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Trend 6: The new pharma supply chain: Collaboration and data

- Pharma companies strengthened supply chain resilience during the Covid-19 pandemic, but new technologies and threats demand continuing development to minimize vulnerabilities.
- Pharma and healthcare firms are using digital tools such as AI, machine learning, and networked devices to gather data and generate insights from that data to build more responsive supply chains.
- We expect the supply chains of the future will be capable of real-time, highly accurate demand sensing, process control, and risk mitigation finally approaching the 30-year vision of carbon-free, lights-out supply chains.

Advances in new therapies, such as chimeric antigen receptor T-cell (CAR-T) therapy, which uses genetically altered immune cells to fight cancer, and gene therapy, have created new business models for drug development, production, and delivery. These innovations promise to save more than a million lives in the coming decades. However, desired health

outcomes will occur only if supply chains that support these increasingly sophisticated healthcare solutions function optimally.

The Covid-19 pandemic, global conflict, and climate change effects have sharply demonstrated how vulnerable supply chains are to disruption. Technology to solve these problems offers both potential promise as well as peril. AI, machine learning (ML), and internet of things (IoT) provide life sciences companies with greater visibility into supply chain activity and performance. At the same time, these technologies introduce additional points of vulnerability, from cybersecurity risks to technical failures.

Supply chain innovation and resilience require a data-centric approach and understanding of shortcomings to affordably and reliably facilitate the complex production of new drug therapies.

Solutions include made-to-order supply chains that meet pharma's needs across scheduling, logistics, patient care, and resource management. Additionally, supply chain operations require more visibility to avoid and mitigate shortages that rapidly become critical in a health crisis.

Supply chains must continuously evolve to deliver these therapies, while at the same time making their supply chains more resilient. In the longer term, we expect that through investments in technology, partnerships, and new technologies, a new era of supply chains is just at the horizon. These supply chains will not only deliver new therapies at scale; they will also be greener, with more visibility and transparency.

Public-private partnerships

The modern global supply chain model developed over decades with a simple goal: make products — from mobile phones to medications — cheap, plentiful, and fast. The just-in-time system was a spectacular success, until the Covid-19 pandemic and wars in Europe and the Middle East demonstrated the fragility of these intricate and often opaque networks.

Shortages of common goods frustrated consumers worldwide in 2020 at the start of the pandemic. In the life sciences and healthcare industries, inconveniences turned into tragedies. Shortages of N95 masks, surgical gloves, and ventilators threatened healthcare workers and forced many to consider supply chain implications for the first time. The surge in demand for some medications created breakdowns in supply networks due to shortages and inefficient allocation — compounded by staffing shortages of frontline workers.

Supply chain disruptions in life sciences continued well past the worst of Covid-19. As of spring 2024, US drug shortages reached an all-time high, with more than 320 drug shortages, including life-saving drugs and those critical for daily functioning such as ADHD medications. Some first-line chemotherapy drugs were among those in short supply and ultimately were rationed.

Industry decision-makers must act decisively to overhaul this system to minimize future vulnerabilities. At the same time, they must balance cost pressures from persistent inflation and meet dozens of regulatory requirements from multiple international agreements and organizations.

Public-private partnerships will also be important to create more resilient supply

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chains. Srinivas Chilukuri of Infosys Consulting explains the importance of partnerships to ensure that products are available to patients wherever they are, whenever they need them, in case of emergencies.

Companies need to establish these partnerships across their entire value chain — not just in transportation, manufacturing, or contract domains (Figure 1). For example, a company managing cold chain logistics will need to have such partnerships in place closer to their markets. A company might need to ship a product, by-product, or even semi-finished product from one country to another. Existing partnerships will be essential to ensure successful shipment, especially in emergencies.

