Hype Cycle for Supply Chain Planning Technologies, 2023

Published 31 July 2023 - ID G00748304 - 140 min read

By Analyst(s): Amber Salley, Pia Orup Lund, Joe Graham, Caleb Thomson, Tim Payne

Initiatives: Supply Chain Technology Strategy and Selection; Supply Chain Planning

> Supply chain planning (SCP) technology leaders can use this Hype Cycle to help transform their SCP capabilities. It is a guide to the maturity and viability of various capabilities and underlying technologies that can transform the way planning decisions will be made now and in the future.

Strategic Planning Assumptions

- By 2026, 95% of companies will have failed to enable end-to-end (E2E) resiliency in their supply chains.

- Through 2026, there will be no dominant approach to delivering a true digital supply chain twin (DSCT), either through broader business networks, planning applications or intelligent data lakes.

- By 2026, over 65% of short-term decisions within supply chain planning (SCP) will be automated or autonomous.

Analysis

What You Need to Know

Major disruptions over the past few years, including COVID-19, inflationary pressures and commodity supply constraints, have launched SCP into the spotlight. Supply chain leaders who thought they'd built sound planning processes quickly found these factors to be too great an obstacle to manage, leading to reactive responses to variability and disruption that are costly. Many have turned their focus on implementing technologies to support digital SCP aspirations to make more-effective and higher-quality planning decisions. This includes more mature planning solutions, as well as emerging technologies.

This Hype Cycle highlights technologies that aim to enable supply chain agility and supply chain resiliency. It recognizes that organizations are on different stages of the SCP maturity journey. More mature planning groups are reimagining how they can make planning decisions so they can capitalize on the challenges in today's business and economic climate. Less mature organizations are identifying the foundational technologies required to support higher levels of planning.

The Hype Cycle

Traditionally, in SCP, process trumps technology. Organizations designed their business process and then looked for technology to enable it. The evolution of technology, therefore, followed process evolution. However, with advancements in advanced analytics, artificial intelligence and machine learning (AI/ML) and cloud computing, organizations cannot evolve their processes fast enough to take full advantage of new technologies. Technology now leads process and organizations are working to digitize their SCP, thus opening up opportunities they didn't think about initially. With well-thought-out digital planning technology initiatives, these organizations can innovate their planning on an almost continual basis. This is important because it helps them to compete better by:

- Improving decision making in global supply chains and across ecosystems — especially with constrained resources

- Planning new and innovative ways to serve customers

- Driving higher planner productivity through decision automation

- Developing new insights and value from exponentially growing data volumes and types (including taking advantage of new data sources)

- Balancing speed, responsiveness, agility and resiliency with cost and efficiency

- Aligning planning decisions horizontally and vertically across a supply chain ecosystem to ensure compliance with corporate goals

- Experimenting with new planning paradigms to generate further business value

Observations relevant to this Hype Cycle:

- Capabilities traversing through the trough are foundational technologies necessary to support end-to-end SCP. They provide the platforms necessary to support network visibility, workflow management and segmentation support.

- Capabilities heading down the peak include technologies, frameworks and planning paradigms that can provide significant business benefit. But organizations may struggle with the organizational readiness required, such as decision governance and data governance structures, to best leverage these capabilities.

- Capabilities climbing the peak have potential to transform how companies design and operate their planning processes.To have a competitive advantage in SCP, an organization must figure out how to embrace these innovations into their SCP roadmap.

Figure 1: Hype Cycle for Supply Chain Planning Technologies, 2023

Hype Cycle for Supply Chain Planning Technologies, 2023
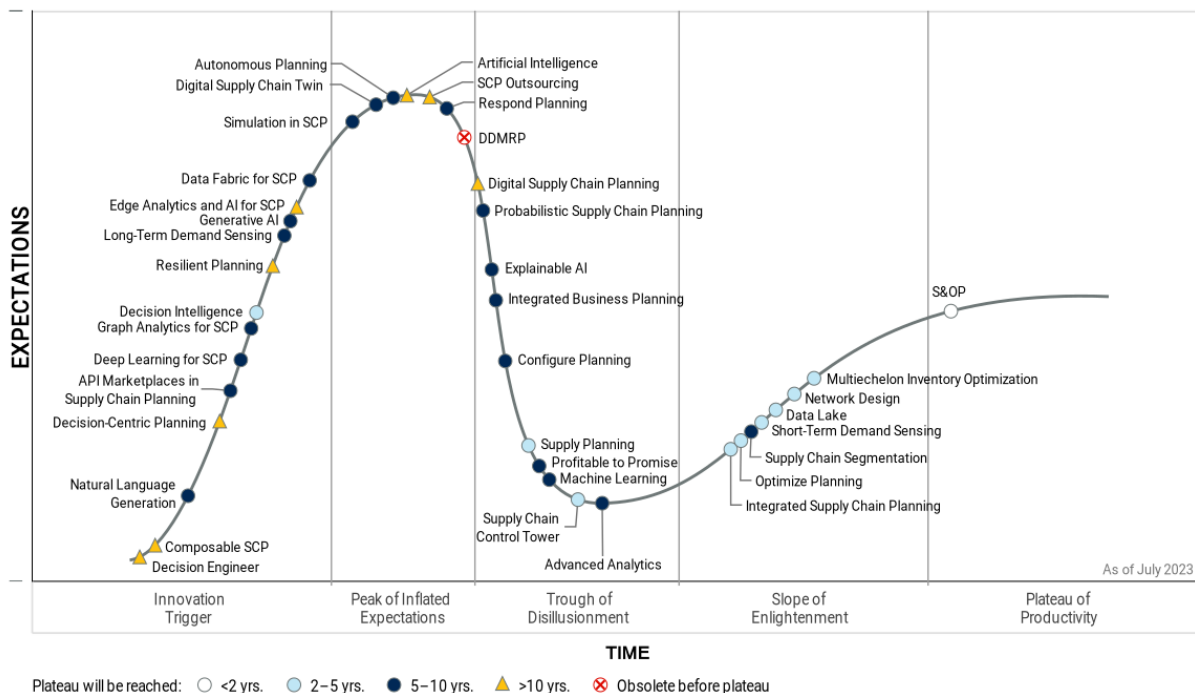
The Priority Matrix

When considering technology investments, SCP technology leaders should relate potential investments to their overall supply chain strategy. Prioritize investments to the role and maturity-level needs of SCP within that strategy.

Technologies that offer moderate or high business benefits to SCP focus mainly on traditional SCP. These technologies may plateau within the next two to five years. Example technologies include S&OP, data lake, multiechelon inventory optimization and optimize planning. Support for segmented SCP and the use and speed of processing big data across the supply chain also contribute to the utility of some of these solutions. The application of these technologies can kick-start a change in the nature of planning decision making through the use of more decision-grade data and advanced analytics.

Technologies forecast to plateau in five to 10 years enhance and transform planning decision-making quality through the application of automated predictive and prescriptive analytics. The convergence of near-real-time planning decisions and execution visibility is enabled through the digital supply chain twin, graph analytics for SCP, respond planning, machine learning and simulation in SCP. Ultimately, these various emerging SCP technologies will coalesce into what Gartner calls resilient (that may be also architected to be composable in nature) and will eventually enable new planning paradigms such as decision-centric planning.

Table 1: Priority Matrix for Supply Chain Planning Technologies, 2023

(Enlarged table in Appendix)

Benefit ↓	Years to Mainstream Adoption			
	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational		Decision Intelligence	Deep Learning for SCP Digital Supply Chain Twin Generative AI Integrated Business Planning	Artificial Intelligence Digital Supply Chain Planning Resilient Planning
High		Integrated Supply Chain Planning Network Design Optimize Planning Short-Term Demand Sensing Supply Chain Control Tower	Advanced Analytics Autonomous Planning Configure Planning Data Fabric for SCP Explainable AI Graph Analytics for SCP Machine Learning Probabilistic Supply Chain Planning Respond Planning Simulation in SCP Supply Chain Segmentation	Composable SCP Decision-Centric Planning Decision Engineer
Moderate	S&OP	Data Lake Multiechelon Inventory Optimization Supply Planning	Long-Term Demand Sensing Natural Language Generation Profitable to Promise	Edge Analytics and AI for SCP SCP Outsourcing
Low			API Marketplaces in Supply Chain Planning	

Source: Gartner (July 2023)

Off the Hype Cycle

Innovations selected for this Hype Cycle are constantly reviewed to try to best reflect those that will have the greatest influence on the SCP solutions of the future.

- Algorithmic supply chain planning has been merged into resilient planning.

- AutoML has been merged into embedded analytics which is part of Hype Cycle for Analytics and Business Intelligence.

