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The 2019 Top Supply Chain Technology Trends You Can't Ignore

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Supply chain technology leaders making decisions about innovation and transformation should assess the disruptive impact they might have on people, objectives and IT systems. This research lays out the top technology trends that should be examined to determine their role in tomorrow's supply chains.

Overview

Impacts

- As companies seek to exploit the benefits of greater levels of digitalization, new and innovative technologies can potentially and significantly disrupt existing supply chain (SC) operating models.

Recommendations

Supply chain technology leaders responsible for technology innovation in supply chain and operations should:

- Assess their readiness to explore, pilot and possibly adopt offerings by determining their company's risk culture first. Risk-tolerant or risk-exploiting firms should explore technologies highlighted in this research now, while risk avoiders should wait.
- Introduce and adopt innovative technologies in the context of the future supply chain strategy, taking into account their impact on people, processes, business objectives and IT systems. Ensure a strong competency in process governance to guarantee success.

Strategic Planning Assumptions

By 2023, at least 50% of large global companies will be using AI, advanced analytics and IoT in supply chain operations.

By 2023, 90% of blockchain-based supply chain initiatives will suffer blockchain fatigue for lack of strong use cases.

By 2022, more than 50% of all people collaborating in Industrie 4.0 ecosystems will use virtual assistants or intelligent agents to interact more naturally with their surroundings and with people.

Analysis

The way people perceive and interact with technology, and vice versa, is undergoing a radical transformation. Having a digital representation of almost all things and processes sets the stage for the automated and optimized monitoring, analyzing, and controlling of supply chain events and activities in real time.

Gartner's top strategic supply chain technology trends have broad industry impact, but haven't yet been widely adopted. These technologies are experiencing significant changes or reaching critical tipping points in capability or maturity.

As a leader responsible for supply chain technology strategy, you should examine the impact of the top strategic technology trends for supply chain on people, business objectives and IT systems. Adjust your supply chain IT strategies and operational models appropriately, and ask yourself the following questions:

- What trends must I know about or need to worry about?
- What trends should I watch, which ones are over hyped, and which trends can I postpone or even ignore?
- Where are my knowledge gaps around emerging and innovative technology?
- What trends or clusters of trends are most relevant to our business, our objectives and our risk tolerance?
- Which trends have the potential to resolve existing or long-standing problems in our supply chain?
- Which trends seem likely to help us capture additional market share or seize a new business opportunity?
- What existing and current technology solutions are the most closely aligned to these trends?

Figure 1. Impacts and Top Recommendations for Supply Chain Technology Leaders Responsible for Technology Innovation

Source: Gartner (March 2019)

Impacts and Recommendations

New and Innovative Technologies Can Potentially and Significantly Disrupt Existing Supply Chain Operating Models

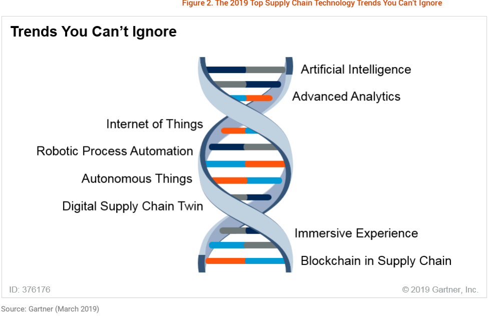
Market dynamics are increasing the urgency for digital transformation in many supply chains. Supply chain organizations are now required to continually re-evaluate their business models, resources, and supporting technologies.

Supply chain leaders for technology innovation and transformation must adopt a mindset and new practices that accept and embrace perpetual change. ContinuousNext is the strategy for achieving success in a world that is constantly changing. Supply chain organizations must master perpetual innovation, integration and delivery. The top strategic supply chain technology trends are a critical ingredient for good technology decision making.

Our top list (see Figure 2) highlights strategic trends that aren't yet widely recognized but will have broad industry impact and significant potential for disruption:

- Examine the business impact of our top strategic supply chain technology trends, and seize the opportunities to enhance your existing products, create new ones or adopt new business models.
- Prepare for the impact of digital business on your industry — it will transform the industry and your supply chain business.

Figure 2. The 2019 Top Supply Chain Technology Trends You Can't Ignore



Source: Gartner (March 2019)

Trend No. 1: Artificial Intelligence

Artificial intelligence (AI) in supply chain consists of technologies that seek to emulate human performance. Typically, it does so by learning, coming to its own conclusions, appearing to understand complex content, engaging in natural dialogs with people, enhancing human cognitive performance or replacing people in the execution of nonroutine tasks. AI can be deployed to improve supply chain functional and cross-functional performance.

