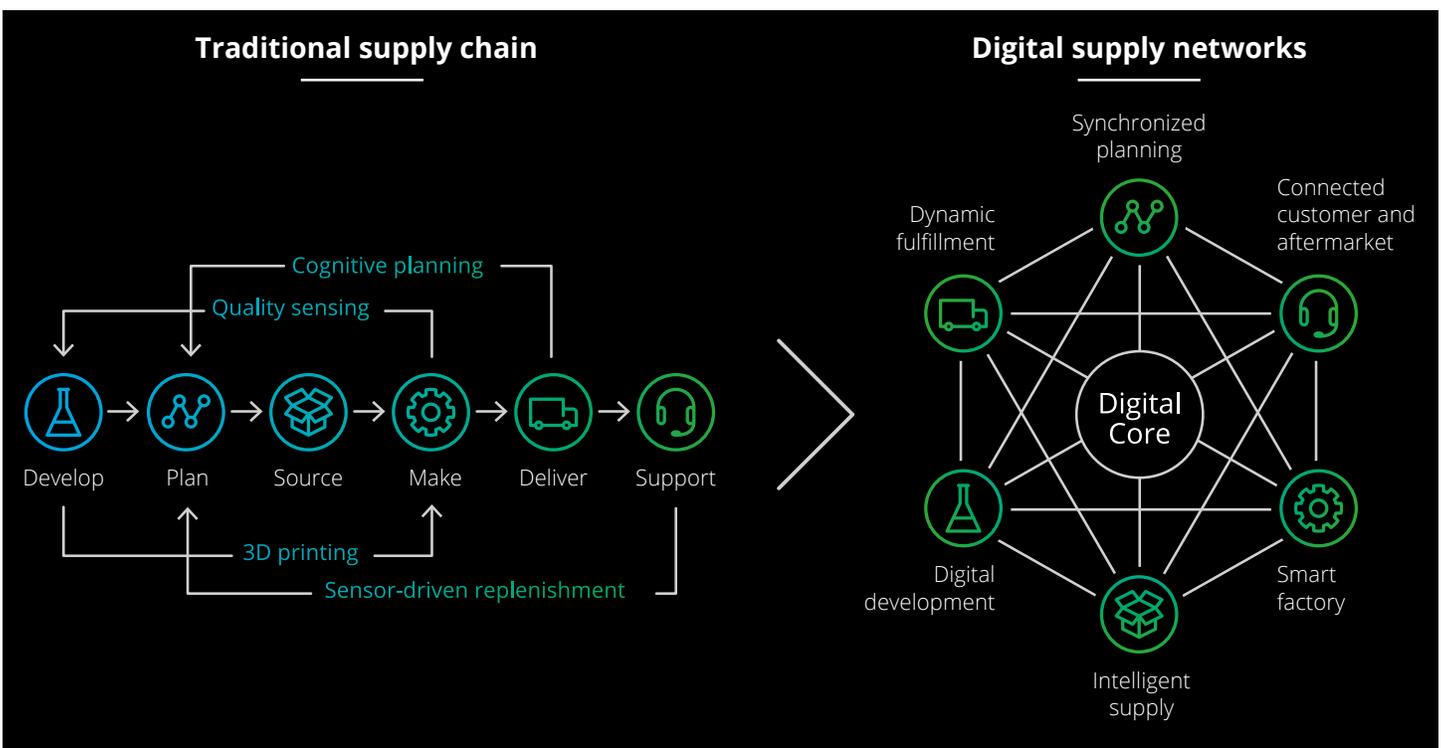
Digitizing the core is an enterprise-wide undertaking in which a common technological platform, often an integrated enterprise resource planning (ERP) system,

links and shares information from central business functions such as finance, purchasing, supply chain—the focus of this paper—marketing, and others. Unlike traditional business networks that operate linearly and sequentially, a digital core enables real-time, cross-functional communication, connecting business operations to a broader set of ecosystem partners such as patients, vendors, and peer systems. The digitized core is the foundation upon which higher-order initiatives are built.

Digitizing the core can help health care providers address supply chain issues by collapsing the traditional, linear supply chain (Figure 2) and creating a connected, smarter, faster, and more responsive digital supply network.

