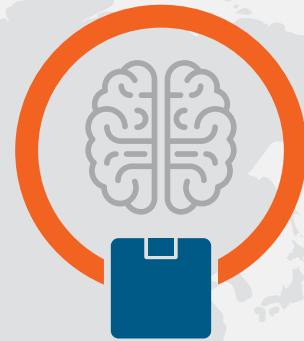




Robotics in Warehouses



Blockchain for Pharma Logistics



AI for Package Arrival

3 Tech Trends That Could Improve Air Cargo Shipping in the Pharma Supply Chain

Over the last decade, exciting changes have transformed the pharmaceutical industry. For example, scientific advancements, particularly those that have contributed to the rise in biologics, are increasing the complexity of patient treatments and pharmaceutical products. In addition, many manufacturers are expanding their global footprints to address unmet patient needs in smaller populations across the world.

However, these factors and more are impacting the ability of supply chain stakeholders to deliver therapies to their destinations in a timely manner and, for temperature-sensitive drugs, without affecting their efficacy and integrity. This is especially challenging in air cargo pharma supply chains, where pharmaceutical goods pass through many different operators and a lack of information flow among them threatens time- and temperature-sensitive packages.¹

With the amount of pharmaceuticals outpacing growth in overall air cargo by nearly a percentage point per year since 2008,² expectations are mounting for innovative and sophisticated solutions that address the challenges with information flow across the air cargo supply chain. The following three technology trends could help mitigate airfreight logistics risks, reduce costs related to transportation issues and/or temperature excursions and, most importantly, help manufacturers deliver high-quality drugs safely and on time.

1

THE RISE OF ROBOTICS AND THE INTERNET OF THINGS

Robotics have long held a place in the shipping industry, automating repeatable tasks and performing jobs dangerous to humans. However, by modernising the way we receive data and how we communicate, the Internet of Things (IoT) is giving people the ability to connect in ways never before possible. This also applies to logistics management, where advanced supply chain technology is being used to create “smart warehouses.”

IoT and robotics in warehouses can:

 **IMPROVE**
OPERATIONAL
EFFICIENCY

 **INCREASE**
KNOWLEDGE &
TRANSPARENCY

 **REDUCE**
AIR CARGO
SHIPPING COSTS
by up to \$2 billion

 **DECREASE**
WORK-RELATED
INJURIES



The use of internet-enabled devices and technology in smart warehouses can improve operational efficiency by connecting devices and employees through an IT infrastructure linked to a warehouse management system (WMS).³ A WMS monitors and manages an unlimited range of data points using devices, sensors and radio frequency identification (RFID) tags. An RFID system includes readers that can read up to 200 RFID tags at once, with those tags storing up to 100 times the data of bar codes.⁴ Additionally, RFID tags are position-agnostic, facilitating scanning and increasing productivity, whereas bar codes must be oriented toward a scanner. With the advantage of speed these tools offer, an item can be tracked in real time, so a distribution manager can know a shipment’s exact location and its progress at any point throughout the supply chain.

The knowledge and transparency of an IoT-enabled warehouse is also paving the way for further robotic automation. IoT-connected robotics are becoming more common, allowing robots to perform more complex tasks such as picking, packing and shipping.⁵ This limits the use of humans for mundane tasks and instead utilises them where they are most valuable, reducing the cost of labour and training. Experts estimate nearly 70 percent of transactions in air cargo shipping could be automated using robotics or artificial intelligence (AI), cutting costs for stakeholders by up to \$2 billion.⁶ Maintaining efficient and cost-effective operations is critical in any warehouse environment. Yet, this can be especially crucial during the storage and distribution of pharmaceuticals, where any excursions in temperature-sensitive products can compromise the efficacy and even safety of a product. By using robotics in the beginning phases of a distribution life cycle in combination with a fully faceted, temperature-controlled shipping container, a pharmaceutical manufacturer can have confidence its product is protected from its facility to the patient.