Although the interest in AI in the supply chain has increased over the past year, its application is still nascent. Early adopters report promising benefits from limited scope pilots, but have yet to embark on broader AI projects. Reaching the Plateau of Productivity in supply chain in 10 years or more will require technology maturity as well as organizational and cultural readiness and talent availability.

AI solutions make sense of structured and unstructured data, and can interact with humans through written or conversational natural language. AI technologies rely on machine learning techniques to identify patterns and make predictions. It continues to refine its findings and strategies through self-learning from new data and its previous performance, to recommend decisions or execute actions.

Artificial intelligence supports organizations' vision for broader supply chain automation. The level of automation could be semiautomated or fully automated (aka autonomous) with a mix, depending on the circumstances. Through self-learning and natural language, AI solutions can help automate various supply chain processes such as demand forecasting, production planning or predictive maintenance. Along with automation comes augmented human decision making, because the human is then no longer involved in the decision making because it is automated. For example, AI can augment current risk mitigation by analyzing large sets of internal and external data, continuously identifying evolving patterns, and predicting disruptive events and potential resolutions.

Use-Case Examples:

- Improving order delivery and service levels by using AI capabilities to determine the routes a company should take to optimize deliveries
- Optimizing shipping replacement parts by applying AI algorithms and notifying users of a potential equipment failure prior to it occurring, as a safety measure
- Enhancing customer services by leveraging AI-based applications for dynamic supply chain inventory optimization to reduce lead times and operating costs

Recommendations:

- Experiment with AI in lower-order supply chain processes such as data and transaction management. These solutions span data harmonization, error detection and correction, and business process automation.
- Engage directly with vendors to understand the role AI plays in current offerings, how AI fits within the future product roadmap and how they plan to incorporate conversational AI to make their technology more user-friendly.
- Focus on specific use cases where you believe AI presents the highest potential, and embark on small pilots. Align your expectations for these pilots with Mode 2 initiatives, where experimentation and learning are key goals.
- Focus on cultural changes to ensure that the supply chain organization is open to the benefits that can be achieved using AI, and minimize resistance to adopting these technologies.

Related Research:

"Find Inspiration in 10 Use Cases of Artificial Intelligence in the Supply Chain"

"Machine Learning 101 for Supply Chain Leaders Part 3: Prioritize Use Cases and Gauge ROI"

"A Supply Chain Analytics Leader's Due Diligence Checklist for AI Projects"

"Disruptive Technologies in Transportation: The Impact of Artificial Intelligence and Machine Learning"

"Cool Vendors in Artificial Intelligence Across the Supply Chain"

"Artificial Intelligence Will Make Manufacturing Operations Smarter — But a Learning Curve Comes First"

"Toolkit: Communicate What AI Means in Manufacturing"

Trend No. 2: Advanced Analytics

Advanced analytics span predictive and prescriptive analytics. Predictive analytics are techniques to analyze data, identify patterns and anticipate future scenarios. Predictive techniques include simulation, statistical modeling, forecasting and machine learning. Prescriptive analytics describe a set of analytical capabilities that finds a course of action to meet a predefined objective. Prescriptive techniques include optimization methods, such as linear programming, and a combination of predictive analytics and rules, heuristics, and decision analysis methods like influence diagrams.

Although predictive and prescriptive analytics are not new, interest in these techniques has further increased for myriad factors. Supply chain organizations strive to become more proactive and actionable in managing their supply chains to take advantage of potential upsides and mitigate potential disruptions.

Advanced analytics have traditionally targeted problems in the strategic and tactical time horizon. Increasingly, advanced analytics are deployed in real time or near real time in areas such as dynamic pricing, product quality testing and dynamic replenishment. The availability of supply chain data — such as Internet of Things (IoT) data, dynamic sales data and weather patterns — provides the ability to extrapolate the current environment to better understand future scenarios and make profitable recommendations.

The impact of advanced analytics on supply chain is significant. Predictive analytics are undoubtedly a powerful competency that enable companies to be proactive and take advantage of a future opportunity, or mitigate or avoid a future adverse event. Prescriptive analytics can improve decision making in functional areas like supply chain planning, sourcing, and logistics and transportation. More importantly, prescriptive analytics can be deployed to improve the end-to-end supply chain performance because they can recommend a course of action that best manages the trade-offs among conflicting functional goals.