Figure 2: Collapsing the supply chain

Traditional, linear supply chain nodes are collapsing into a set of dynamic networks, allowing dramatically increased differentiation



A DSN can be enabled and leveraged via a “digital thread” built to flow information, goods, and services through physical and digital channels. This provides an agile, “always-on” flow of information and analytics that can help hospitals and health systems achieve new levels of performance, improve operational efficiency and effectiveness, strengthen patient engagement, and create new revenue opportunities (Figure 3); specifically:

- Produce integrated views of the supply network and rapid responses to changing situations

- Gain network-wide insights from centralized, standardized, and synchronized data
- Optimize human-machine decision-making for spot solutions
- Increase visibility into critical aspects of the supply network
- Enable better decision-making for the network as a whole.

To illustrate a DSN's potential benefits, a nurse places an order for new sphygmomanometers. That order is

processed through integrated digital channels, with information passing to finance for payment, supply chain for procurement, and warehousing for inventory management. This interconnectedness not only increases transparency and communication, it expedites processes, reduces costs, and better informs business management decisions.

Figure 3. DSN characteristics

Digital Supply Networks are “Always-On”—dynamic, integrated networks characterized by a continuous flow of information and analytics



Digital development

Optimize product lifecycle management with advanced digital tactics



Synchronized planning

Provide significant efficiencies through synchronization



Intelligent supply

Reduce costs through new advanced technologies, models, and capabilities



Smart factory

Unlock new efficiencies by a more connected, agile, and proactive factory



Dynamic fulfillment

Boost customer service through new levels of speed and agility



Connected customer

Create seamless customer engagement from inspiration to service



Implications



Companies can achieve new levels of performance, improve operational efficiency and effectiveness, and **create new revenue opportunities**



As companies leverage their full supply networks, the **traditional barriers of time and space shrink**

As illustrated earlier in Figure 2, health provider DSNs operating within an integrated ERP system primarily focus on connecting the four component parts or nodes—Plan, Source, Deliver, and Support—which serve as the main operating levers within the industry's supply chain life cycle.

Each node has inherent value drivers that act as catalysts on the health care ecosystem. For example, applying metrics such as machine uptime and downtime, response time, and energy efficiency creates a dynamic and real-time standard of actual performance upon which the support node operates. This is particularly important given the nodes' interconnectedness. If planning is not integrated with delivery logistics, there is likely to be a less-than-optimal product count on hand when needed by doctors and nurses. Each node is defined by its core value drivers and each of these drivers supports the other nodes. When the value drivers are aligned efficiently—in other words, when metrics from one node incentivize activities that yield positive metrics in another node—the foundation is in place for the digital core to deliver on the organization's broader strategic, value-driven priorities, as seen by examining each of the nodes in greater detail.

Plan

Current state: Supply chain planning often requires significant manual data collection and analysis to understand purchasing and usage trends. This information is then passed from individual to individual before decision can be made, creating a slow and error-prone process.

Digital state: Artificial Intelligence (AI) and Robotic Process Automation (RPA) technologies can analyze large data sets in a fraction of the time a human can perform the same task, with significantly fewer errors. Machine learning can be applied to customized data analysis and reporting, decreasing throughput times and improving margin.

Example: *Using data to plan and track influenza medication*

Leveraging real-time data to forecast seasonal demand for influenza medication provides a clearer picture of where the medication doses sit in the hospital's supply chain (at manufacturer and facility locations), verifies that the right supplies are available for the right patient at the right time, and allows the hospital to redistribute supplies to locations of highest need during a shortage. This planning capability enhances patient quality and enables better cost and product forecasting.

Source

Current state: Collecting patient usage and product effectiveness data is integral to helping hospitals determine whether to order a certain product, from which vendor, and in what quantity. Currently, however, hospitals' organizational structure can make it difficult to link performance, cost, and procurement, resulting in less-than-optimal product ordering and delivery time.

Digital state: Innovative technologies from RPA to blockchain are strengthening the link between sourcing, procurement, usage, and impact. Machine learning and automation simplify data entry and analysis, while blockchain, which is a connect set of data that serves as an immutable ledger, tracks data and activity within the supply chain to increase transparency and traceability of supply chain information. The blockchain outputs, similar to an accounting ledger, yield a chronological list of activity, cost, time, etc., that are tied to contracts and metrics, enabling automated and proactive supply chain management. These technologies allow patients and providers to view firsthand a product's effectiveness and use that information to inform future purchasing decisions in real time.

