# Digital Transformation
## NETWORK
An Initiative of BSA | The Software Alliance

# Supply Chain & Logistics

# Digital Tools Transform Supply Chain Management

In the last decade supply chains have gone from a quiet, background corporate function to a global buzzword. The COVID pandemic, war in Ukraine, Brexit, and volatile energy prices have brought disruption to everything from basic vegetables on the dinner table[1] to luxury vehicle deliveries.

Supply Chain Management (SCM) originated in the 1980s as an inventory management approach to optimize the physical flow of goods from primary producers to end customers, with an emphasis on working together to keep costs down for the consumer. It has grown ever since; many companies now employ Chief Supply Chain Officers (CSCOs) and, as _The Economist_ put it, "supply chains are the fibers out of which the past decades' globalization is woven."[2]

The cold chain logistics sector in particular was crucial to the pandemic response; with vaccines required to stay at sub-zero temperatures from manufacture to injection. In the United States alone, the cold chain sector has delivered more than 750 million COVID-19 vaccine doses.[3]

**THIS REPORT EXPLORES THREE AREAS:**

**SECTION 1** which focuses on the pandemic response, details the unprecedented collaboration between pharmaceutical and technology companies to get vaccines shipped and working.

**SECTION 2** dives into the intersection between physical and digital in SCM.

**SECTION 3** explores how AI and digital tools can predict and stimulate demand while shaping resource management more widely for a sustainable tomorrow.

After the shocks of the 2020s so far, companies worldwide are experiencing what Ernst & Young call the "great supply chain reset."[4] Thinly stretched linear global chains based on mass production with low-cost countries, just-in-time inventory, and limited inherent resilience made sense in a relatively stable world. But with a new normal shaped by changing international trade policy, global tax reforms, increasing China-US tensions, and environmental, social, and governance (ESG) pressures, companies in many sectors are being forced to shift to segmented "supply networks."

Doing so requires a transition that can only be achieved through digital transformation. According to the Association for Supply Chain Management (ASCM), members worldwide are striving to optimize execution, diminish risk, improve dexterity, and gain competitive advantage in this uniquely challenging environment. To achieve these goals, it will be essential to create data-driven networks and maximize the latest digital transformation capabilities,[5] they note.

Recent digital technologies such as cloud computing, Internet of Things (IoT), big data, artificial intelligence (AI), and Machine Learning (ML) have significantly advanced the ways in which supply chain processes can be managed. In a 2022 survey by McKinsey of 113 global supply chain leaders,[6] more than 90 percent said they invested in digital supply chain technologies last year.

A parallel need exists for physical infrastructure to fulfil ever-expanding consumer requirements. The Federal Aviation Administration (FAA) recently awarded more than $31 million in grants to expand cargo infrastructure at nine airports nationwide, with Transportation Secretary Pete Buttigieg noting this will "help strengthen America's supply chains." BSA members are involved at every stage of creating digital tools to complement this bricks and mortar investment.

Digital tools and the IoT mean every part of the supply chain, from packaging and pallets to warehouses and airports, can be connected. Sensor nodes sending information about location, conditions, and temperature prevent lost shipments and wasted time. Digital automatic coupling (DAC) is poised to revolutionize rail freight transport in Europe,[7] allowing more freight wagons to travel by rail and enabling denser rail traffic overall. Impossible without digital, it will bring both efficiency and sustainability benefits.

In line with United Nations' Sustainable Development Goals (SDGs), circular and sustainable supply chains, as well as systems dedicated to delivering essential goods, must be prioritized—especially after years of disruption. Digital transformation can help companies do this.

**SECTION 1**

# Global Collaboration in Urgent Times

Late in 2019, headlines started popping up about a novel coronavirus. By January 2020, the World Health Organization had declared COVID-19 a public health emergency of international concern (PHEIC). Lockdowns, travel bans, and total supply chain disruption ensued. A global race was on to create testing, treatments and, above all, a vaccine for this new disease. BSA members were at the forefront of this work, reflecting the necessity of the digital transformation for a successful response to COVID.