Use-Case Examples:

- Using condition-based maintenance in industrial, discrete and process manufacturing, and using historical data to predict equipment failures before they happen
- Using advanced analytics to enable proactive event management in areas like shipping disruptions, interlocking production processes or quality improvements
- Collecting and analyzing data on customer returns to help deter potentially fraudulent customers and place limits on the number of returns
- Improving the sales process by leveraging advanced analytics to combine transactional data with pipeline data for predicting product demand

Recommendations:

- Build a foundation of descriptive and diagnostic analytics using visibility as a foundational capability and prerequisite. Without understanding what is going on and what might be the problem, it is unrealistic to accurately predict future outcomes.
- Identify the supply chain processes that can benefit from predictive and prescriptive analytics, and clarify how the analytics' output will be embedded in the process and incorporated in users' decision making.
- Ensure the availability and readiness for the data required to conduct predictive and prescriptive analytics. Here, technologies can handle more dynamic data sources and satisfy requirements for faster response times.
- Ensure that organizational structure and governance will enable the company to implement and maintain functional as well as cross-functional predictive and prescriptive analytics recommendations.

Related Research:

"Augment and Automate Supply Chain Decision Making With Advanced Analytics and Artificial Intelligence"

"Define Your Talent and Organization Strategy to Support Advanced Analytics and Artificial Intelligence"

"Market Guide for Supply Chain Analytics Technology, 2018"

"Successfully Adopt Advanced Supply Chain Analytics With Limited Data Scientist Resources"

"Deploy Supply Chain Analytical Platforms to Build Flexible Solutions"

"Evolve Your Manufacturing Intelligence Strategy to Keep Pace With New Analytics Requirements"

"Toolkit: Assess Your Organization's Supply Chain Analytics Maturity Level"

Trend No. 3: Internet of Things

The Internet of Things is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.

Over the past year, we continue to see more supply chain practitioners exploring the potential of IoT. IoT is now past the Peak of Inflated Expectations and is descending into the trough as SC practitioners move past early excitement and now seek practical applications. Adoption is growing in select SC domains, but rarely as part of a complete end-to-end SC process. Some manufacturers or even retailers are assessing the business value of expanding beyond their current use of operational technology (OT) — digitized devices often having closed or proprietary connectivity. Logistics groups already use sensors to track assets or containers. They are now examining the additional benefits of IoT, opening them to an internet-based world.

Many organizations are building business cases and identifying applicable uses. Some SC organizations are piloting IoT in functional areas to quantify benefits. The IoT could have a broad and profound impact on the SC in areas such as improved asset utilization and higher uptime, improved customer service, improved end-to-end SC performance, or improved supply availability, supply chain visibility and reliability.

Use-Case Examples:

- Providing more dynamic inventory tracking by using IoT technology to increase visibility within an organization's retail supply chain
- Using IoT technology to receive alerts when parts on a machine need attention or replacement, and also automatically sending an alert to the company's channel partners, letting them know when to deliver the replacement part
- Monitoring environmental conditions while shipments are in transit by leveraging IoT technology (such as for "cold chain" requirements)
- Monitoring cargo security (such as against unauthorized opening) by leveraging IoT technology

Recommendations:

- Work with process subject matter experts to identify SC processes that can benefit from IoT, ranging from demand fulfillment and better customer visibility to manufacturing process optimization.
- Keep up with innovation in and maturity of IoT technologies that will impact the speed of adoption and return on investment.
- Learn from the IoT use cases outside of your industry and in functional areas outside the SC, and assess their applicability in the SC.
- Invest in talent to ensure there is expertise to keep pace with the rapidly emerging IoT technology choices and how they apply to the supply chain.

Related Research:

"Get Ready for IoT Order Buttons in Supply Chain Planning and S&OP"

"The Importance of Identifying and Classifying Assets Across the Supply Chain"

"Shape Your Supply Chain Network to Support Growth and Manage Risk"

"Predicts 2018: Chief Supply Chain Officers Will Reshape Operating Models in Response to Digital Drivers"

"Hype Cycle for the Internet of Things, 2018"

"Magic Quadrant for Industrial IoT Platforms"

Trend No. 4: Robotic Process Automation

Robotic process automation (RPA) tools perform "if, then, else" statements on structured data, typically using a combination of user interface (UI) interactions or by connecting to APIs to drive client servers, mainframes or HTML code.

Robotic process automation tools cut costs, eliminate keying errors, speed up processes and link applications. RPA has proven to be very effective in simple use cases, mainly where a third party in the supply chain will not provide an API or other means for automated data integration. However, the potential to achieve strong ROI is entirely dependent on the applicability of RPA in each individual organization.

RPA should be considered in light of other technical options and with some process change management skills. An RPA tool can be triggered manually or automatically, move or populate data between prescribed locations, document audit trails, conduct calculations, perform actions, and trigger downstream activities.

Select use cases for RPA include customer management or order-to-cash processing. Companies are seeking to automate an existing task, reduce or remove head count from batch data input and output tasks, or automate data rekeying or linking to external systems that cannot be connected to through other IT options. RPA use cases are largely siloed by function at this stage, yet offer the opportunity to connect different functions.