Example: *Using blockchain to track assets across the care continuum*

Blockchain use in the pharmaceutical and medical device industries—specifically, tracing material assets across a supply chain to maintain product integrity and safety

(Figure 4)—offers benefits to hospitals and health systems, as well. Blockchain's immutability provides a basis for product traceability from materials provider to manufacturer to health care provider to consumer could aid in investigations of how opioids are getting into the wrong hands. In another example, blockchain could assist in the recall of pacemaker cardiac rhythm management (CRM) devices identified as being vulnerable to cyberattacks by tracing where the pacemaker is within the medtech-to-hospital-to-cath lab-to-patient supply chain and remove it from inventory. Traceability is critical also for general patient care products such as catheters and gauze as the system volume is high and the requirement for product location identification and recall resolution are urgent.

Blockchain also could be used to enter, authenticate, and validate information in registries of patients with embedded medical devices to determine product efficacy across the continuum of care. For example, providers could review a registry of stents and see which (de-identified) patients did better with one company's stents versus patients using another company's stents. As more hospitals move to outcome/risk-based contracts with their suppliers, they can use these registries to provide metrics for value-based payment models.

Deliver

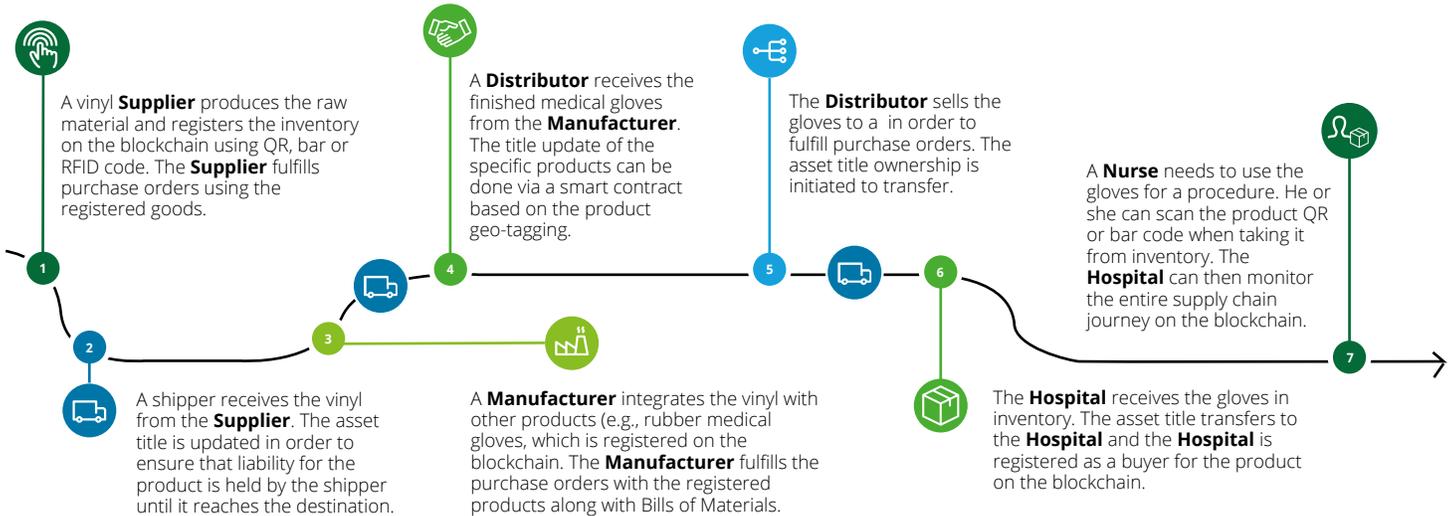
Current state: How, when, and where products are delivered is integral to a hospital's effectiveness both as a health care provider and as a business. Significant time and cost can accumulate during the logistics or delivery process. Additionally, employees on the front lines of patient care may be left with stock-outs or storage issues when dealing with less-than-optimal product deliveries.

Digital state: An integrated order system can improve product delivery efficiency. In this scenario, an order is placed by a hospital practitioner, and filled by the processing team, which is digitally connected to

Figure 4. Using blockchain to improve supply chain transparency

Tracechain Track & Trace in the health care space

A Blockchain powered prototype envisions the “art of possible” with an example of medical gloves, by providing transparency throughout the process and a variety of efficiency improvements to help track assets



Universal Registration
All personas including the Producer, Supplier, Manufacturer, Hospital, regulator, Shipper and Validator, can be registered on the blockchain.

Analysis and Traceability
The data can be analyzed at anytime through reports to develop the traceability matrix and map finished products to sources.

the vendor and can provide detailed instructions on what products to bring, in what quantities, and where to deliver them. Front-line employees can then use tools such as blockchain and Google Glass to locate products much faster.