- Continuous intelligence has been replaced by decision intelligence.

- Continuous planning has been replaced by decision-centric planning.

- CORE, which served as an umbrella planning term, has been split into configure planning, optimize planning and respond planning.

- Data fabric has been replaced with data fabric for SCP.

- Demand signal repository has been retired because it was too focused on the consumer goods industry.

- Descriptive analytics has been retired because it is fully mature.

- Diagnostic analytics has been retired because it is fully mature.

- Discrete-event simulation in SCP has been replaced by simulation in SCP.

- Internet of things has been replaced by edge analytics and AI for SCP.

- Predictive analytics has been replaced by advanced analytics.

- Prescriptive analytics has been replaced by advanced analytics.

- RPA has been retired because the level of interest has decreased.

- Stochastic supply chain planning has been replaced by probabilistic supply chain planning.

Composable SCP

Analysis By: Amber Salley, Tim Payne

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Composable supply chain planning (SCP) designs its business models, technology architecture, data management and integration, and partnership ecosystems in a modular manner. This is done to enable an SCP technology landscape that can be rapidly and safely changed and recomposed at any moment of need.

Why This Is Important

The move to composable SCP will be driven by companies' desire to improve the agility and innovation capabilities of their technology solutions that enable digital supply chain planning and eventually achieve Stage 5 planning maturity. Therefore, composable SCP will be, to some extent, tied to these initiatives in a company.

Business Impact

Organizations that adopt the model of composable SCP in their business, technology and culture achieve a new level of resiliency and transformative access to planning decision innovation. They move from the rigid and inefficient traditional norm of hierarchical and siloed thinking to the active agility of a composable planning experience.

Drivers

- Organizations that move toward composable SCP assemble (integrate) their planning decision-making experiences from internal and external ecosystems using components (called "packaged business capabilities") to empower their organization to actively track and support the specific (and dynamic) requirements of its users and supply chain.

- For a couple of years now, Gartner has been seeing the very initial signs that the SCP technology market is changing. Currently, the market has discrete planning solutions that tightly bundle data, data models and predictive analytics together into a single application to facilitate supply chain planning. This will change to a technology market where users can source data, data models and analytics (both predictive and prescriptive) from a variety of different sources into an environment that enables their supply chain planning.

- This change means that users can easily incorporate different and changing data sources into their planning; they can create a single data model (aka digital supply chain twin) from that data to drive decision alignment.

- It also means they can easily plug in the most appropriate planning analytics to create and manage the various plans, all run off the digital supply chain twin.

Obstacles

- The challenge to achieving consistent benefits of composable SCP is not any one particular investment but the essential underlying requirement for the pervasive practice of "composable enterprise thinking." This fundamentally cultural change — from the rigidity of the familiar supply chain structures to the elasticity of active continuous change — is the most significant barrier to achieving the benefits of a composable supply chain.

- Articulating business value for composable SCP is challenging and composability in planning is not yet a strategic imperative for most organizations.

- Software vendors are still creating their visions and strategic roadmaps to support composable SCP. It is very likely that a composable SCP technology environment will consist of a collection of technologies that may be developed and maintained by different vendors.

User Recommendations

- Devise an SCP technology strategy that includes hallmarks of composable SCP — or lose the ability to adapt and gain effectiveness in your SCP. Reimagine your SCP to align with the emerging generation of applications, architectures and technologies. The old monolithic SCP mindset and practices must go away.

- Ensure your strategy covers the acquisition and management of data and the association of that data into a digital supply chain twin. Ensure the ability to plug and play configurable predictive and prescriptive analytics and AI techniques from a variety of sources into that twin.

- Don't limit your thinking to just traditional SCP resources — materials and machines. All constrained resources must be included to ensure feasible plan creation.

- Invest in enabling technologies along your SCP journey — data integration and management capabilities, digital supply chain twin, AI, low-code/no-code development, API, event management, open data, and analytics ecosystems must all be part of a composable SCP strategy.

Gartner Recommended Reading

Use Gartner's Reference Model to Deliver Intelligent Composable Business Applications

E2E Supply Chain Ecosystem Collaboration: Part 1 — Before Thinking About the Technology, Clarify the Business Capabilities

E2E Supply Chain Ecosystem Collaboration: Part 2 — The Right Technology Pieces for Level 5 Maturity

E2E Supply Chain Ecosystem Collaboration: Part 3 — 11 Elements for Level 5 Supply Chain Maturity

Decision Engineer

Analysis By: David Pidsley

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Decision engineers apply analytics and engineering skills to decision intelligence platforms and practices. This practical discipline advances decision-making experiences with design thinking by engineering how decisions are modeled and made and how outcomes are evaluated and improved via feedback. Practitioners foster multidisciplinary collaboration in decision support, augmentation and automation by applying decision engineering to processes with embedded analytics, data science and AI.

Why This Is Important

Decision engineer is a decision-centric role that operationalizes embedded decision models, monitors feedback and optimizes outcomes with decision intelligence practices and platforms. The emerging role is not only focused on implementation. It is also essential in fostering multidisciplinary collaboration to bridge the gap between business domain and process experts on the one hand, and data scientists and AI experts on the other. They collaborate with the business, inventory decision models to manage and monitor, and report on the business value of decisions under management to promote reuse and deduplication of decision models.

Business Impact

Most decisions that currently use data are or soon will be at least partially automated. Decision engineers apply process, (computational) software engineering and mathematical techniques to help organizations make better decisions. Decision engineering leverages data, analytics, DSML, optimization and simulation to support decision augmentation and automation across a range of industries and contexts.

Drivers

- Though they recognize the need to collaborate, executives report that too many stakeholders and unclear decision ownership cause problems and delays in taking action. Instead of supporting multiple decision types for a single business unit, decision engineers can support a specific decision type, such as cost management or product improvements, across a number of business units.

- The shift from data-driven to decision-centric enterprise accelerates the demand for emerging roles that apply analytics and engineering skills to decision intelligence platforms and practices.

- Gartner identifies decision intelligence as a top strategic technology trend that is disrupting decision-making culture, and a decision engineer describes "who" plays a key role in this.

- Data and analytics leaders are upgrading their operating models, especially for organizations and people, to ensure they can enable dynamic business outcomes amid disruptive market conditions.

- Challenges in executing high-impact reengineering of decisions will accelerate common definitions of embryonic roles to have a high benefit and mature into productivity in the coming decade.

- Decision engineers bring a deeper understanding of how effective decision-making processes work, and they provide human and social perspectives. Some top data science teams will be rebranded as cognitive science or science consultancies, increasing diversity in staff skills.

- Skills in demand for decision engineering include data science, simulations, optimization, SQL, Python, R, DAX, VizQL, process methods, software engineering techniques, design thinking and communication skills.

Obstacles

- Decision engineers may become a role, but not a job title. Similarities to other roles like citizen data scientist, data steward or D&A translator lead to confusion among candidates and hiring managers.

- Embryonic roles have less than 1% of target market adoption and are undifferentiated from adjacent D&A and decision-making roles. Despite different focuses and responsibilities, these roles all involve working with data and using quantitative methods to augment and reengineer decision making.

- Skill and staff shortages are the top roadblocks for success in D&A initiatives. Late adopters will struggle to recruit decision engineers and must instead focus on upskilling, motivating and retaining decision intelligence talent.

- Failure to operationalize decision intelligence or embed decision models into workflows and business processes makes for ineffectively integrated decision making.

- Not employing adaptive governance of decisions to ensure ongoing optimization of business outcomes by establishing clear decision-making processes, proactively identifying and addressing issues, continuously refining and optimizing decision models based on data-driven insights, and aligning decision intelligence with the organization's goals and values.

- Existing organizational structures silo decision intelligence approaches which, in fact, go across domains. Tactical, functional decisions are often compartmentalized by technology vendor or product (e.g., CRM, ERP, HCM, FP&A).

- Localized implementations may create fragmentation in organizational units, where decisions are very similar but regulated differently.

User Recommendations

D&A leaders responsible for analytics, BI and data science solutions should:

- Evolve their D&A approaches to support data-driven decisions by empowering and supporting business units to embed D&A in business processes.

- Assess the impact of the transition from data-driven to decision-centric and update your operating model for decision intelligence practices.

- Assess the impacts that demand for decision engineering will have upon existing skills shortages and how to fill the role by considering how other companies do this (see sample vendors).

- Define decision engineers' roles, responsibilities, requirements and qualifications (a bachelor's or master's degree in computer science, mathematics, statistics, operations research or a related discipline).

- Foster and develop decision intelligence talent to address staff shortages by recruiting decision engineers and data scientists, forming fusion teams with business experts and fostering communities of practice.