**Pfizer** was developing one of most widely used vaccines, known as Pfizer/BioNTech. The group already operated one of the industry's most sophisticated supply chain systems, with more than 35 Pfizer-owned sites and more than 300 suppliers globally. One complication: the vaccine needed to stay at -112°F (-80°C) throughout transport; once opened and mixed, the vaccine it had to be used within six hours.

Pfizer designed temperature-controlled thermal shippers,[8] which used dry ice to keep conditions steady for up to 10 days. Fitted with GPS-enabled thermal sensors, they were tracked across pre-set routes to get where help was needed, quickly. This IoT-based solution worked in tandem with a strong digital foundation; Pfizer runs **SAP** enterprise resource planning (ERP) with **Oracle** Database on IBM Power Technology. SAP Business Warehouse, which is critical for operations and is not just a reporting tool, also runs on **IBM** Power Systems with the SAP HANA Database.[9] "Running SAP HANA on Power allows us to scale up all of our workloads and that simplifies the architecture which is a key capability," explains Scott Groth, Director, ERP Technical Architect, Pfizer.

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In those harrowing early months of the pandemic, there was also no way of knowing who had the highly contagious disease. **Abbott** took on one of the greatest challenges, creating a series of antigen, molecular, and serology tests to confront the virus in different ways.[10] Doing what traditionally takes years in a matter of months, they soon developed an effective, fast test. The next challenge was getting it into the hands (and noses and throats) of consumers.

As soon as the pandemic began, Abbott started investing hundreds of millions of dollars in high-tech manufacturing, leveraging and fortifying their supply chain. Working with more than 75,000 suppliers in 120 countries, they used the digital difference to get tests to millions of people around the world.

Testing and vaccine development is not the end of the story. New variants are a constant threat. Companies must be able to react quickly to unexpected interruptions, and that can only be done by digitally managing the complete supply chain from end-to-end—from procurement through production and on to delivery. For years, governments have faced long-standing supply chain challenges related to inadequate storage, transportation, and human capacity.

Today, though, 95 percent of the world's major vaccine producers have adopted **SAP** solutions[11] to manage the end-to-end vaccine effort—from manufacturing to distribution to administration and even post-vaccine monitoring.

**SECTION 2**

# Physical Changes for Digital World

In a digital world, manufacturing equipment and shop floor operations generate millions of data points. This volume becomes overwhelming when left in its raw state. Connectivity platforms enable manufacturers to operationalize this data by capturing data from sensors, programmable logic controllers (PLCs), and machine controls, then sending it directly to the cloud for cleaning and organization.

Sensors can be placed in endless elements of supply chain parts; digital twins can model whole systems. And data can be useful at every stage. After it's collected, the information is standardized into a common model with edge device compatibility. Some is sent directly to the cloud, some is partially processed, and some is immediately actionable, further supporting control and automation of equipment at the source. This means shipments can say where they are; warehouses can let managers know when a pallet has been forgotten.

## Unpacking a Challenge

The most basic part of the supply chain is the Stock Keeping Unit (SKU), a distinct type of item for sale, purchase, or tracking in inventory: for example, one box of juice, one pair of leggings. Since the invention of barcodes, these items have been easier to track; with QR codes, RFID tags, and sensors, there's a wealth of ways companies and retailers can track everything from apples to aircraft parts, digitally.

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**Microsoft**

**Data for Source of Sauce**
Golden State Foods (GSF) provides 200+ leading foodservice customer brands to more than 125,000 restaurants in more than 50 countries from 50 locations and feeds more than one billion people every day. Their Liquid Products business provides hundreds of liquid products in multiple packaging options to quick-service restaurants (QSR), from single-serve and dipping cups to bulk. If you've been to McDonalds, you've eaten their products.

The pandemic led to a dramatic overnight shift in business. Sit-down dining dropped to a small fraction of pre-pandemic levels, while takeout dining levels soared. Across the board, customers switched from self-serve ketchup pumps to single-serve ketchup packets. Thanks to **Microsoft** Dynamics 365 warehouse management,[12] GSF never ran out of any ketchup SKU. They also created a more sustainable sauce dispenser for restaurants, enabling them to dispense more products, more safely and more sustainably.