How data boosts efficiency

The stakes could not be higher in the global life sciences supply chain to achieve its fundamental purpose: evolve quickly to

Figure 1. Partnerships at each point in the clinical supply chain build resilience



Source: Infosys Knowledge Institute

grow and serve the market, while mitigating vulnerability and risk. Fortunately, technology tools to reinvent supply chains already exist, such as AI, ML, and IoT.

"New technologies enable supply chain executives to create differentiated and meaningful business capabilities while still achieving high levels of platform simplification and standardization," says Edward Francis, partner, health and life sciences, Infosys Consulting.

Al is already helping businesses lower operating costs, improve route calculations, and reduce risks. Gartner's Supply Chain Executive report found high-performing companies were two to three times more likely to use Al and ML in supply planning, logistics, and distribution.

Similarly, IoT's ability to communicate between devices and locations makes it an effective tool for life sciences supply chains. An exhaustive literature review of IoT's impact on supply chains — published in the journal Internet of Things — found that IoT improved process performance and transparency, both critical supply chain issues.

Indeed, life sciences companies plan to prioritize investments in flexible supply chain modeling, planning and transparency solutions, and digitalization in the next five years (see Figure 2). However, smaller companies (those with revenues between \$1 billion and \$3 billion) indicate they will prioritize investments in planning and transparency more than larger companies (those with revenues greater than \$3 billion). Regardless of size, companies plan to invest in these areas more than in flexible supply chain models.

Healthcare providers and life sciences companies are integrating these technologies into supply chains and delivering benefits such as improved analytics and accurate disruption forecasting. This is particularly valuable in drug development, from sourcing materials to effectively transporting goods between locations and cleanrooms.

Drug delivery supply chains enabled by Al, ML, or IoT technology could increase effectiveness exponentially, as each transaction allows the technology to learn, compound its understanding, and further improve the process. For example, Al evaluates inventory variations and supply interruptions more thoroughly, finding

Figure 2. Smaller life sciences firms will prioritize supply chain transparency in the next five years



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Source: Infosys Knowledge Institute

patterns and causality previously not possible with traditional analysis techniques.

Tech for resilient supply chains

No supply chain will ever be completely disruption-proof, given the inherent unpredictability of global events. However, AI and ML offer potent tools that can develop insights from data, increasing the ability to predict disruptions faster and more accurately, and then recommend effective corrective actions.

Increased use of generative AI will transform several supply chain areas (Figure 3). We asked respondents which supply chain generative AI use cases currently achieve return on investment (ROI) and which ones they expected to achieve ROI in the next three years. Some 10% of respondent companies already see positive ROI from flexible supply chain modeling and supply chain resilience use cases. Over 90% of respondents expect that generative Al use cases will show ROI, as well as in visibility and sustainability use cases, in the next three years.

New therapies, new methods

Groundbreaking work in cell and gene therapy has led to a rapid evolution of the traditional supply chain model. These new therapies are tailored to each patient and require a different approach that will distribute to patients faster and more reliably. Chain of custody and chain of identity are important supply chain metrics for cell and gene therapy, providing visibility to ownership along the supply chain. It also aligns partners to corporate quality standards as the product moves through the supply chain.

Local partnerships, such as apheresis centers (blood banks) and contract manufacturing organizations (CMOs), are important for cell

Figure 3. Generative AI has already begun to prove ROI in supply chain, and expectations are high



Note. Percentages do not total to 100 due to rounding.

Source: Infosys Knowledge Institute

and gene therapy production and delivery. Supply chain visibility is especially critical to this new generation of treatments. Cell and gene therapies need to be stored and transported at cryogenic temperatures (minus 150 degrees Celsius) and must be monitored closely throughout their life cycle.

Since these personalized cell therapies are developed from the patient's cells, the chain of custody is essential. (See also Trend 7, this volume, for more on partnerships and ecosystems in life sciences.)

While all drug development requires effective supply chains, novel cell and gene therapies present, well, novel challenges. They require major changes to supply chain infrastructure, such as how material is handled, routes are mapped, and timelines are planned.