Use-Case Examples:

- Reducing process lead times significantly by using RPA technology to automate the creation of purchase orders or shipments and contract monitoring
- Using RPA technology to reduce human intervention and improve process consistency across manual data sources within manufacturing
- Deploying bots to help automate a range of activities, including retrieving information from documents and answering employee questions

Recommendations:

- Find and catalog unautomated processes where people are keying in or moving data between systems for manual, repetitive, rule-based activities.
- Evaluate RPA against myriad other automation options. Investigate why intelligent business process management suites (iBPMSs), APIs, and dedicated software tools are not already in use or could not be used.
- Learn from the RPA use cases outside of your industry and in functional areas outside the SC, and assess their applicability in the SC.
- Investigate where RPA tools, specialized software or fully managed services could quickly support key corporate initiatives, such as improving client service, working capital or auditability for compliance.

Related Research:

"Video: Ericsson — RPA (Robotic Process Automation) in Supply Chain"

"Video: Transporting Digital Procurement to the Next Level at Maersk"

"Video: How Dell Technologies Streamlined Its Supply Chain"

"Predicts 2019: RPA Evolution"

"Market Guide for Procurement Business Process Service Providers"

"Evolving B2B Expectations Are Creating Pressure on Order Management Systems"

Trend No. 5: Autonomous Things

Autonomous things use AI to automate functions previously performed by humans. Their automation goes beyond the automation provided by rigid programing models, and they exploit AI to deliver advanced behaviors that interact more naturally with their surroundings and with people.

The rapid explosion in the number of connected, intelligent things has given this trend a huge push. Robots, drones or autonomous vehicles are enabling new business scenarios as well as optimizing existing ones. AI is driving advances for autonomous things — either semiautonomous or fully autonomous — and delivering enhanced capabilities to many existing things. As autonomous things proliferate, we expect a shift from stand-alone intelligent things to a swarm of collaborative intelligent things. In this model, multiple devices will work together, either independently of people or with human input.

Autonomous things come in many types, and operate across many environments with varying levels of capability, coordination and intelligence. They are often in the form of a physical device operating in the real world. Examples include robots, drones and autonomous vehicles. But there are also virtual things that do x or are in the form of y. Although autonomous things offer many exciting possibilities, they cannot match the human brain's breadth of intelligence and dynamic general-purpose learning. Instead, they focus on well-scoped purposes, particularly for automating routine human activities.

Examples of business scenarios include:

- Advanced agriculture — creating planning algorithms for robots to autonomously operate farms
- Unmanned aerial vehicles (UAVs) — operating UAVs with human scouts to study solutions for farmers of specialty crops
- Safer automobile transportation — prototypes by high-tech firms or traditional automotive companies to remove the human error element and optimize transportation

Use-Case Examples:

- Robots carrying out jobs in a coordinated fashion to create a seamless and connected process in manufacturing facilities
- Simplifying the materials movement process by using self-driving robots in warehouses that calculate their position and route to move containers or parts
- Reducing time for inventory checks by using drones for inventory quality assurance through taking images with the drone's camera
- Providers offering a bots-as-a-service model, with an entry price of around $1,000 per month per robot (Users can start with a few units and flex up and down as the business requires.)
- AMR unloading trucks and delivering palettes of goods to specific departments in a retail store without human intervention

Recommendations:

- Evaluate the use of autonomous things as both substitutes and complements to the human workforce. Note that labor reductions seem the most likely drivers, but improvements in overall throughput and productivity will be the primary value, regardless of whether labor is reduced.
- Validate that your organization has the right technologies in place and the right level of maturity to be ready to adopt or experiment with these technologies.
- Examine current business processes into which autonomous things such as robots and drones can be deployed. Consider redesigning supply chain processes to take advantage of the benefits of autonomous things within and outside your facilities.
- Evaluate the potential use of collaborative autonomous things, not only in the context of autonomous physical things working together, but also in the context of autonomous virtual things.
- Explore the potential value of machines when looking to build new automated facilities. Some industries are further along in using this technology, such as the life science industry. We also see extensive use of this technology in manufacturing facilities with the benefits of improved traceability and compliance.

Related Research:

"Supply Chain Brief: Urban Delivery Robots Make Slow Progress in Drive for Last-Mile Delivery Solution"

"Supply Chain Brief: Autonomous Trucking Adoption Timeline — 2020 or 2030?"

"Supply Chain Brief: Favorable Regulations Will Accelerate Global Adoption of Autonomous Trucking"

"Supply Chain Brief: New Investments in Infrastructure Will Accelerate Autonomous Commercial Vehicle Adoption in the U.S."