Example: Improving inventory visibility
By adopting leading-practice technologies such as radio frequency identification (RFID) and digitizing the supply chain at the point of use, both health care providers and vendors can improve visibility into consignment inventory at the patient bedside and adjust direct movement of inventories in real time to areas experiencing shortages. These activities may lead to enhanced service levels and a lower total cost of ownership across the continuum, with benefits shared by both parties.

Support
Current state: Running an effective and cost-efficient hospital supply chain requires identifying, analyzing, and deciding which processes work, which do not, and how/when to make a change. For many providers, though, important data may be siloed, feedback may move slowly up the management chain, and decision-making may be based on incomplete or erroneous information.

Digital state: Collecting real-time data using RPA can dramatically expedite the decision-making process and reduce the analytical error rate. Having more accurate information on product performance or procedural effectiveness enables a much faster and more customized patient experience...not to mention, a significant reduction in costs.

Example: A national not-for-profit health system with operating revenues of \$15.9 billion

completed an RPA project to build three automations within its accounts payable department: invoice receipt and transfer, non-PO approver set-up, and vendor request on invoice set-up.

Project timeline was 10 weeks, with the potential for further automations within accounting, finance, and managed care contracting. The health system expects a net NPV of \$2 million in Year 5, with an immediate positive return on investment.

Digitizing the DSN core can be a large and costly undertaking, but it does not have to be done as a single project. Each node can be implemented separately, as they are self-sustaining and individually value-enhancing. However, a DSN's full value emerges when the nodes are interconnected. In the next section, we will explore a provocative, cutting-edge solution—a DSN control tower—that demonstrates the value of an interconnected approach.

The DSN control tower

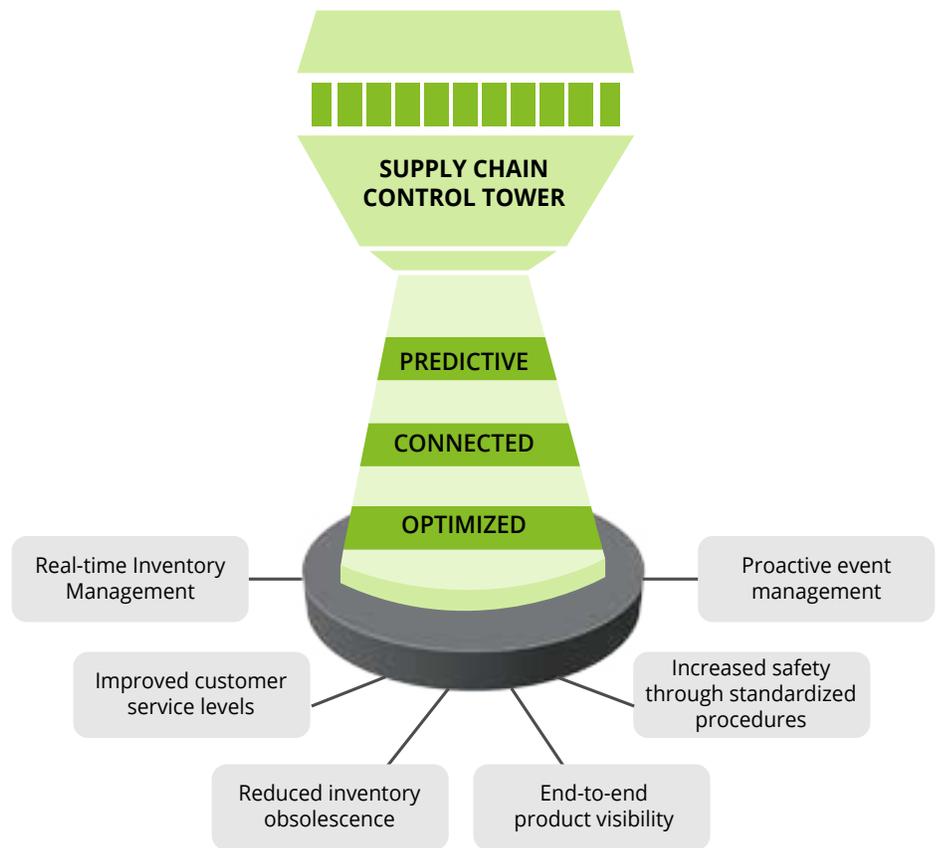
A next step for hospitals and health systems that have solidified their digital core and are looking to be among first movers in executing a truly comprehensive digital supply chain is to consider implementing a DSN control tower. This scalable, adaptable, and centralized hub uses technology, processes, and talent driving the control tower (reading the analytics, factoring in key variables, selecting optimal formulas, etc.) to compile and exploit supply chain data, execute increasingly dynamic business models, and provide analytics and information to support executive decision-making (Figure 5).