## Reefer Madness

Central to food and medicine supply chains, refrigerated trucks—known as reefers—get everything from ice cream to insulin from the manufacturer to customers. Breaks in the cold chain can cause everything from melted cookies'n'cream to public health disasters; there is also a global shortage of reefers.[13] According to the ITA, despite technological advances, more than one billion metric tons of global food waste are created per year, due primarily to a lack of proper facilities, inadequate food handling processes,[14] and improper personnel training. Tracking the cold chain has traditionally been complicated, but digital changes everything.

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IBM

### Walmart and the Blockchain

Keeping things cold is not a breeze. Fragmented transportation networks and the demanding mechanical requirements of properly storing food for long journeys mean logistics and distribution companies face many critical challenges. One solution is tracking them on the blockchain. **IBM** Food Trust, built on the IBM Blockchain Platform,[15] enables a single item to be tracked in greater detail than ever before. The "unspoken promise is that they expect the food that they buy in our stores to be safe," says Frank Yiannas, Walmart's Vice President of Food Safety. Walmart can track food products through complex supply chains using the blockchain, even when there are systems that don't typically speak to each other.

## Drive to Survive

The most obvious place to see the supply chain in action is on the road. From trucks traveling to distribution centers to deliveries being handed over at the doorstep, digital makes a difference. Efficient routing for vehicles, predictive maintenance for the fleet, and optimized loading for cargo—every part of the process has been enhanced through digital technology. Digital solutions can reduce insurance premiums, cut fuel use, and ensure drivers stay within speed limits at all times.

One leading distribution company used advanced analytics to understand what was behind attrition rates for drivers, as explained in this McKinsey report.[16] Based on what they learned, they redesigned the daily routines of frontline roles. Improvements included more accurate delivery scheduling, reduced driver idle time, and significant reductions in downtime, all leading to a 15 percent increase in driver retention rates.

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### A Pipeline to Safer Driving

San Diego's Bill Howe Plumbing wanted to improve driver safety. Verizon Connect Reveal is an app designed for SMEs[17] that enables users' smartphones to locate vehicles on a live map, run reports and view driving replays, and equip drivers with information to help them be safe and efficient.

With weekly reporting and immediate alerts for unsafe driving, as well as vehicle maintenance reminders, their fleet management has dramatically improved. The year before implementing Reveal, the company had 16 accidents totaling nearly $1 million in damages. After implementation, accidents dropped to two. One driver commented that his "driving habits have changed dramatically." They've seen other positive side effects, including lower insurance costs and reduced fuel consumption. And Live Map features and GPS tracking also helps them provide quicker service to their customers.

## Sustainability, Tracked

Global supply chains pass through multiple countries, cultures, and jurisdictions. For many consumers, knowing that people at every stage of this value chain have been fairly compensated is a deciding factor when selecting shopping, as well as a big step toward UN SDGs. Some countries, such as Germany, already have laws about corporate responsibility toward the environment and human rights, and others are considering legislation in this area.

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### The Sweet Taste of Sustainability

Eckes-Granini is Europe's biggest fruit juice supplier. For Bernd Neufert, the idea of a "sustainable supply chain" affects every hand that touches that fruit, from tree to bottle, and the land where it is grown, whether it's in Germany, Brazil, or Spain.

Eckes-Granini has set a goal to have 100 percent of its juice sustainably sourced by 2030.[18] To keep track of the data harvest required for this, Neufert turned to **Microsoft** for help. They used Azure Data Factory Flows to automate the process of inputting data from reporting agencies, sustainability ratings, suppliers, and their own records into a central database.

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**The Sweet Taste of Sustainability** *(continued)*

To analyze the data, they customized a Microsoft Power BI dashboard. Power BI is a cloud-based platform that gives a visual overview of data, then drill down into vendor or supplier specifics. For Neufert, a truly sustainable supply chain benefits everyone involved—guaranteeing a reliable supply of quality fruit, steady work for farm families, and long-term stability and profits for all.