A prime example is CAR-T therapy, which engineers more effective versions of naturally occurring immune cells to target cancer cells. This system attacks solid tumors and fights cancers with high mortality rates. However, CAR-T therapies are relatively new modalities, and their effectiveness is constrained by aging supply chain infrastructure. Engineered CAR–T cells typically must be delivered to the patient within 48 hours.

While CAR-T is one of the better-known breakthroughs, it is only the start of this therapeutic revolution. Seven gene therapies were approved by the US Food and Drug Administration in 2023, with more than 500 therapies in the pipeline. Immunotherapies offer great hope for those with serious diseases, but these treatments are also more vulnerable to disruption than most medications.

Life sciences firms have invested into their supply and distribution networks over many years. The significant physical and digital supply chain infrastructure in place is a mixed blessing.

While these assets provide an existing foundation, their legacy nature also suggests modernization will be required to take

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Partner, health and life sciences, Infosys Consulting

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advantage of the new tech. Our survey found lower priority for investment in supply chains in other areas. Leaders must integrate the power of AI, ML, and IoT technologiess to generate the improvements needed while operating within budget constraints.

New tech creates new risks

Although modern supply chains solve many problems, they will also likely create new ones. Life sciences companies must contend with — or even better, anticipate — new vulnerabilities that emerge.

An Organization for Economic Co-operation and Development report found that the life sciences industry is particularly vulnerable to counterfeiting. These vulnerabilities highlight the need for data-driven solutions that increase visibility, yet even the solutions create further risks. As supply chain managers rely on technologies like AI, ML, and IoT, cybersecurity inevitably becomes a major consideration.

Cybercriminals frequently target life sciences companies by seeking sensitive —and commercially valuable — information from their suppliers, distributors, and customers, from intellectual property to patient data.

In the US, cybercrime across industries cost \$320 billion in 2023 and is projected to increase to \$452 million in 2024. Medical records are significant commodities targeted by cybercriminals. A single data breach for a life sciences company costs \$7.1 million on average.

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Adoption priorities

Supply chain development and operation is not static: for life sciences, it should be viewed as an organic entity with flows across its network nodes. Routes, plans, and relationships must be nurtured, developed, and even completely re imagined as needed.

The book The Live Enterprise (McGraw-Hill, 2021) explores this concept, comparing supply chains to living organisms that continually evolve and adapt to their shifting environment. This is possible only when architecture is designed to evolve, and life sciences leaders must incorporate this capability into their operating models to increase supply chain resilience. Three fundamental requirements are needed to optimize supply chain management in life sciences.

First, adopt effective technology. While no technology guarantees a perfect supply chain for all life sciences and drug development needs, ML techniques and Al tools have already demonstrated measurable impact on this industry, even as they continue to evolve and mature. Supply chain asset and technology investment should be a priority. While supply chain investment doubled in the last two years, leaders now say that other areas such as generative Al will be a higher priority over the next five years. Supply chain use cases must articulate their value to benefit from continued investments.

Second, prioritize resilience and visibility. Supply chain resilience and visibility are



traditional fault lines in product fulfillment, and a lack of resilience can cause very disruptive fissures. Building a resilient supply chain involves diversifying suppliers, developing contingency plans, and implementing risk management strategies. This ensures that companies can quickly respond to disruptions and maintain continuity of supply.

Finally, aggressively collaborate with external partners, including technology providers, logistics companies, and regulatory bodies, to boost supply chain efficiency and innovation. Strategic partnerships also help companies navigate complex regulatory environments and access new markets. The pharmaceutical industry supply chain faces numerous challenges, from regulatory complexities and disruptions to cost pressures and the need for technological integration.

However, by embracing advanced digital technologies, sustainable practices, and a patient-centric approach, the industry can build more resilient and efficient supply chains that are responsive to future demands.

The pharmaceutical supply chain is on a journey to optimization and resiliency — ensuring that transformative new life-saving medicines can reach patients promptly and safely.

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