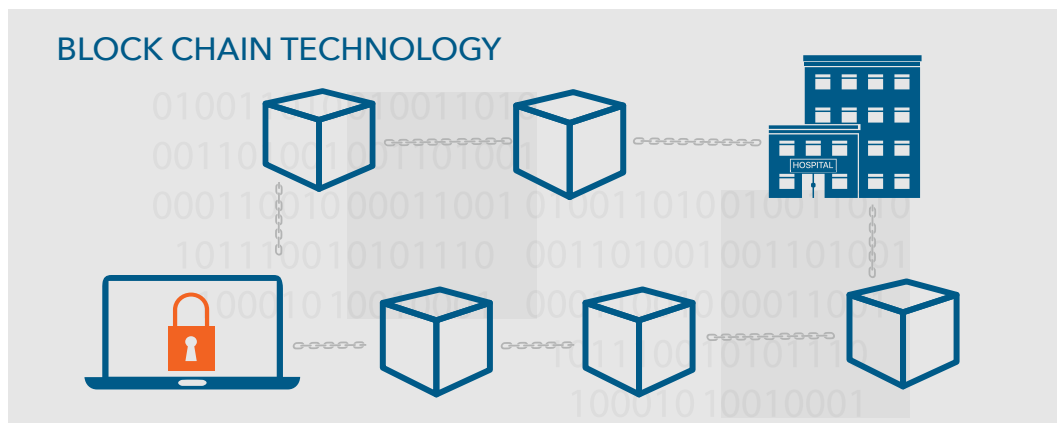
Robotics can also improve employee safety. Sarcos Robotics, a developer of robotics and microelectromechanical systems, plans to introduce a powered exoskeleton suit in 2019 for warehouses and distribution centres. These “exosuits” are intended to reduce work-related injuries and problems associated with continuous lifting and moving of heavy items.⁷ According to the U.S. Bureau of Labor Statistics, workplace injuries and accidents cost U.S. employers more than \$60 million annually, so technology such as this not only offers the productivity advantages of robotics but can also extend employee longevity.

2 THE BLOCKCHAIN MOVEMENT

With the launch of Bitcoin in 2009, the business world also saw the advent of blockchain technology. This software functions by grouping records and log transactions into chronologically ordered blocks that are linked and secured by cryptography technology. The blocks essentially create a digital ledger system, allowing for easy coordination and authentication of documents and data.⁸

Blockchain technology can:

- ✓ Ease coordination and authentication of data
- ↑ Increase visibility and offer traceability of falsified or counterfeit drugs
- ⚙️ Optimise costs and shipment times



While a wide range of industries, from financial services to energy suppliers, use blockchain technology, it has become especially useful in pharmaceutical manufacturing and distribution. That is because this industry requires multiple stakeholders to coordinate the shipment and logistics of high-value drugs that could mean life or death for a patient should they receive a product that has been compromised or if they do not receive it at all. Currently, major users of blockchain technology in the logistics industry include UPS, McLeod, DHL, FedEx and Union Pacific.

In an article published by pharmaphorum, author Gunjan Bhardwaj offers five use cases for blockchain technology in pharma:⁹

1. Increase visibility in the pharmaceutical manufacturing supply chain
2. Offer traceability throughout the supply chain to prevent infiltration of falsified or counterfeit drugs
3. Enable manufacturers to efficiently manage inventory levels to prepare for spikes in demand
4. Assist with recall management
5. Facilitate clinical trial management

The potential benefits of blockchain and the transformative power it could have over the future of the pharmaceutical supply chain gives rise to new possibilities in a number of areas. For example, blockchain technology creates transparency that increases accountability for product damage. Photo Equipment Interchange Receipt (PEIR) is a blockchain-encrypted app created

by logistics services provider TCompanies that allows operators to take and save pictures of shipments at each destination throughout a supply chain. According to TCompanies' CEO Tom Burke, 25 percent of the 37.5 million cargo containers and trailers shipped throughout the United States each year are damaged at some point in transit.¹⁰ Improved accountability also helps mitigate pharmaceutical cargo theft, which can cost shippers and transporters up to \$30 billion a year, with an average of \$4 million per loss.¹¹

Blockchain not only can track the chain of custody and pinpoint where any damage occurred, but the secured and facilitated performance of contracts without the involvement of third parties also reduces the transaction costs and time associated with contracting.¹² "Smart contracts" is another term for the blockchain technology, as this automated functionality releases payments in escrow once predefined stipulations are met. Managing and optimising costs and even time of shipments is also possible through blockchain, as the information it provides allows shippers to track capacity, cost and estimated delivery times for different routes. Inflated markups by brokers would no longer be possible as real-time updates from carriers about their capacity for shipping vehicles and lanes dynamically adjusts the fairest prices based on supply and demand.¹³

Just as with any information stored in blockchain's decentralised, encrypted digital ledger system, these logs of critical transport data cannot be altered once they are entered. Customs and government authorities can use this ledger to easily see what the originating company and country was for a shipment and what its value is, so they can assess the appropriate tariffs. As pharmaceutical manufacturers begin or even continue, to expand their global footprint, using blockchain technology to track their shipments is seen as an invaluable tool in global trade.