## Where Next for Warehouses

Supply chains are inherently physical; they consist of moving goods from one place to another. Adding a digital element can make all the difference. Take the PALIoT, created by a New-York-state-based startup[19] with a name derived from "pallet" and "IoT." These smart shipping pallets are made of polyurea-coated, engineered plywood, and 20 pounds lighter than the traditional wooden version. Thanks to the addition of sensors, they essentially become a smart mesh network, where all the pallets in a shipment can report inventory and environmental data back to the cloud.

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**SAP**

### A Virtual Warehouse for Real Improvements
For years, ERP from SAP has been conducted on computers and mobile devices. That's changing with the **SAP** Extended Reality Cloud (XR Cloud), which is based on Unity's platform and enables the development of mixed reality applications.[20] SAP's Extended Reality Venture team has identified areas where AR, VR, and XR can add significant value to its customers. They then use Unity, the engine behind many leading video games, to create these hybrid worlds.

One demo they built was an enhanced warehouse management project. Autonomous freight trains use AI for navigating, loading and unloading equipment, and upgrading a planning process that typically takes place in a 2D spreadsheet—making it difficult to envision the end result and optimize routing. With a virtual environment using Unity and SAP S/4HANA, its intelligent ERP system, SAP can improve stakeholder understanding and ensure optimal route planning for the next generation of warehouses.

## Inclusivity, Activated

Supply chains exist to get products to everyone who needs them. From home delivery to scaling small businesses, they play a vital role in breaking down barriers and enhancing economic opportunity for all. Digital technologies are playing their part in this, making supply chain essentials accessible to everyone, whether as a customer, employee, or founder.

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### twilio

**Internet Shopping, Without the Internet**

Schwarz Supply Source is a leading provider of customized SCM solutions, from stock scanners to packaging peanuts. Their client list includes Fortune 500 companies and some of the top retail brands in the world—as well as smaller companies in remote locations. System uptime matters, especially during periods of peak demand such as the holiday season. Some of Schwarz's customers are retailers who need to place offline orders from locations that don't have internet access.

They worked with software company **Twilio**[21] to ensure that these customers weren't left behind by building an Interactive Voice Response (IVR) ordering platform that uses automated phone system technology. They needed a system that could integrate and leverage all capabilities of their existing e-commerce and ERP systems. Streamlining call workflow to ensure a perfect balance of call length, usability, and functionality was also important.

## Supply Chains, the Foundation of Everything

Many BSA members work with consulting firms to provide wide-ranging technology solutions for the way companies run their businesses. Transferring a range of manual functions such as HR, bookkeeping, facilities management, inventory, and ordering onto a single ERP solution can bring enormous benefits, both in terms of cost savings and overall efficiency.

But above and beyond technology infrastructure, the real world business of managing supply chains touches every aspect of business as well. Retail, catering, healthcare, manufacturing… few businesses can function without an efficient supply chain. A true ERP overhaul means bringing together digital and physical worlds.

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**A Health Check for Healthcare**

John Muir Health, a three-hospital system in northern California with around 5,000 employees decided to remove about one-third of their operating costs out of the budget in future years. Like many of their industry peers, modernizing their technology infrastructure was an obvious first step. Legacy systems across Human Resources, Finance, and Supply Chain were long past due for an upgrade, so they went to Workday to advise on technology migration.

Workday suggested John Muir Health was putting the cart before the horse, and that they should review their supply chains before tackling other functions. They adopted **Workday**'s SCM product;[22] having Supply Chain Management in the same system as Workday Financials enabled them to accelerate progress on their core capabilities.

John Muir Health worked with Workday and PwC to continue to advance the SCM offering for healthcare, integrating real-time input from procurement and inventory users (including mobile) to influence ongoing development. They saved time and money, improved compliance, and can easily scale up systems to match future growth.