- Define the role's key responsibilities as collaboration with business functions outside of D&A, decision modeling using frameworks, decision model management (especially deduplication, reuse and mitigation of model drift), valuation and data storytelling, and continuous learning and trendspotting.

- Involve relevant stakeholders in the business, D&A and adjacencies in a collaborative way by applying best practices to fill the role through upskilling, attracting recruits, motivating and retaining decision engineers.

Sample Vendors

Airbnb; Amazon; Google; LinkedIn; Meta; Microsoft; Netflix; Philips; Uber

Gartner Recommended Reading

What Are the Essential Roles for Data and Analytics?

Maverick Research: Data and Analytics Roles Will No Longer Be a Priority

The Future of Data and Analytics: Create Competitive Differentiation Through Better Decision Making

Predicts 2023: Analytics, BI and Data Science Composability and Consolidation

Redefining Analysts as Decision Experts (Philips)

Natural Language Generation

Analysis By: Joe Graham

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Definition:

Natural language generation (NLG) solutions automatically convert structured and unstructured data into text-based narratives. This is achieved either through rule-based methods, which have been in use for over 15 years, or via large language model (LLM) and generative AI methods. Both approaches have strengths and weaknesses; however, they can also be combined into hybrid solutions.

Why This Is Important

Digital supply chain transformation depends on the ability to successfully adopt data and analytics technologies, but many business users face a steep curve in learning to effectively interact with these technologies. NLG can offer organizations an intuitive approach to using data and analytics technologies without the need for technical proficiency, and NLG opens access to performance metrics, root causes or actionable recommendations in written or spoken natural language.

Business Impact

NLG can be instrumental in the adoption of data and analytics solutions. With NLG, companies can expand beyond the use of dashboards, charts and reports to share data-driven insights. Business users can gauge supply chain performance and act upon recommendations by understanding intuitive, context-specific narratives. This can reduce the time and effort needed to train business users on existing or new technologies.

Drivers

- Increasing demand from the business to synthesize data and insights without the need for technical know-how.

- Increased complexity of supply chains and the growing need for faster decision making.

- Increased maturity of NLG capabilities, resulting in more scalable and reliable functionality.

- Supply chain technology vendors and business intelligence vendors embedding NLG capabilities into their solutions.

- Improved narratives that enable collaboration and internal/external personalized communications.

- Broader adoption of NLG in day-to-day activities, increasing business users' general comfort level with NLG.

- Increased adoption of mobile supply chain applications when traditional queries, reports and dashboards limit users' ability to access data-driven insights.

Obstacles

- Inability to scale NLG applications deployment across the enterprise.

- User resistance to a new medium for accessing data and insights.

- Lack of incentive for supply chain technology vendors to further develop their NLG capabilities.

- Challenges in integrating NLG with preexisting supply chain technology.

- Challenges with building an attractive business case for NLG in the supply chain.

- Low adoption of advanced analytics in general, with continued reliance on Microsoft Excel as the go-to analytics tool.

User Recommendations

- Support a business case for pursuing NLG by acknowledging how current technologies' difficulty of use has contributed to limited adoption.

- Work with analytics and machine learning solution providers to understand current and future plans to embed NLG capabilities in their solutions.

- Track NLG capabilities for different supply chain use cases to assess their ability to be trained and perform in a supply-chain-specific context with the appropriate jargon and tone.

- Assess a solution's maturity, particularly in terms of data integration and preparation requirements.

- Study the scope of the platform's self-learning capabilities, upfront setup and configuration required, the range of languages supported, and the extent and accuracy of narration.

- Use NLG to comply with the Americans With Disabilities Act (ADA) in the U.S. and similar mandates in other countries.

Gartner Recommended Reading

Hype Cycle for Natural Language Technologies, 2022

Market Guide for Analytics and Decision Intelligence Platforms in Supply Chain

Decision-Centric Planning

Analysis By: Cristina Carvallo

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Decision-centric planning (DCP) is a concept and an approach to business decision making. Decision centricity means that processes and activities are designed to make the best possible decisions, involving the right decision makers, stakeholders, capabilities and data. The decision itself thereby becomes the focal point for all the decision-making activities. DCP is enabled by continuous monitoring, event impact assessment, impact-driven decision-rights and composable planning processes.

Why This Is Important

Today's planning processes are designed in a way that makes the processes the focal point, instead of focusing on what we need to do in order to make the highest quality decision. The current approach to supply chain planning hinders organizations from realizing the full value of data and technology, and does not fit the highly volatile and uncertain environment supply chains are facing today. Supply chain planning needs to be reframed based on technology advancements and business needs.

Business Impact

DCP implies a complete shift in the way organizations approach supply chain planning decisions; impacting processes, organizational design, skills and competencies. Existing processes like demand and supply planning will be continuous, enabled by data-driven automation. Orchestration processes (S&OP/IBP/S&OE) will run both ad hoc and in cycles, but with a shift in focus from volumes and value plans to business rules, priorities and probabilities, and actions regarding risks and opportunities.

Drivers

- According to the 2022 Risk Assessment in a Volatile World Survey, 74% of organizations are frequently surprised by risk events; waiting for cyclical processes to respond to the risk event may not be possible or optimal (e.g., most profitable).

- According to the 2022 Gartner Supply Chain Technology UWaN Survey, 29% of organizations include enhancing the decision-making process as one of the top three factors motivating their organizations to invest in supply chain technology over the next two years.

- The evolution (and combination) of technologies, such as hyperscale cloud platforms, artificial intelligence and machine learning, digital supply chain twins and data-enabled visibility have advanced the capabilities of supply chain planning solutions. Advanced capabilities enable continuous monitoring and the possibility of near-real-time decision making.

- Many companies struggle with the handover(s) between different, distinct planning processes defined by different time horizons. This challenges the continuity and consistency of decisions, and creates inefficiencies which are pushing high-maturity organizations to realize there is a need for change.

- According to the 2022 Gartner Understanding Decision Making Models in the Supply Chain Survey, measuring the impact of the decision on supply chain performance is highly important, and it's one of the areas needing the greatest improvement to support decision making. Current decision-making models and traditional planning processes do not recognize this issue.

- High-performing organizations are more likely to recognize, and work toward, making more connected, contextual and continuous decisions. In some cases, they are running their processes more frequently, but that might require mobilizing more resources than optimal.

Obstacles

- The vast majority of organizations deploy digital technology designed to fit legacy processes rather than reimagine them.

- Siloed organizational structures and culture hamper an organization's ability to perform end-to-end decision making.

- The 2022 Gartner Supply Chain Technology UWaN Survey found that finding and keeping the right supply chain/IT talent, low supply chain organization maturity and corporate culture are top challenges to successfully pursue emerging digital supply chain initiatives.

- Continuous monitoring and decision-centric planning relies on huge amounts of low-latency granular data availability from multiple sources. Acquiring, maintaining and harmonizing the data remains a challenge.

- Lagging adoption of newer supply chain planning technology represents a barrier to successfully deploy continuous monitoring.

User Recommendations

- Collect and invest in real-time information feeds to monitor demand and supply assumptions, and define thresholds of when replanning is needed.

- Invest in a digital supply chain twin to advance your ability to leverage real-time information flows to assess the impact of events and simulate responses to enable higher-quality decisions.

- Define what rules and thresholds should be used to differentiate impact; clarify and document decision rights for all types of decisions and impact thresholds.

- Start using impact as the guiding principle for decision making.

- Adapt planning processes to focus on outcomes and risks — not horizons. Shift the meeting focus from discussion on volumes and gap closure to alignment on business rules, priorities, risks and opportunities.

- Increase process flexibility and adaptability to deliver composable processes that can be assembled and triggered depending on what business decision needs to be made.

Gartner Recommended Reading

Maverick* Research: It Is Time to Move Beyond Traditional S&OP — Introducing Decision-Centric Planning

Maverick Research: The Digital Era — The End Of S&OP?

Infographic: High-Performing Organizations Are Reengineering Decision Making to Excel in Complex Supply Chains

Prepare Your Supply Chain Planning for the Digitized Future With These 3 Proven Concepts

Make Your Data Do the Work in Supply Chain Planning to Better Respond to Disruptions

API Marketplaces in Supply Chain Planning

Analysis By: Amber Salley

Benefit Rating: Low

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

An API marketplace is a platform to share APIs. They range from basic API catalogs, to API developer portals from a single API provider, to commercial marketplaces with APIs from many providers. Consumers, mainly developers, (both vendors and end users) use API marketplaces to discover APIs and, in some cases, may purchase access. Although public API marketplaces are better-known, a growing number of organizations are deploying internal or private API marketplaces.