The control tower is a key element of the digital core because it enables proactive, end-to-end supply chain management through a fully integrated ERP system. It can help health care providers achieving new supply chain efficiencies through connected, end-to-end product visibility, proactive event management, and predictive insights. The control tower's capabilities collectively work to optimize inventories through real-time management, increase safety through standardized procedures, and improve customer service levels.

How does the control tower help solve the health care industry's most pressing supply chain issues?

01. Optimizing cost: Product waste and obsolescence is a significant cost for many providers, so increasing visibility into the supplies and equipment that hospital physicians and staff purchase can present a major cost-reduction opportunity. Conventional supply chain models typically track inventory and purchasing; however, a supply

Figure 5. DSN control tower



chain control tower can provide more real-time visibility into these areas and offer powerful artificial intelligence (AI) capabilities that move beyond a traditional support model towards an autonomous decision-making architecture.

By gathering data about current inventories and physician and staff purchasing habits, the control tower

can build trend analyses that recognize purchasing anomalies in real-time and promptly alert appropriate decision-makers. Furthermore, the scope of the control tower's real-time inventory tracking can be expanded to include special events like stock-outs, recalls, and natural disasters.

Imagine this scenario: Doctor A recently switched from medical device vendor X

to vendor Y. Under the hospital's current supply chain model, any of Doctor A's remaining inventory from vendor X would go to waste. In contrast, the control tower model would reroute this inventory in real time to another doctor that needs supplies from vendor X, preventing the inventory from becoming obsolete and driving up costs.

02. Reducing unnecessary variation:

Increased automation allows health care organizations to reduce the likelihood of human error by standardizing and streamlining existing processes. The control tower aids this effort by constantly collecting and analyzing data, and using its machine learning capabilities to recognize the optimal path for executing a process. In addition, the control tower can alert decision-makers when there are deviations from that path.

The control tower of the future may expand on this capability by recognizing not only the optimal way to execute a standalone process but also the optimal way to allow separate processes to work together. This may help eliminate gaps between departments and forge a supply chain that resembles an interconnected nervous system rather than multiple, straight-line processes.

03. Enhancing patient care, delivery, and engagement:

As mentioned earlier, automating low-value-add tasks can give hospital clinicians more time to focus on providing patient care and increasing satisfaction. A digitally connected control tower enables proactive, strategic data interpretation to better identify low-value activities and facilitate root-cause analysis of why they are pulling skilled staff away from patient care. The control

tower can then direct automation of the more menial tasks to free-up staff time for more impactful activities.

Automation also may help reduce patient wait times. Much like tracking supplies in real time, a control tower can proactively gather data about a machine in need of maintenance and dispatch a repair technician in real time. The decreased equipment downtime will reduce patient and staff disruption and, ultimately, wait times.

04. Addressing new value-creation priorities:

The control tower offers a way for health care providers to improve their value propositions for key stakeholders by using its cognitive abilities to enhance real-time decision-making and improve customer response time.

The increasing prevalence of IoT and connected devices is forecast to be a major part of future health care delivery. While this shift is anticipated to create more value for health care providers and their customers, the increased complexity of a connected ecosystem also presents potential operational risks and challenges that could diminish stakeholder value. As envisioned, the control tower of the future may help mitigate potential issues by acting as a central hub for all connected devices and allowing providers to diagnose issues in real time and promptly make fixes. In addition, the control tower of the future may enable seamless integration of new delivery options, such as telemedicine, to the existing provider delivery model. These and other control tower contributions should enable value creation that looks beyond the bottom line to include enhanced scalability, agility and speed; heightened engagement; talent optimization and creativity; and elevated brand loyalty.

DSN control tower in action

A recent engagement with a major life sciences company provides a real-world example of the control tower's potential impact. The company identified that supply chain reliability issues were generating increased in-transit and safety stock levels; it wanted to implement a control tower that would proactively identify and mitigate supply chain disruptions and use analytics to identify and execute improvement projects. A pilot based on three international intercompany transportation lanes yielded approximately \$15 million in in-transit and safety stock savings. The pilot was expanded to strategic intercompany transportation lanes (i.e., high-volume international lanes), resulting in an additional approximate \$60 million in savings potential. Furthermore, expansion of the control tower capabilities to cover more lanes and a supply chain scope across the source-make-deliver spectrum is expected to generate significant additional savings.