"For Supply Chain Executives: Get Ready for Autonomous Vehicles"

"Innovation Insight: Explore the Value of Drones in Logistics"

"For Supply Chain Execs: A Look at Last-Mile Logistics, 2025"

Trend No. 6: Digital Supply Chain Twin

A digital twin is a digital representation of a real-world entity or system. The digital supply chain twin is a digital representation of the physical (often multienterprise) supply chain. It is a dynamic, real-time and time-phased representation of the various associations between the data objects that ultimately make up how the physical supply chain operates. It is the basis for local and end-to-end decision making for the supply chain that ensures that this decision making is aligned horizontally and vertically throughout the supply chain. The digital supply chain twin is derived from all the relevant data across the supply chain and its operating environment.

In other words, a digital supply chain twin is a digital representation of the relationships between all the relevant entities of an end-to-end supply chain — such as products, customers, markets, distribution centers/warehouses, plants, finance, attributes and weather (see Note 1).

The notion of a digital representation of real-world entities or systems is not new. Its heritage goes back to computer-aided design representations of physical assets or profiles of individual customers. IoT has re-energized interest in digital twin today. In this case, the digital-twin trend focuses on creating the appropriate digital representations of the operations of physical assets in the real world. Digital twins include the model, data, a one-to-one association to the object and the ability to monitor it. They are linked to their real-world counterparts and are used to understand the state of the thing or system, respond to changes, improve operations, and add value. Well-designed digital twins of assets could significantly improve enterprise decision making.

Digital supply chain twins are part of the digital theme that describes an ever-increasing merger of the digital world and the physical world. The digital supply chain twin trend focuses on creating the appropriate digital representation of the physical supply chain. It creates end-to-end visibility by being in lock step with the real-world supply chain. Through this linkage to the real world, situational awareness and supply chain decision making are greatly enhanced. Organizations would use a digital supply chain twin for all levels of supply chain decision making, from strategic through to executional. Appropriate predictive and prescriptive analytics (including machine learning and AI) would be applied to the digital supply chain twin so that aligned (and to some degree automatic) decisions could be made. By being a truer representation of the real-world physical supply chain, these decisions would be faster and of a higher quality.

Use-Case Examples:

- Movement (in a few SCP vendor cases) toward Gartner's definition of a digital supply chain twin. In these cases, more detailed and accurate digital models are being created, often through the use of graph data models (rather than relational data models) to facilitate the model creation and flexibility.
- Supply chain visibility that creates a higher resolution model of the physical supply chain to enable enhanced end-to-end visibility and situational awareness. Note that, certainly, there is a cost associated with gathering and processing the data, which has to be balanced against benefits — like with any of these technologies presented.
- AI platforms that ingest source system data and, from that, create a digital representation of the associations/relationships between that data. This allows a company to get improved alerting and action recommendations to shore up its legacy supply chain decision making (which will be utilizing a poor and inaccurate model as the basis for its decision making).

Recommendations:

- Develop a digital roadmap that enables your aligned supply chain decision making. Put the notion of a digital supply chain twin at the center of this technology roadmap. A full digital supply chain twin is a prerequisite for Stage 5 planning (aka decision making) maturity.
- Examine the roadmaps of any supply chain visibility or supply chain planning solution being used or considered. Understand if the provider is considering building out a more extensive, detailed and dynamic supply chain model that would, in essence, become your digital supply chain twin.
- Examine early opportunities to add digital supply chain twinlike capabilities to your existing technology landscape. Mostly likely, this will involve pairing up the new capability with existing supply chain visibility and/or planning solutions. In looking for suitable technology options, choose those that can automatically ingest and correlate source system data (both internal and external). Also look for those that leverage advanced analytics, AI and machine learning and can make recommendations using both human-decision-maker-derived learning and prescriptive analytics. This approach will help to speed up a company's understanding of how the technology can add value.
- Prepare to eventually sacrifice some existing technology investments (such as supply chain visibility, supply chain planning and generic analytics platforms). As company's increase their understanding of the use of a digital supply chain twin, they will start evaluating eventual replacements (rather than just complements) of incumbent solutions.
- Continuously increase the visibility and value of digital supply chain twins by adopting an industry data governance strategy. Engage the business ecosystem in an aligned initiative by setting up governance policies for digital supply chain twin data that align with evolving industry guidelines and standards where available and practical.