**SECTION 3**

# Staying Ahead of the Curve

According to the ASCM, one of the biggest advantages of digital transformation is the ability to mitigate disruption through agile SCM. The implementation of predictive and prescriptive analytics—as well as advances in big data, algorithms, and robotics—have broad-reaching effects for companies. They benefit from greater visibility, synchronized planning and execution, data-driven decisionmaking, predictability, agility, and profitability.

AI models have clear advantages over traditional spreadsheet-based analytic methods. According to McKinsey, applying AI-driven forecasting to supply chain management,[23] for example, can reduce errors by between 20 and 50 percent—and translate into a reduction in lost sales and product unavailability of up to 65 percent.

## Forecasting Brilliance

"Supply and demand" is economics 101, but in the real world, predicting both can be extremely complicated. Traditional forecasting methods rely on historical sales data, time series analysis, and causal models for increased demand. They often presume that previous patterns will simply repeat—which can be misleading, especially in the current atmosphere of global uncertainty. Additionally, these models need to be manually adjusted to account for market trends, economic indicators, and unforeseen events, which can greatly affect demand.

Automated AI-driven forecasting represents a new frontier, insofar as it can consume real-time data and continuously identify new patterns. Algorithms can analyze vast amounts of historical data, bring in trends, examine information about global events and economic indicators, identify complex patterns, and use these to predict future demand, rather than just expecting a cycle to repeat.

Deep learning models such as recurrent neural networks (RNN) and long short-term memory networks (LSTM) are trained on historical sales data and features to propel demand drivers like promotions, price adjustments, seasonality, and external factors. After validation and testing, they can generate forecasts and connect to ordering and inventory planning engines.

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**The Power of Forecasting for GE Power**
GE Power provides energy for more than a third of the world, serving customers in more than 150 countries. It had more than five ERP systems from different vendors as well as other legacy systems scattered across 100 locations—so all forecasting and demand management were running independently. With subdivisions doing everything independently, accuracy was around 55 percent at best.

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The Power of Forecasting for GE Power *(continued)*

GE Power turned to **Oracle** Supply Chain Planning;[24] together they consolidated 15 separate demand forecasting tools down to one. The previous methods of forecasting relied on spreadsheets and took teams more than five days; now, forecasting takes just half a day and can be easily replicated by teams around the world. In addition, forecast accuracy improved from 55 percent to 70 percent.

## Full Shelves, Happy Customers

Supply chains are the backbone of the global retail sector. Demanding customers and busy factories and shops that need stock constantly refreshing make for a complex, interdependent web of time-critical variables. Retailers face several potential pain points in managing their supply chain operations. Inventory management, delays in product delivery, transportation management, and demand planning are particular challenges. The biggest names in retail are hiring the biggest brains in digital to smooth the whole process, from design studio to shelf.

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**salesforce**

### Shipping, Simplified

Founded more than a century ago, Maersk is one of the world's biggest shipping companies. They offer SCM services to help companies manage logistics complexities worldwide. Maersk Line—a worldwide leader in transportation and logistics, with a fleet of more than 600 vessels that move in excess of 12 million shipping containers each year— is expanding its use of Salesforce,[25] adding **Salesforce** Marketing Cloud, Einstein Analytics, and Community Cloud to its current deployment of Sales Cloud and Service Cloud.

"Success in the complex and high-stakes world of global transport and logistics relies on meeting customer expectations every step of the way," notes Steen Erik Larsen, Senior Director IT at Maersk Line A/S. "With Salesforce, we're bringing the entire customer journey, from lead to prospect to customer, on one platform and adding analytics to get deeper insights that will allow us to continually meet the evolving needs of our customers."

## A Beginning, a Middle, and an End—Tracked

Inspiration, design, sourcing materials, manufacturing, delivery, aftercare—every stage of a product's lifecycle is part of a bigger logistical story. Product lifecycle management (PLM) tracks and improves every stage. In the age of the circular economy, it even extends back to the raw materials used in production, and forward to recycling and repurposing. Tracking, recording, and analyzing these stories enables companies to make meaningful improvements and innovations, quickly. PLM software provides effective collaboration for every stage of the supply chain and beyond.