Why This Is Important

API marketplaces enable organizations to publicize their APIs. They are usually associated with external marketplaces that share APIs with a community of developers and enable partners to implement solutions using the APIs. However, as most APIs are meant for consumption by teams within an organization, marketplaces can also be internal. They make it easier to find APIs internally, helping with wider sharing of capabilities between different business units, product and development teams.

Business Impact

API marketplaces within supply chain planning (SCP) solution environments enable users to extend the capabilities of their core planning platform. An API marketplace can increase developer visibility and user mind share, drive API usage, and by extension, increase business impact. API consumers can use marketplaces to simplify finding and comparing different APIs when they are looking for specific functionality but have not selected exactly which API to use.

Drivers

- The number of APIs within an organization is climbing, driving the need for developers to more easily discover which APIs and services are available.

- Composable business, including composable supply chain planning, relies on the use of API marketplaces to share APIs and packaged business capabilities.

- Increased use of low-code platforms, integration platforms, robotic process automation (RPA) and analytics tooling enables more citizen development, using APIs that may be sourced from API marketplaces.

- New open-source platforms, such as Backstage from Spotify, are driving the creation of internal API marketplaces as part of larger developer hubs.

Obstacles

- There are very few supply chain planning software vendors that provide any environment resembling an API marketplace. Some are building partner ecosystems, but few have shared a vision to establish a public API marketplace.

- Public API marketplaces that provide a public directory of APIs from multiple providers have generally had disappointing results, as developers are more likely to go directly to API providers to sign up for APIs. Therefore, SCP vendors may be hesitant to attempt to launch a public API marketplace. However, internal API marketplaces have had more success for API providers since they enable developers to share APIs across multiple teams. Time will tell if the same holds true for SCP API providers.

- API portals provided as part of API management platforms are typically basic in nature, resulting in significant customization work to create a customer-oriented API marketplace.

User Recommendations

SCP API providers should:

- Create an internal API marketplace focused on the needs of software engineers to share APIs across the organization, as part of an internal developer portal.

- Manage senior business stakeholders' expectations by ensuring they are aware that outcomes from placing APIs in public API marketplaces are often disappointing.

- Examine billing terms to understand what goes to the marketplace provider when considering commercial API marketplaces.

- Establish a commercial model upfront (e.g., through registration fees and/or revenue share) and a clear governance process for onboarding third-party APIs if you plan to build your own API marketplace.

SCP API consumers should:

- Ensure that you use APIs from trusted marketplaces and trusted API providers, examining usage agreements, licensing and billing terms carefully.

- Investigate whether consuming an API directly from the API provider offers better pricing or usage terms than consuming the API via a marketplace.

Sample Vendors

Achieve Internet; Bump; Postman; Pronovix; ReadMe; SmartBear (Swagger); Spotify (Backstage); Stoplight

Gartner Recommended Reading

Innovation Insight for Internal Developer Portals

Reference Model for API Management Solutions

Deep Learning for SCP

Analysis By: Pia Orup Lund, Joe Graham

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Deep learning (DL) in supply chain planning (SCP) is a variant of machine learning algorithms that utilizes multiple layers to extract valuable insights from complex supply chain problems. It enables the transformation of raw data into high-level features and informed decision making. Deep learning techniques leverage the power of neural networks to autonomously learn from vast datasets, enabling increases in operational efficiency to improve overall supply chain performance.

Why This Is Important

Deep learning techniques are beginning to emerge in SCP to better handle complex, multidimensional and granular data (such as images, speech or text). Deep learning can outperform other ML techniques by automatically extracting data-driven insights, and provide decision intelligence which can reduce the need for manual data engineering.

Business Impact

DL has become an impactful technology in supporting the journey to higher levels of automation and digital planning maturity. It allows organizations to generate insights from disparate and unstructured data sources. Success is fostered in the ability of DL algorithms to exploit weak signals in the dataset, which in isolation, may not carry much meaning, but in a group may highlight results that would have been neglected or not even surfaced. A prerequisite would be a digital supply chain twin.

Drivers

- Interest in resilient planning and supply chain resiliency has increased significantly as a result of COVID-19 and other events over the past few years that have crippled supply chains. As a result, resilient planning capabilities, such as deep learning techniques, have gained interest as well.

- The adoption of hyperscale cloud computing, performance improvements, and improving affordability is helping drive the interest and adoption of deep learning in supply chain planning.

- The vast availability of huge training datasets (such as image, audio, video or text) is enabling the use of DL techniques to help organizations enrich their decision-making process.

- Availability of DL techniques in commercial supply chain planning solutions is also a driver for DL adoption in SCP.

- Algorithmic breakthroughs, such as recent advancements in natural language processing (NLP) techniques using DL methods, have propelled the use of foundational models that promise state-of-the-art results in conversational platforms.

Obstacles

- Deep learning techniques are construed as black box in nature; so governing and ensuring explainability, while gaining stakeholder trust of these solutions, is a constant challenge.

- To leverage DL techniques in supply chain planning requires the availability of high volumes of diverse, granular, high-quality data that is correctly labeled, which is seldom available with an average customer.

- DL systems perform well on specialized tasks, but are brittle outside of the domain they are trained on. Slight changes (such as a very slight alteration of rules in the environment) can cause DL systems to go awry.

- The infrastructure investments required to create and maintain DL solutions are still high, requiring significant computational power, necessitating access to suitable resources and scalable infrastructure.

- The skills required to create and manage DL solutions from scratch are hard to come by; and while increasing in adoption, still uncommonly found packaged with SCP solutions to this point.

User Recommendations

- Invest in data quality management and governance, as deep learning in SCP will require access to diverse and accurate data sources to train deep learning models effectively.

- Explore DL techniques when other machine learning approaches have failed to deliver an acceptable solution.

- Examine and select targeted use cases where deep learning can provide the best value, especially where there is wide and heterogeneous data and the black-box nature of DL is not a concern.

- DL in SCP has been most successful in feature selection, inventory optimization and demand planning — especially in use cases where continuous updating of parameters is required.

- Examine SCP solutions that are offering deep learning capabilities first, then evaluate custom-made solutions for the obstacle.

- Create a diverse talent pool from industry and academia to ensure interpretability as well as privacy, compliance, ethics and governance in DL usage.

Gartner Recommended Reading

Embracing the Future: A Guide to Successfully Implement AI/ML in Supply Chain Planning

Innovation Tech Insight for Deep Learning

3 Types of Machine Learning for the Enterprise

Decision Intelligence

Analysis By: Erick Brethenoux

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Decision intelligence (DI) is a practical discipline that advances decision making by explicitly understanding and engineering how decisions are made and how outcomes are evaluated, managed and improved via feedback.

Why This Is Important

The current hype around automated decision making and augmented intelligence, fueled by AI techniques in decision making (including generative AI), is pushing DI toward the Peak of Inflated Expectations. Recent crises have revealed the brittleness of business processes. Reengineering those processes to be resilient, adaptable and flexible will require the discipline brought by DI methods and techniques. A fast-emerging market (DI platforms) is starting to provide resilient solutions for decision makers.

Business Impact

Decision intelligence helps:

- **Reduce technical debt and increase visibility.** It improves the impact of business processes by materially enhancing the sustainability of organizations' decision models based on the power of their relevance and the quality of their transparency, making decisions more transparent and auditable.

- **Reduce the unpredictability of decision outcomes**. It does so by properly capturing and accounting for the uncertain factors in the business context and making decision models more resilient.

Drivers

- **A dynamic and complex business environment, with an increasingly unpredictable and uncertain pace of business.** Two forces are creating a new market around decision intelligence platforms (DIPs). The first is the combination of AI techniques such as natural language processing, knowledge graphs and machine learning. The second is the confluence of several technology clusters around composite AI, smart business processes, insight engines, decision management and advanced personalization platforms.

- **The need to curtail unstructured, ad hoc decisions that are siloed and disjointed.** Often uncoordinated, such decisions promote local optimizations at the expense of global efficiency. This phenomenon happens from both an IT and a business perspective.

- **Expanding collaboration between humans and machines.** This collaboration, supplemented by a lack of trust in technologies (such as AI), is increasingly replacing tasks and promoting uneasiness from a human perspective. DI practices promote transparency, interpretability, fairness, reliability and accountability of decision models critical for the adoption of business-differentiating techniques.

- **Tighter regulations that are making risk management more prevalent.** From privacy and ethical guidelines to new laws and government mandates, it is becoming difficult for organizations to fully understand the risk impacts of their decisions. DI enables an explicit representation of decision models, reducing this risk.

- **Uncertainty regarding decision consistency across the organization.** Lack of explicit representation of decisions prevents proper harmonization of collective decision outcomes. DI remedies this issue.