Related Research:

"Supply Chain Brief: Digital Planning Requires a Digital Supply Chain Twin"

"Digital Twins Will Impact Economic and Business Models"

"Five Approaches for Integrating IoT Digital Twins"

"Technology Reference Model for Stage 5 Maturity Supply Chain Planning"

"Adopt a Data Governance Strategy for Long-Term Digital Twin Success"

"Survey Analysis: Digital Twins Are Poised for Proliferation"

"Innovation Insight: Manufacturers Need MPM and MBM to Innovate Digitally Enabled Design Through Production"

Trend No. 7: Immersive Experience

The immersive experience combines the following technologies. A conversational system is a high-level design model in which user and machine interactions occur, mainly in the user's spoken or written natural language, and typically are informal and bidirectional. VR provides a computer-generated 3D environment that surrounds a user and responds to an individual's actions in a natural way. AR is the real-time use of information in the form of text, graphics, video and other virtual enhancements integrated with real-world objects. MR then enables people to interact with virtual objects.

The user experience will undergo a significant shift in how users perceive the digital world and how they interact with it. Conversational platforms are changing the way in which people interact with the digital world. Virtual reality (VR), augmented reality (AR) and mixed reality (MR) are changing the way in which people perceive the digital world. This combined shift in both perception and interaction models leads to the future immersive user experience.

The integration of VR and AR with multiple mobile, wearable, IoT and sensor-rich environments and conversational platforms will extend immersive applications beyond isolated and single-person experiences. Although the potential of having all together — conversational platforms, VR, AR and MR — is impressive, there will be many challenges and roadblocks. The shifting user experience will create many new digital business opportunities, but will also pose significant IT security and management challenges. The realization of the continuous, immersive and conversational user experience will require a profoundly better appreciation of privacy and permission.

Use-Case Examples:

- Using augmented reality to improve customer experience, providing renderings of equipment to visualize the footprint in a defined space and compare different configuration options
- Using augmented reality along with QR (quick response) codes and mobile technology to speed up changeovers in locations, such as equipment changeovers in factories, within global supply chains
- Using voice-controlled personal assistants to help improve customer experience by remotely checking product features or appointments
- Using video across locations to improve training and reduce travel costs, for example

Recommendations:

- Look for opportunities to leverage the immersive experience to make users more productive with their business apps and mobile platforms in targeted, well-defined use cases.
- Start by identifying supply-chain-specific use cases, such as field service, logistics, warehousing, manufacturing, maintenance or design, which can benefit from those technologies.
- Plan for a postweb and postbrowser UI world where conversational systems will be the primary interface to many of the apps and services in use today and to some yet to be developed.
- Engage employees in the process of defining interactions with devices, which ensures their buy-in.

Related Research:

"Conversational Platforms Will Transform Supply Chain Interactions in the Digital World"

"Innovation Insight for Conversational Platforms in Sourcing and Procurement"

"Market Guide for Conversational Platforms"

"Top 10 Strategic Technology Trends for 2018: Conversational Platforms"

"Alexa for Business: B2B/B2E Disruptor Profile"

"Redefine Your Application Strategy to Exploit Conversational AI for Digital Business Success"

"Virtual Reality and Augmented Reality: Using Immersive Technologies for Digital Transformation, Customer Experience and Innovation"

"Examine 4 Use Cases for Augmented Reality Apps in the Enterprise"

"How Architecting for Next-Generation Experiences Helps to Deliver Customer and Business Outcomes"

"Cool Vendors in Enterprise Wearable and Immersive Technologies"

Trend No. 8: Blockchain in Supply Chain

A blockchain is an expanding list of cryptographically signed, irrevocable transactional records shared by all participants in a network. Each record contains a time stamp and reference links to previous transactions. With this information, anyone with access rights can trace back a transactional event, at any point in its history, belonging to any participant. A blockchain is one architectural design of the broader concept of distributed ledgers.

Supply-chain-related blockchain initiatives are nascent with solutions in early stages of development. Interest in potential applications across supply chains have accelerated significantly during the last year. These initiatives are a mix of vendor-led and industry- and consortium-driven discussions. Blockchain is aligned to potentially fulfill critical and long-standing challenges presented across dynamic and complex global supply chains that traditionally have held centralized governance models. Current supply chain activity for proofs of concept (POCs) and pilots are well-positioned to play a role in the increasing need for secure, collaborative working models across extended groups of trading partners.

Current capabilities offered by blockchain solutions for supply chain can include a loose portfolio of technologies and processes that spans middleware, database, verification, security, analytics, contractual and identity management concepts. Blockchain is also increasingly being offered as a service or development option across supply chain solutions that target closely aligned objectives such as automation, traceability and security. A critical aspect of blockchain technology today is the unregulated, ungoverned verification of successful transactions as well as immutability. These capabilities fund much of blockchain development for supply chain. Other concerns include lack of scalability and full transparency, privacy over consumption of resources, and a perceived operational risk with decentralized protocols.

Blockchain technology adoption challenges for supply chain also include lack of standards for governance across transactions, scalable distributed consensus systems and foundational electronic interoperability across trading partners.