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# ⚡ AUTODESK

### Smart PLM for Smart Meter Leaders

Founded in 1972 in Hazelwood, Missouri, Aclara Technologies is a world-class global supplier of smart infrastructure solutions to more than 780 water, gas, and electric utilities in the US, Spain, and the United Kingdom. To keep up with the pace of new product introduction, they invested in **Autodesk**'s Cloud PLM solution.[26] This allowed them to eliminate costs associated with onsite maintenance and systems upgrades while providing a robust system to manage product information efficiently and securely across a globally dispersed supply chain.

After quickly getting Autodesk PLM up and running, Aclara immediately saw more secure design processes, reduced risks, and lower costs. Improved collaboration and visibility across the supply chain team allowed stakeholders to oversee and manage the entire product lifecycle, preventing bottlenecks and potential errors. The implementation of Autodesk PLM brought all the moving parts of product development together into a single, integrated view.

## Maintenance, Predicted

Vital for manufacturing, predictive maintenance optimizes the performance and lifespan of assets by continually assessing their health in real time. By collecting and analyzing data from sensors, predictive maintenance can identify, detect, and address issues as they occur, as well as predict the potential future state of equipment. Digital twins can show when an asset needs repairing—before it stops production. Getting spares there promptly needs strong, responsive supply chains, and advance warning can keep everything running smoothly.

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### What Goes Around, Comes Around

Factories are like organisms, and the heart is often a turbine or electric motors that go around. Known in expert circles as rotating machines,[27] typical examples include turbines in wind power generators or electrical systems in car factories. It's not uncommon for these kinds of rotating machines to have an operational life of 10 to 20 years or more.

What if the heart of the factory could talk? With a digital twin, it can. Bosch has developed an Integrated Asset Performance Management (IAPM) solution powered by a Digital Twin that runs on **Microsoft** Azure. This solution lets rotating machines flag when they need

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**What Goes Around, Comes Around** *(continued)*

maintenance, helping them to run with optimal costs and maximum efficiency. Performing repairs when necessary, rather than as a precaution (or worse, when production has broken down), plays a vital part in making the circular economy a reality.

"Our Digital Twin enables them to make data-driven decisions to avoid breakdowns from the outset," says Bhuvan Shetty, Sales & Global Strategic Partnerships at Bosch. "As a digital assistant, it really lightens the day-to-day workload."

## Workflow, Reimagined

In an interconnected world, work is a team effort. Companies in every sector are turning to digital tools and solutions to help digitize and unify organizations so that they can find smarter, faster, and better ways to get things done. Many organizations still rely on outdated, siloed systems of record that were not built for today's agile work and are difficult and costly to change. Finance and Supply Chain workflows bring together people, processes, data, and technology in one easy-to-use platform to get work done across critical business systems.

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**Securing Supply Chains**

ServiceNow's new AI-powered workflows[28] help finance, supply chain, and procurement leaders reduce costs and accelerate time to value, while improving user experience. Finance and Supply Chain workflows uses AI to help organizations modernize mission-critical processes like sourcing, procurement, supplier, and accounts payable management.

Organizations can now simplify operations and experiences, create more resilient supply chains, and increase compliance. This lowers the total cost of operations, while improving user experiences. By using data from existing ERP investments, businesses can automate processes and digitize mundane, manual work faster without the cost and organizational impact associated with large migrations.

# Conclusion: Digital Supply Chains for a Growing World

The great supply chain reset is underway, and affecting every sector, industry, and country worldwide. Delivering the goods and services people need, at the right speed and price point, requires a complete digital transformation. BSA members are supporting companies of every size and type to optimize execution, reduce risk, and become more agile to gain competitive advantage as the world recovers from successive shocks.

Supply chains are on everyone's agenda now; the average consumer might not understand the intricacies of warehouse management, but empty supermarket shelves are shorthand for crisis. With digital solutions to predict demand, optimize manufacturing and speed up delivery, this realignment is underway; tomorrow's world is one where sustainability, smooth processes, and smart systems improve life for us all.

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