- **Emergence of software tools in the form of decision intelligence platforms.** DIPs will enable organizations to practically implement DI projects and strategies.

- **Generative AI.** The advent of generative AI is accelerating the research and adoption of composite AI models, which are the foundation of DIPs.

Obstacles

- **Fragmentation:** Decision-making silos have created data, competencies and technology clusters that are difficult to reconcile and that could slow down the implementation of decision models.

- **Subpar operational structure:** An inadequate organizational structure around advanced techniques, such as the lack of an AI center of excellence, could impair DI progress.

- **Lack of proper coordination between business units:** The inability to impartially reconsider critical decision flows within and across departments (also because of fragmentation) diminishes the effectiveness of early DI efforts.

- **Lack of modeling in a wider context:** In organizations that have focused almost exclusively on technical skills, the other critical parts of human decision making — psychological, social, economic and organizational factors — have gone unaddressed.

- **Lack of AI literacy:** Many organizations still suffer from a lack of understanding when it comes to AI techniques. This AI illiteracy could slow down the development of DI projects.

User Recommendations

- **Promote the resiliency and sustainability of cross-organizational decisions** by building models using principles aimed at enhancing traceability, replicability, pertinence and trustworthiness.

- **Improve the predictability and alignment of decision agents** by simulating their collective behavior while also estimating their global contribution versus local optimization.

- **Develop staff expertise** in traditional and emerging decision augmentation and decision automation techniques, including predictive and prescriptive (optimization, business rules) analytics. Upskill business analysts, and develop new roles, such as decision engineer and decision steward.

- **Tailor the choice of decision-making technique** to the particular requirements of each decision situation by collaborating with subject matter experts, AI experts and business process analysts.

- **Accelerate the development of DI projects** by encouraging experimentation with generative AI and expediting the deployment of composite AI solutions.

Gartner Recommended Reading

Innovation Insight for Decision Intelligence Platforms

Reengineer Your Decision-Making Processes for More Relevant, Transparent and Resilient Outcomes

How to Choose Your Best-Fit Decision Management Suite Vendor

AI Security: How to Make AI Trustworthy

Top Strategic Technology Trends for 2023: Adaptive AI

Graph Analytics for SCP

Analysis By: Pia Orup Lund, Afraz Jaffri

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Graph analytics techniques allow for the exploration and discovery of relationships between entities and concepts such as organizations, people or transactions. Graph analytics consists of models that determine the connectedness across data points. Graph analytics is typically portrayed via data visualization where surfacing relationships can lead to better-informed insights and decisions.

Why This Is Important

- Graph analytics has not only proven its value in specific enterprise-level use cases (e.g., disease tracking) but also for supply-chain-related use cases (e.g., the digital supply chain twin).

- It is an effective way of analyzing data where connections and links between data items need to be identified, which is highly relevant for supply chain planning (SCP).

- It is an enabler of knowledge graphs, which are also accelerating in market adoption.

- It enables the exploration of connected data without the limitation of legacy data models.

Business Impact

Graph analytics for SCP helps in areas such as:

- Application to digital supply chain twin (creation and maintenance) where network effects and impacts of proposed changes need to be simulated and correlations in datasets found.

- Analyzing data for insights into relationships in complex, connected supply chain data.

- Assessing risks to detect potential disruptions to plans, route optimization, clustering, outlier detection, Markov chains and more.

- Identifying outlier and unusual patterns that cannot be detected by other methods.

Drivers

- Rapid uptake in use cases that require analysis across complex models or datasets is developed and used within machine learning (ML) with the output stored in graph databases.

- The availability of low- or no-code tools for domain experts and business users to take advantage of graph analytics techniques for complex investigations.

- The increasing maturity of graph databases for storing, manipulating and analyzing the widely varied perspectives in the supply chain graph model due to their graph-specific processing languages, capabilities and computational power.

- Established artificial intelligence (AI) techniques (such as Bayesian networks) are increasing the power of knowledge graphs and the usefulness of graph analytics by adding further representational power.

- Analytics vendors are beginning to claim specialization in graph analytics, and some traditional analytics vendors are offering interactive network graphs. Similarly, SCP software vendors are also incorporating the use of graph technologies in their SCP solutions in combination with other more traditional approaches.

- The utilization of graph analytics is necessary to develop knowledge graphs and hence digital supply chain twins, which are central to obtaining true digital SCP.

- Graph analysis on data can be further augmented by leveraging metadata from unexpected sources adds to the graph analysis capabilities in the following ways: (1) Certain evaluations can build data "push" models by analyzing data access logs and users' analytical model development; graph analytics can track and recommend data based on data's relationships and users' acceptance. (2) Augmented data profiling combined with graphs can evaluate unfamiliar assets for similarities as compared to currently used datasets — identifying characteristics that are aligned to production AI techniques or ML features.

Obstacles

- Very few incumbent SCP vendors use graph technology today, hence it will require a significant rewrite of their solutions to leverage this. However, many of the newer entrants in the SCP technology market focusing on the respond planning area are using graph technology but do not yet enable full end-to-end SCP.

- Transforming data into graph data models suitable for analysis remains a substantial challenge for large-scale usage. The tooling available is largely concentrated on facilitating end-user ease of use but there is still a need for low-code tools that can manage complete graph analytics workflows and life cycles or "GraphOps."

- Graph analytics and closely related graph databases are driving demand for new skills related to graph-specific knowledge, which may limit growth in adoption. Some vendors have created graph analytic solutions that make it possible to execute graph analytics using SQL.

- New skills required include knowledge and experience with graph algorithms and applying the right algorithm to solve a problem.

User Recommendations

- Evaluate opportunities to incorporate graph analytics into the SCP technology portfolio and strategy. This will enable high-value use cases that are less suited to traditional SQL-based queries and visualizations. For example, computing and visualizing the shortest path, relationship between entities and their influence on a network, creating and enriching the digital supply chain twin, and more.

- Examine graph analytics to enhance pattern analysis.

- Implement user interfaces with graph elements to find insights and analytic results. Store the outputs/results for repeated use in a graph database (e.g., within supply chain network visualization and modeling, as related to the digital supply chain twin).

- Train existing personnel on aligning data assets, statistical processes and algorithms to create training datasets and build processes to detect data changes that will drive changes in the analytical models.

- Evaluate existing SCP tools to determine their graph capabilities.

Gartner Recommended Reading

Graph Technology Applications and Use Cases

3 Ways to Enhance AI With Graph Analytics and Machine Learning

Use Multistructured Analytics for Complex Business Decisions

How Graph Techniques Deliver Business Value

Acquire and Mature a Digital Supply Chain Twin With a Gradual Approach

Resilient Planning

Analysis By: Amber Salley, Tim Payne

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Resilient planning is defined as accurate, executable short-term plans that are balanced by midterm and long-term plans that mitigate against uncertainty by ensuring the right degree of resiliency is constantly being designed and utilized. To enable resilient planning, a combination of a new planning paradigm, hyperscale cloud platforms, AI/ML, a digital supply chain twin and compliance to CORE is required.

Why This Is Important

Supply chain planning is deterministic for most. Planning is fundamentally based on a paradigm that involves forecasting demand and then propagating this signal back up the supply chain. The theory is that if there is an accurate plan, then a supply chain can execute this plan to achieve the goals built into the original plan. But, there is a problem, uncertainty, and with new technologies and new planning frameworks, a company can evolve its approach and consider resilient planning.

Business Impact

Resilient planning is born out of the nexus of four key technology trends: hyperscale cloud platforms, digital supply chain twin, use of AI/ML and the use of the CORE model guiding the different layers of planning capability in an aligned way.

There must be a paradigm shift in thinking to accompany these technology shifts to move from traditional planning to resilient planning. Only then can a company reap the rewards of being more agile and responsive in its market through resiliency.

Drivers

- Over the past few years, interest in resilient planning and supply chain resiliency has increased significantly due to COVID-19 and other low-frequency high-impact events that have crippled supply chains. Unfortunately, very few companies will get anywhere close to achieving true resiliency in their supply chains in the next couple of years.

- In a world of high and increasing uncertainty, the way the organization plans its supply chain needs to master this uncertainty through the way its supply chain plans are created and updated. Gartner expects to see companies that are leading the charge in digital planning (and are at the higher levels of digital planning maturity) to figure out that they need to change their planning paradigm to extract the most value from their new technology investments.

- As an approach, resilient planning will be applicable to any industry, as all are confronted with uncertainty. However, it is likely to be an approach that appeals more to organizations that are in the upper half of the supply chain maturity journey. These organizations tend to look to further digitize their planning and evaluate ways to drive more agility and responsiveness in their supply chains.