Use-Case Examples:

- Using blockchain to track global shipments, allowing a reduction in the time needed to send paperwork back and forth and enabling better coordination with port authorities
- Enhancing customer safety, identifying counterfeits and protecting business performance by using tamper-evident labels with blockchain technology
- Leveraging blockchain technology to redefine B2B processes and support digital transformation, allowing the support of a many-to-many connection of companies and facilitating document and data transfer for payment processing

Recommendations:

- Identify how the term is being used and applied internally and by providers to better understand the return on capital employed, and the incremental value that could be realized beyond proven technology options.
- Assess the solution's ability to map and execute across specific supply chain use-case criteria and risks — such as location, status and ownership — and its planned timing and positioning across your strategy technology roadmaps.
- Identify specific high-risk areas of supply chains that exhibit transactional complexity across multiple stakeholders. These are prime candidates for blockchain — for example, trade contracts, asset management, transportation and traceability.
- Closely monitor the evolution of blockchain technology solutions for supply chain that might materialize through working groups, consortia or peer-to-peer industry initiatives.

Related Research:

"Five Key Lessons to Learn From Supply Chain Blockchain Pilots"

"Blockchain Fundamentals for Supply Chain: A Guide to the New Boardroom Buzzword"

"Supply Chain Brief: Industry Consortia to Drive Education and Standardization of Blockchain in Transportation"

"Toolkit: Accelerate Your Blockchain Technology Competency Across the Supply Chain"

"Blockchain Solutions in Supply Chain: 2018 Market Insight"

"Supply Chains Are Racing to Understand Blockchain — What Chief Supply Chain Officers Need to Know"

"Follow Four Evaluation Steps to Decide If Blockchain Is Right for Your Supply Chain"

"Unify End-to-End Supply Chain Processes With Supply Chain Convergence"

Other Trends to Watch

The supply chain technology trends identified in this research are certainly not exhaustive. The below trends are candidates for becoming top strategic trends — emerging, adolescent and early mainstream — in future years, where Gartner will closely monitor upcoming developments and market adaption. Based on your organizational strategy or other influencing factors, those other technologies might be of interest to you in the upcoming future, such as:

- **5G networks (emerging)** — 5G is the next generation of mobile broadband and cellular standard. It is projected to quickly replace (and/or augment) existing 4G and Wi-Fi services, services such as 4G (Long Term Evolution [LTE], LTE Advanced [LTE-A] and LTE Advanced Pro [LTE-A Pro]). Planned network rollouts represent massive leaps from previous generations' more incremental upgrades, such as 2G to 3G or 3G to 4G. Recent reports on pilots and testing have identified that 5G can be up to 1,000 times faster than 4G. The increased speed and throughput of data is just one of a range of new enablers that can be released across the supply chain through 5G-enabled technologies and devices (see Note 2).

  Use cases in supply chain for leveraging 5G networks could include the following:

  - Reliable low latency for business-critical applications relating to security, brand retention or safety — for example, autonomous vehicles, healthcare monitors or voice-of-the-customer applications.
  - The factory-in-a-box concept, or what Gartner refers to as the "mobile factory," which reflects the market trend of exploring innovative future factory concepts to support localized, agile production. These factories can be packed into a container or trailer, transported, and put into service at a fraction of the time and cost of conventional factories. Remote production would, therefore, rely on the usage of 5G networks.
  - Customer experience in retail, inside and outside the store. Services (such as augmented reality/virtual reality) will rely on 5G and next-generation Wi-Fi and may have a disruptive influence on the industry.
  - Robust asset-to-asset communications optimization for enhanced governance, tracking and visibility in "real" real time — for example, high-value reusable packaging and transportation asset routing and return cycles.

- **Empowered computing (emerging)** — The edge is where things and people connect with the networked digital world. Edge computing is a part of a distributed computing topology that has depth and is where information processing is located — close to the edge. Processing can take place at any or all of the layers between the cloud (or central enterprise data center) and the edge. Edge computing will also allow greater opportunities to localize data capture, management, and analytics to provide a more seamless level of business intelligence without data being routed or filtered through multiple systems and protocols.

  Edge computing is disrupting the market for an increasing number of enterprise technology products, as end users require distributed architectures to deal with the demands generated by digital business and, in particular, by the Internet of Things (IoT).

  Edge devices becoming more advanced, with specialized AI chips, as an example (recognizing that there are overlaps within various trends — for instance, IoT combines with AI, and augmented analytics overlaps with edge computing). Drones and sensors used in supply chain operations will execute data processing right at the data source and are not transmitting most of their data collection back for internal processing, allowing faster and smarter decision making.