Blockchain in Transport Alliance

Blockchain technology's benefits, while appealing, do not come without concerns from potential users. Deloitte recently outlined five areas that, if progress were made, could overcome barriers to blockchain's adoption:¹⁴


1. Increasing throughput and performance for large-scale applications
2. Enhancing standards and interoperability
3. Reducing complexity and costs
4. Gaining regulatory support
5. Multiplying consortia

While work is being done in all of these areas, there are still many questions around when blockchain could be ready for mass adoption, if at all. The standards and advocacy organisation Blockchain in Transport Alliance (BiTA) shares common goals among its 450+ members "to develop a standards framework, educate the market on blockchain applications and encourage the use of those applications."¹⁵

AI and predictive software can:

 Empower air cargo supply chain stakeholders in a rapidly growing

 Provide end-to-end visibility and predictive foresight

 Improve customer experience

3 ARTIFICIAL INTELLIGENCE AND PREDICTIVE SOFTWARE

Not only would access to data improve efficiency and productivity in air cargo shipping for the pharmaceutical supply chain, but the use of AI could empower air cargo supply chain stakeholders facing a rapidly growing market. In an IATA article, Tim Strauss, vice president of cargo for Air Canada, explains why it is essential the air cargo shipping industry utilises innovative new technologies, such as AI.¹⁶ “It is both important and urgent for the industry to transition to the modern age of supply chain technologies and systems if it wants to remain relevant in a world driven by data, information and microsecond-decisions being made via artificial intelligence,” says Strauss. “This is the clear path to the next generation of efficiencies and differentiation between providers of air cargo services. It is very likely that the shippers will eliminate airlines and handlers who are unable to work in this new era of distribution/information and most certainly will be sidelined in the e-commerce, pharmaceutical and perishables marketplace.”

The data extracted from AI software can provide the information needed to foresee potential issues and make recommendations or decisions on optimal actions.¹⁷ Data sets about inventory, supplier performance, demand fluctuations and even conditions along a route, such as weather, road or customs delays, can be used to plan ahead and/or take action in real time, facilitating decision making and increasing speed. The ability to apply predictive analytics to the pharmaceutical supply chain offers end-to-end visibility never before possible but incredibly crucial in an industry that is responsible for not only developing high-value products but also—and more importantly—millions of lives.

An example of the power of combining artificial intelligence and predictive analytics is the machine learning platform PAI 2, developed by the cloud computing company Alibaba Cloud. PAI 2 allows customers “to collect information, discern patterns in data and adapt to new input without explicit programming.”¹⁸ An example of PAI 2’s capabilities is its ability to learn and predict airfreight shipping each day for supply chain operators while taking into consideration factors like weather patterns along the intended route.¹⁹ Customer expectations can be maintained appropriately in real time by adjusting delivery dates as unexpected weather creates delays. The algorithms possible with AI software are also able to predict other types of patterns, such as future buying habits, letting shippers better forecast when and where resources need to be diverted, as well as potential issues related to customs/borders.

Overall, technology trends such as these are creating revolutionary opportunities to change the face of air cargo shipping. The efficiency of a smart warehouse using IoT, the transparency from blockchain technology and the risk mitigation of predictive analytics are all critical pieces of the pharmaceutical industry's modern evolution. Research by CargoSense found 25 percent of vaccines are degraded by the time they reach their destination due to incorrect shipping; 30 percent of wasted pharmaceuticals are due to logistics issues and 20 percent of temperature-sensitive products are damaged due to issues during transport through the cold chain.²⁰

Manufacturers investing billions of dollars in lifesaving drug products must be able to rely on supply chain stakeholders to deliver these high-value packages on time and within specifications. As you consider the best way to ship your valuable pharmaceutical products, consider these tools as ways to preserve the quality of your product and protect the safety of patients. Not only is this necessary for a healthy bottom line but also to meet the wide range of needs and expectations of today's patient population.

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