- Some of the technology required to enable resilient planning is emerging (e.g., the digital supply chain twin and use of hyperscale cloud platforms) but is not yet mature. This prevents full-blown resilient planning from being a reality today, but it does allow for small-scale pilots to be attempted. Companies are starting to experiment with the concept and figuring out what it might mean for them and what they might need from their technology providers in the future.

Obstacles

■ One significant challenge is the misuse of the term "resilient planning." Supply chain technology leaders responsible for supply chain solutions should be on the lookout for anyone that is renaming traditional planning to resilient planning.

■ The achievement of resilient planning will be slow. Too many supply chains are still wedded to the idea of planning accuracy (especially the forecast) to seriously get into resilient planning yet. Although the required technology is continuing to mature, there is still a lot to do to fully enable resilient planning.

■ No company has yet deployed resilient planning in its entirety because it is an emerging concept. However, Gartner is aware of examples where leading companies are experimenting with the approach — typically in experimental mode — in selected areas to evaluate the potential impact.

User Recommendations

For resilient planning, combine several technologies together:

■ Increase the use of AI/ML to progressively move from unknown uncertainty to known variability for aspects of entities, attributes and parameters in the supply chain. Leverage AI/ML for cheaper, more expansive and faster predictions. Use this to enable the creation of many plans instead of just a single deterministic plan.

■ Resilient planning requires computing power. Leverage hyperscale clouds to provide the required level of scalability.

■ Build the SCP technology roadmap to encapsulate the layers of the CORE model. All these decision layers are required for full resilient planning. Achieve the right interplay between planning layers to mitigate against uncertainty and planning to execute accurately using a digital supply chain twin.

■ Change the planning paradigm from a focus on accuracy only to one of resiliency/accuracy balance. That is accuracy in respond planning and resiliency in optimize and configure planning.

Gartner Recommended Reading

Acquire and Mature a Digital Supply Chain Twin With a Gradual Approach

Long-Term Demand Sensing

Analysis By: Pia Orup Lund, Tim Payne

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Long-term demand sensing (LT DS) provides insights to support longer-term planning over the two- to five-plus-year time horizon, with a market-level, leading-indicator-driven assessment of longer-term demand.

Why This Is Important

The intent of LT DS is to predict future trends in market demand for a company's products or services. LT DS considers the impact of macroeconomic factors (e.g., GDP, inflation), leading indicators and long-term causal influencers. LT DS utilizes artificial intelligence/machine learning (AI/ML) and multiple external datasets to predict the market demand levels.

Business Impact

The benefit of LT DS increases as an integrated business planning (IBP) process becomes more mature, and integration between sales and operations planning (S&OP) and corporate financial planning tools is more pronounced. When this occurs, long-range scenarios and trade-offs can be evaluated with a higher level of confidence, which can lead to improved decision making in the configure planning processes.

Drivers

- The supply chain planning (SCP) and analytics software markets are starting to deploy features that provide support for LT DS. Market pull for this type of software is still low, but is increasing as many companies experience a higher urgency to elongate their planning horizons due to the current — and likely also future — highly volatile market conditions.

- As incumbent SCP vendors continue to make investments in AI, ML and advanced analytics, they will enhance their IBP/S&OP product offerings to include more comprehensive support for LT DS.

- New entrants into the SCP market that focus on AI/ML and big data will also enter this area. However, to be successful, vendors will need to have both the analytics and the necessary external data to help their customers.

Obstacles

- The impact of LT DS is dependent on a company's ability to link/align decisions from strategy to execution, support for scenario modeling and collaboration, and its ability to find insights in large amounts of external data.

- LT DS capabilities can be strengthened using a software solution that has features designed to adequately support IBP, long-range planning and configure planning.

User Recommendations

- Build a strong configure planning capability that allows modeling of the end-to-end supply chain over long-term time horizons.

- Secure access to relevant data streams that represent the influencing factors that will provide appropriate insights into long-term market demands.

- Prioritize matured sales and the operations planning process to create long-term plans through IBP.

- Evaluate vendors on their LT DS capabilities. It may be necessary to procure LT DS capabilities from a vendor different from your primary SCP vendor.

Gartner Recommended Reading

Make Your Data Do the Work in Supply Chain Planning to Better Respond to Disruptions

Ignition Guide to Creating a Strategic Plan for the Supply Chain Planning Function

Edge Analytics and AI for SCP

Analysis By: Caleb Thomson

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Edge analytics and AI represents analysis that is performed at the edge of the data network, as represented by a logical client device (e.g., white-label CPU device). The data will be analyzed at the network edge rather than the planning system core, and sources can include IoT sensors, machine vision, and other sources of sensory information. Edge analytics and AI allows for the decentralization of some supply chain planning decisions, optimizing both "global" and "local" decisions.

Why This Is Important

Edge analytics and AI are important for supply chain planning leaders to the extent that they enable granular analysis and data collection at the network edge. Of particular importance is the ability to drive better insight from manufacturing OT, leveraging integrated IoT devices into the manufacturing environment. Other feasible solutions include temperature, weight, volume, and machine vision solutions to monitor conditions from the network edge within production and distribution facilities.

Business Impact

The business impacts of edge analytics and AI include:

- Edge analytics and AI integration into supply chain planning technology can optimize data collection across activities and sites, separating meaningful information signals from data volumes.

- Visibility into current conditions allows for the separation of decision making and automation between "global" and "local."

- Buildup of historic execution data can enable deeper process analysis to identify particular operational sticking points and enhance "digital supply chain twin" capabilities.

Drivers

- Lower-cost white-label computing devices can be coupled with IoT-integrated devices to provide monitoring and analysis at the network edge (e.g., across supply chain execution sites).

- Visibility into internal and external supply chain execution site conditions (particularly manufacturing, distribution and transportation) can enable faster, more effective and efficient decision making.

- The buildup of historic conditions data "fact patterns" can enable greater insight into continuous improvement opportunities from a distribution and manufacturing perspective and support planning improvements via root-cause analysis and development of "digital supply chain twin" related insight.

- Edge Analytics & AI technology are enabled by the proliferation of low-latency and high-bandwidth telecommunications technologies, including fiber optic wavelength division multiplexing (WDM), mmWave 5G, private 4G-LTE networks, and other advanced network protocols, such as Wi-Fi 6.

Obstacles

- Deployment use cases should be carefully vetted to ensure both immediate and long-term benefits. It is likely that on a long enough time scale, deployments will continue to decrease in price.

- Validate approaches for signal processing. Datasets can become prohibitively large very easily, considering how and if full datasets should be archived and what data signals should be recorded and fed into centralized supply chain planning logical environments for further analysis.

- Deployment can often be dependent upon private network infrastructure investment and modernization, and certain conditions can impede signal propagation (i.e., environments with significant liquids, concrete and metal structures). However, wired solutions may help to alleviate some of these issues.

- Deployments into customer-facing environments (e.g., retail stores and other consumer distribution locations) require increasing consideration of data privacy and protection requirements across jurisdictions.

User Recommendations

- Ensure that you have the right kind of network IO skills to ensure adequate security and long-term support and maintenance.

- Consider the optimal locations to maximize the value of the investment; where do you have a limited line of sight into supply chain execution activities? How can an edge monitoring device provide greater visibility into "gray" and "dark" to drive more effective "respond" planning decisions?

- Develop a long-term view to support the capital intensive-network infrastructure modernization along with opportunities to better model and monitor current supply chain execution processes to drive further improvement opportunities (i.e., a more visible and predictable supply chain can drive further improvements to customer service levels, and satisfaction).

Sample Vendors

Amazon Web Services (AWS); Arundo; CloudPlugs; FogHorn; Microsoft; PTC; Samsara; TIBCO Software

Gartner Recommended Reading

Quick Answer: How Can IoT and Edge Computing Improve Supply Planning?

Top Trends in Data and Analytics, 2022

Generative AI

Analysis By: Noha Tohamy

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Definition:

Generative AI (GenAI) technologies can generate new derived versions of content, strategies, designs and methods by learning from large repositories of original source content. GenAI has profound business impacts, including on content discovery, creation, authenticity and regulations; automation of human work; and customer and employee experiences. In supply chain, GenAI improves communication with internal and external partners and interfaces to tech, and derives novel strategies and workflows.

Why This Is Important

GenAI can create tailored customer and supplier communications. It can increase technology adoption by providing users with an intuitive Q&A-based interface to provide a better understanding of the logic behind complex supply chain solutions. It can come up with novel scenarios and workflows for complex supply chain problems like production scheduling and long-range planning. Through code generation, GenAI can accelerate the development and deployment of advanced analytics.

Business Impact

GenAI will help synthesize contracts, ensure regulatory compliance, communicate with suppliers, prepare meeting materials and offer tailored customer service. This can free up staff for higher value tasks, enable better communication across functions reducing siloed decision making.