  Use cases in supply chain for empowered edge include the following:

  - Improved operational efficiency, such as enhanced visual inspection systems in a manufacturing setting
  - Enhanced customer experience, through the use of conversational platforms with inferencing performed at the edge
  - Reduced latency in decision making, with the use of streaming analytics and migration to an event-based architecture

- **Event stream processing (adolescent)** — Event stream processing (ESP) platforms are not new, they are software systems that perform real-time or near-real-time calculations on event data in motion. The input is one or more event streams containing data about customer or procurement orders, shipments, tweets, emails, financial or other markets, or sensor data from physical assets such as vehicles, mobile devices or machines. The platforms process the input data as it arrives (hence, "in motion"), before optionally storing it in some persistent store. They retain a relatively small working set of stream data in memory, just long enough to perform calculations on a set of recent data for the duration of a time window.

  ESP is one of the key enablers of continuous intelligence and other aspects of digital business. It had become essential to supply chain, fleet management and other transportation operations, supporting IoT, customer experience management and fraud detection applications.

  Use cases in supply chain for ESP include the following:

  - Improved the quality of decision making by presenting information that could otherwise be overlooked
  - Enabled smarter anomaly detection and faster responses to threats and opportunities in the supply chain
  - Helped shield users from data overload by eliminating irrelevant information and presenting only alerts and distilled versions of the most important information
  - Formation of event/alert/signal monitoring (in factories) for process engineers, maintenance and quality

- **Real-time visibility (early mainstream)** — Real-time visibility is a core part of logistics technology and plays a complementary function that supports transportation management, warehouse management, yard management and fleet management. These solutions complement the planning and executional capabilities of transportation management systems (TMSs) with real-time visibility.

  Real-time visibility adds incremental benefits to logistics and transportation, further reducing costs and improving customer service in dynamic environments.

  Use cases in supply chain for real-time visibility include the following:

  - Real-time tracking of shipments for shippers and service providers — location and condition monitoring, exception alerts, ETA calculation, arrival/pickup/delivery updates (mostly focusing on domestic road transportation, but lately also expanding into international multimodal)
  - Higher customer delivery service through proactive action when deviations occur from the plan (e.g., ability to update dock appointments), updated ETAs to customers allowing them to assess whether changes are needed on their side
  - Carrier efficiencies — increased driving time and reduced detention times due to dynamic and more accurate dock scheduling (tighter windows), but also cost avoidance because services are mainly free for carriers (versus electronic data interchange [EDI] setup costs and ongoing charges)

Related Research:

"Supply Chain Brief: 'Factory in a Box' Concept Challenges Traditional Factory Setup"

"Predicts 2019: IoT Will Drive Profound Changes to Your Core Business Applications and IT Infrastructure"

"Include 5G and Next-Generation Wireless in Roadmaps to Elevate In-Store Retail Customer Experience"

"Innovation Insight for 5G Networking — Cutting Through the Hype"

"The Edge Completes the Cloud: A Gartner Trend Insight Report"

"Market Guide for Event Stream Processing"

"Technology Insight for Event Stream Processing"

"How to Leverage Events to Empower Decisions in Business Real Time"

"Market Guide for Real-Time Visibility Providers"

"Real-Time Transportation Visibility Platforms Provide Transportation Leaders With Supply Chain Efficiencies"

Note 1
Digital Twin

The term "digital twin" is used in different ways based on the audience. With respect to Gartner Research, we can distinguish as follows:

- **Digital twin in IoT:** A digital twin is a virtual representation of a real object. Digital twins are designed to optimize the operation of assets or business decisions about them, including improved maintenance, upgrades, repairs and operation of the actual object. Digital twins include the model, data, a one-to-one association to the object and the ability to monitor it.
- **Digital supply chain twin:** A digital twin is a digital representation of a real-world entity or system. The digital supply chain twin is a digital representation of the physical (often multienterprise) supply chain. It is a dynamic, real-time and time-phased representation of the various associations between the data objects that ultimately make up how the physical supply chain operates. It is the basis for local and end-to-end decision making for the supply chain that ensures that this decision making is aligned horizontally and vertically throughout the supply chain. The digital supply chain twin is derived from all the relevant data across the supply chain and its operating environment.
- **Digital twin of the organization:** This dynamic software model of any organization relies on operational and/or other data to understand how an organization operationalizes its business model, connects with its current state, responds to changes, deploys resources and delivers expected customer value.

Note 2
5G Network References

"4G vs. LTE: The Differences Explained," Digital Trends.

"4G LTE Advanced — What You Need to Know About LTE-A," 4G.co.uk.

"What Is LTE-Advanced Pro?," 5GUK.

"Ericsson Showcases Nearly 1000x Faster 5G Networks," The Economic Times.

"5G vs 4G: No Contest," 5GUK.

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