As is the case with digitizing the core, implementing a DSN control tower is a complex undertaking; one that requires significant cross-functional coordination to break down siloes and share information across the supply chain. However, basing supply chain operations on this strong, central pillar may increase the effectiveness of a health care provider's overall digital transformation and provide a platform for future technology and process improvements.

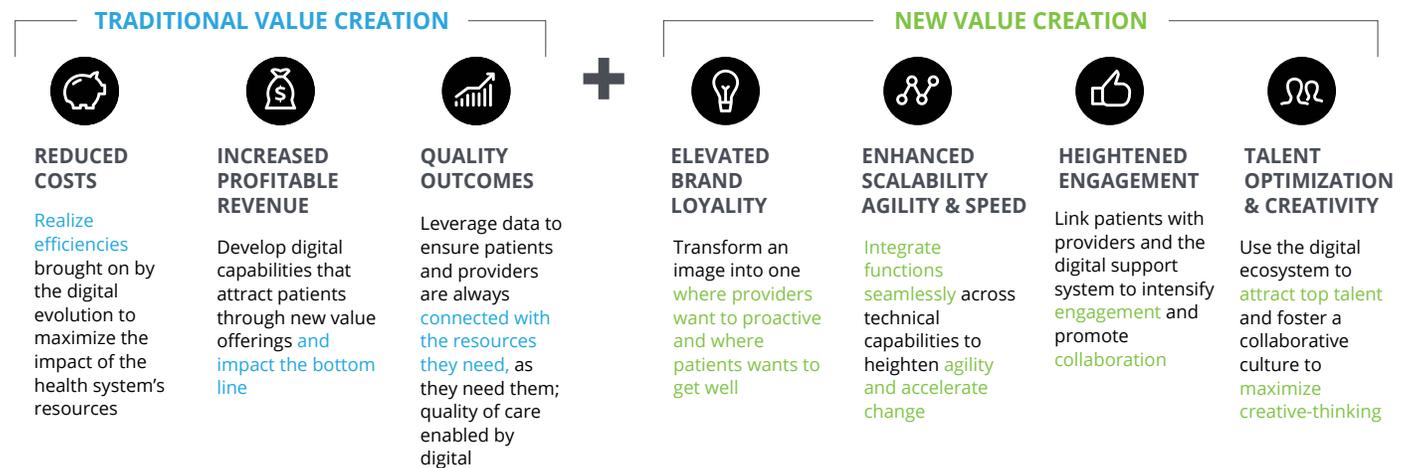
Gaining an edge through digital transformation

Implementing a digital supply network is one way that hospitals and health systems can move toward a broad, enterprise-level digital transformation to enable seamless, integrated health care. When a DSN is coupled with innovations such as machine

learning, process automation, data analytics, and 3D printing, organizations can progress their health care provision from reactive to proactive and from preventive to predictive to gain a clinical and operational edge (Figure 6).

Figure 6. Creating value through digital transformation

Digital transformation requires organizational value drivers to be reimagined and expanded. Success must be measured across the entire organization and driven by value creation that looks beyond the bottom line



Sample metrics for evaluating success

- Net revenue growth
- Operating costs
- Patient satisfaction
- Re-admission rates
- Access (next available appointment)
- Wait times
- Clinician retention rates
- Clinician engagement and provider satisfaction
- Market share
- Patient acquisition cost
- Patient safety and quality scores
- Risk of mortality
- Timelines of care
- Interoperability

The journey to digital transformation is a highly intentional process that will look different for every health system and their suppliers. For organizations evaluating the path forward it is imperative to understand:

- **How digital you are today**—Knowing where to begin and what to leverage is the foundation of DSN project planning.
- **How digital you need to become**—Recognizing where you need to get to in 6, 12, and 18 months helps prioritize focus, energy and investments.
- **How you can get there**—Infusing digital traits and characteristics into your existing legacy environment can make change happen more rapidly.
- **Who can help**—Achieving the full benefits of digital transformation requires an optimal mix of people, processes, and technologies; working with professionals skilled in redesigning business models and processes in the health care industry can result in time and cost savings.

Endnotes

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