GenAI will democratize data and analytics through intuitive conversational interfaces, but could pose data and cybersecurity risks.

Drivers

- The hype around and interest in GenAI in our personal lives has accelerated the desire for supply chain organizations to understand its potential impact on their supply chains.

- Supply chain organizations are assessing its potential in various supply chain use cases, as it observes its opportunities and challenges in other enterprise functions, like marketing and customer service.

- Synthetic data draws enterprises' attention by helping to augment scarce data, mitigate bias or preserve data privacy. These capabilities can be well utilized to predict demand and supply patterns in complex supply networks.

- Combined with development automation techniques, GenAI can automate up to 70% of the programmers' work. In addition to its direct impact on the productivity of software engineers, these gains will significantly improve the availability and speed-to-value of supply chain solutions.

Obstacles

- There are a few pilots and proof points of benefits in the supply chain as it is an emerging technology.

- Little clarity of the investment requirements to adopt GenAI.

- Lack of cohesive messaging of how tech providers will incorporate GenAI in their solutions.

- Lack of clarity of the most suitable deployment model for GenAI: consuming GenAI embedded in supply chain applications, embedding generative AI model APIs in a custom application frame, extending GenAI models via data retrieval, extending generative AI models via fine-tuning or building custom foundation models from scratch (How to Choose an Approach for Deploying Generative AI).

- Lack of tech and data foundation limits the ability to leverage GenAI in the short term.

- There is a lack of clarity of how GenAI solutions will fit in current technology footprint.

- Full and accurate detection of nefarious content, such as deepfakes, will remain challenging or impossible.

- Investments in compute resources for training models are substantial and unaffordable to most enterprises.

- Sustainability concerns about high energy consumption are rising.

User Recommendations

- Assess the organization's technical maturity level and cultural appetite for emerging technology.

- Secure requisite subject matter expertise and technical talent to build, maintain and adopt Gen AI solutions.

- Understand and communicate expected ROI ranging from understanding of potential and challenges to quantifiable productivity improvements.

- Work with your supply chain technology providers to understand their — and require a clear — roadmap of incorporating GenAI in their offering.

- Quantify the advantages and limitations of GenAI. Supply GenAI guidelines, as it requires skills, funds and caution. Weigh technical capabilities with ethical factors. Beware of subpar offerings that exploit the current hype.

- Mitigate GenAI risks by working with legal, security and fraud experts. Understand the risks that GenAI can pose to your organization's intellectual property and your internal, customers and suppliers data security and privacy.

- Optimize the cost and efficiency of AI solutions by employing composite AI approaches to combine GenAI with other AI techniques.

Gartner Recommended Reading

Innovation Insight for Generative AI

Quick Answer: What CSCOs Should Know About ChatGPT's Capabilities and Pitfalls

Emerging Tech: Generative AI Needs Focus on Accuracy and Veracity to Ensure Widespread B2B Adoption

ChatGPT Research Highlights

Data Fabric for SCP

Analysis By: Caleb Thomson

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Data fabric for supply chain planning (SCP) will enable data alignment toward the representation of a digital supply chain twin across supply chain execution systems among others. It's an emerging data management design for attaining flexible and reusable data integration services across supply chain systems. It's intended to support different data integration methods, leveraging MDM solutions, knowledge graphs, semantics and machine learning to optimize data integration design and delivery.

Why This Is Important

Data fabric represents a move toward "data singularization." It allows organizations to invest in enduring solutions that can adapt to dynamic markets, both supply disruptions and customer demands. It leverages AI/machine learning (ML), graph database and semantic learning to streamline, automate, and optimize data-integration methods between and among existing solutions. Data fabric becomes a mandatory design concept to enable a composable supply chain function and to drive a digital supply chain twin.

Business Impact

Data fabric provides:

- Ready identification of data sources, uses across supply chain system architecture; including proactive identification and alignment of new and existing data sources.

- Profiling of unknown data for similar uses, content and recommendations for data categorization and classification.

- Rapid development of incremental system touchpoints and interfaces.

- Visibility and observability across the supply chain data estate to drive further automation and emerging AI use cases.

Drivers

- Techno-functional expertise scarcity in the supply chain domain, along with high levels of demand for these skills, creates an environment where the solution development scale requires greater technology support in the form of better data alignment tools and methods.

- Typical supply chain system architecture continues to be severely constrained by historic practices (with respect to data entry and quality), and the presence of legacy solutions; constrained budgets require newer approaches that can accelerate modernization.

- Historical approaches to data governance are time-consuming and require constant attention to system defects; data approaches that rely on ML and AI capabilities can alleviate these burdens.

- Modern graph database-driven solutions are emerging as leaders in supply chain planning, creating a greater impetus for further modernization to maximize data-driven business performance improvements.

- Organizations continue to experience diverse ETL requirements across legacy and modern solutions, data fabric can support the varied data-integration methods required by diverse system architectures.

Obstacles

- Master data management (MDM) solutions may not have adequately defined metadata and data dictionaries; without these elements, training data fabric solutions reliant upon ML and AI will become more challenging.

- Data fabric development requires the combination of process and data governance to understand both data values and organizational use of data across systems with further consideration of legal, regulatory and privacy requirements.

- Data fabric solutions are designed to learn from organizational use of varying data element sources and their uses across different systems; poor current practices may be engendered (e.g., "learned") by the data fabric solution, further institutionalizing poor practices and improper use.

- Data fabric solutions will require cross-skilled data, system and supply chain expertise, and coordination to adequately align data sources with optimal data uses to drive singularity of reference and transaction data elements across supply chain system architecture.

User Recommendations

- Identify the skills required to implement the data fabric solution first, then assemble the implementation team; efforts will likely require cross-functional supply chain expertise, specific system SMEs, and deep data and analytics experts.

- Prioritize data elements for incorporation into a data fabric solution, between the dimensions of data type, reference data (master data) and transactional data, and in-scope systems with consideration to the data source and expected uses.

- Perform due diligence to determine where legacy systems will present particular challenges, and consider if further key enablers should be considered to improve data quality and latency (e.g., an enterprise supply chain data lake, or other API-enabled messaging service modernization).

Gartner Recommended Reading

What Supply Chain Executives Need to Know About Data Management Strategies

Acquire and Mature a Digital Supply Chain Twin With a Gradual Approach

Supply Chain Brief: Navigating Through the Ever-Increasing Complexity of Application Architecture

Simulation in SCP

Analysis By: Joe Graham, Tim Payne

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Simulation in SCP refers to the application of mathematical models to simulate supply chain operations and evaluate the impact of various planning decisions. These techniques enable supply chain leaders to identify potential bottlenecks and risks, simulate various scenarios, optimize planning decisions and better understand how a particular supply chain design will behave under different operating conditions. This helps improve overall supply chain performance and make informed decisions.

Why This Is Important

Simulation tools have been around for many years; however, with more SCP technology vendors offering a variety of simulation capabilities, organizations are exploring simulation techniques within SCP to solve complex challenges. Allied with the digital supply chain twin, simulation techniques (for example, Monte Carlo and discrete-event), will find homes within resilient planning as it continues to emerge.

Business Impact

Simulation in SCP can help a company understand the degree to which its supply chain can handle disruptions and ranges of outcomes for various what-if scenarios, and can lead to a form of resilient planning at higher maturity levels. Think of it as something to have on the roadmap of SCP capabilities once a strong foundation is in place to help with testing the robustness of different supply chain configurations.

Drivers

- Interest in resilient planning and supply chain resiliency has increased significantly as a result of COVID-19 and other events over the past few years that have crippled supply chains. As a result, resilient planning capabilities, such as simulation techniques, have gained interest as well.

- Increasing complexity of supply chains, with more multienterprise partners and nodes involved, makes it difficult to assess the impact of changes or disruptions without simulation tools.

- The increased availability and adoption of hyperscale cloud deployments and in-memory computing have increased the ability to work with extremely complex and large datasets to integrate with simulation capabilities.

- Interest in decision-centric planning is also driving the use of simulations, especially in support of impact analysis.

Obstacles

- Companies have tried to use simulation in the supply chain context, because supply chains can be viewed as complex systems that are influenced by specific events (for example, a machine failure or customer order). However, due to past computing limitations, simulations were restricted to help model small sections of a supply chain, rather than the end-to-end plan.

- Simulation techniques like Monte Carlo simulation and discrete-event simulation in SCP are likely to be of more interest to higher maturity companies that have a strong supply chain foundation in place to stress-test the supply chain and implement the findings.

- Simulation techniques are often confused with scenario planning. Simulation supports testing the robustness of a system under uncertainty, utilizing techniques such as discrete-event or Monte Carlo simulation.

- There needs to be an underlying model of the supply chain that the simulation capabilities can leverage.

User Recommendations

For discrete-event simulation:

- Use discrete-event simulation at a strategic level, such as configure planning, to determine how different designs will likely perform under different operating conditions.

- Use these techniques to simulate the impact of a period's worth of events to see how the current supply chain design will perform in a fraction of that period.

- Apply use cases supported by discrete-event simulation for network design, flow, and optimization, logistics planning, and inventory management.

For Monte Carlo simulation:

- Use Monte Carlo simulation at a strategic and tactical level by helping companies understand the likelihood of outcomes and risks associated with various scenarios.

- Use these simulation techniques when timing and sequence of events are less important, or when data is scarce, incomplete, or uncertain.

- Apply use cases supported by Monte Carlo simulation for demand forecasting, inventory optimization, supply planning variability, and risk assessment.

Gartner Recommended Reading

Innovation Insight: AI Simulation

Quick Answer: Defining Control Tower, Command Center and Digital Supply Chain Twin

E2E Supply Chain Ecosystem Collaboration: Part 3 — 11 Elements for Level 5 Supply Chain Maturity

Digital Supply Chain Twin

Analysis By: Tim Payne

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

A digital supply chain twin is a high-resolution digital representation of the physical E2E supply chain that is synchronized with the real world to provide visibility and enable aligned E2E decisions. It is built from granular low-latency data to form a dynamic, synchronized, real-time representation of the various associations among the data objects and entities that describe and make up how the physical supply chain operates. It is then used for future projections across the supply chain.

Why This Is Important

The digital supply chain twin's primary purpose is to enable higher-quality aligned decisions for the E2E supply chain. This increase in decision quality is the essence of any supply chain maturity journey that companies embark on. Therefore, it sits at the heart of any digital supply chain initiative and is transformational.

Business Impact

Digital supply chain twin is making an impact in several ways:

- The increasing hype in digital supply chain twin is causing confusion for businesses interested in this concept.

- Impact is the resulting higher-quality decisions an organization can drive, with increased value generation and reduced value loss.

- A digital supply chain twin enables the digitization of decision making by enabling appropriate visibility, aligning and supporting automation of decisions, raising the impact of low-latency and granularity data, and providing the basis for innovation.

Drivers

- The majority of technology providers working in the supply chain visibility, control tower, command center and decision-making spaces are heavily messaging on digital supply chain twins. This is increasing the hype. Vendors in areas such as supply chain planning, supply chain analytics, supply chain visibility, big data and machine learning are marketing their interpretation of the digital supply chain twin.

- The evolution (and combination) of technologies, such as hyperscale cloud platforms, artificial intelligence and machine learning, and graph data models is helping data-derived digital supply chain twins to gradually emerge to replace previous human-derived abstract models of the E2E supply chain.

- The end-user market's desire for outcomes, such as agility, responsiveness and resiliency, through the application of E2E visibility, insight and recommendations is driving significant interest in digital supply chain twins.

- The end-user market's desire to move away from fragmented and siloed visibility and decision making to E2E visibility and horizontally and vertically aligned decision making is driving significant interest in digital supply chain twins.

- The end-user market's desire to digitally transform E2E supply chain is driving significant interest in digital supply chain twins.

- The market wants to enable E2E visibility and support E2E decision making by being in lockstep with the real-world supply chain. Through this link to the real world, situational awareness, supply chain decision making and risk management are greatly enhanced. Moreover, a digital supply chain twin provides the basis on which all existing and new predictive and prescriptive analytics can run and align, allowing their full value to be realized by the organization.

- The desire to converge execution visibility and decision making is driving significant interest in digital supply chain twins.

Obstacles

- Getting a fully evolved digital supply chain twin is not easy — it is an emerging capability. We have yet to see a fully evolved digital supply chain twin at either a technology provider or an end-user organization.

- A digital supply chain twin evolves in breadth and depth dimensions — breadth of scope of the supply chain that is being modeled, and depth of how detailed and synchronized to the real world that model is. This often leads to initiatives trying to address each dimension separately, and potentially missing the required connection between model breadth and depth that a digital supply chain twin requires.

- Enabling a fully evolved digital supply chain twin requires the ability to handle and process huge amounts of low-latency granular data from numerous internal and external data sources. These issues will take significant time to fully resolve.

- There is confusion between digital supply chain twins, control towers and command centers, which is slowing the progress.

User Recommendations

- Take an uncompromising position on reducing decision-making models across the supply chain. A digital supply chain twin initiative implies a single model of the E2E supply chain.

- Establish a roadmap for the evolution from the breadth and depth perspectives. Understand that acquiring a digital supply chain twin is a journey, and a fully evolved one cannot currently be purchased or built. Drive the breadth through the supply chain planning technology roadmap and the depth through the execution visibility/control tower/command center roadmaps.

- Merge the roadmaps for the digital supply chain twin, visibility control towers and command centers at an appropriate point along the breadth and depth spectrums.

- Examine early opportunities to add digital-supply-chain-twin-like capabilities to your landscape. This might be pairing up the new capability with supply chain visibility and/or planning solutions. Be prepared to experiment and/or go outside of your usual technology providers to get this capability.

Gartner Recommended Reading

Acquire and Mature a Digital Supply Chain Twin With a Gradual Approach

Artificial Intelligence

Analysis By: Noha Tohamy

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Artificial intelligence (AI) applies advanced analysis and logic-based techniques, such as machine learning, deep learning, regression analysis and prescriptive analytics, to identify and predict patterns, self-learn, and make and execute decisions. AI augments human decision making or automates routine and nonroutine tasks.

Why This Is Important

AI has the potential to transform supply chains. It significantly augments humans' ability to make decisions, by identifying patterns and making actionable recommendations.

With AI, organizations can automate decision making and execution. This is critical for dynamic supply chain processes that require analyzing large sets of data and real-time response. For example, AI can automate order promising, production scheduling and product testing. AI can support overall digital transformation.

Business Impact

Leveraging AI in decision automation allows supply chains to dynamically react to changing supply and demand patterns. AI closes the gap between planning and execution, ensuring that the factors driving decisions are still valid at execution.

AI has a profound impact on talent, freeing up staff from non-to-low value-add tasks. This allows them to pursue more fulfilling, higher value-add priorities, such as internal and external collaboration and scenario planning.

Drivers

- Continued interest in AI from supply chain leaders looking to alleviate supply chain talent shortages.

- Ability of supply chain technology providers to embed AI capabilities for identifying patterns and predicting, making and executing decisions into their existing solutions.

- More best-of-breed, AI-oriented supply chain technology vendors that position their solution as a complementary intelligence layer to augment current supply chain solutions.

- Identifying more use cases for AI within individual functions such as planning, sourcing and manufacturing.

- Interest in using AI to augment decision making with better actionable recommendations.

- A better articulated vision for automating supply chain decision making, beyond initial use cases like demand forecasting and demand sensing.

- Emphasis on supply chain agility as organizations cope with significant spikes in demand and supply variability, inflationary pressures, and continuously changing business conditions.

Obstacles

- Continued challenges with the availability and quality of data that can accurately represent a supply chain process.

- Limited data required to effectively train AI algorithms and generate accurate recommendations.

- Shortage in data science talent attracted to supply chain organizations due to organizations' technical immaturity and lack of attractive career paths.

- Lack of organizational readiness to adopt complex AI solutions and rely on them in mission-critical decisions.

- AI initiatives are mostly pilots, with few deployments — at scale — that have demonstrated technology maturity and ability to support supply chain objectives.

- Lack of transparency in AI technology, further challenging the willingness of users to trust their output.

User Recommendations

- Experiment with AI in lower-order supply chain processes such as improving data quality and data harmonization.

- Align supply chain AI strategy with overall enterprise AI strategy to leverage enterprisewide technology and talent resources.

- Beyond pilots, prioritize solution scalability and reusability when choosing AI technology vendors to support broad AI adoption.

- Focus on specific use cases where you believe AI presents the highest potential, and embark on small pilots to gauge potential benefits and challenges to success.

- Ensure the availability of data science resources, internally or from service providers, to build and maintain AI solutions.

- Focus on cultural changes to ensure that the organization is in step with the AI vision. This includes training supply chain users on incorporating AI into their decision-making process.

- Define new career opportunities for supply chain users to pursue, once their nonroutine tasks are automated with AI.

Gartner Recommended Reading

Use-Case Prism: Artificial Intelligence for Supply Chain

Top Trends in Strategic Supply Chain Technology 2023

Autonomous Planning

Analysis By: Amber Salley, Tim Payne

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

Autonomous planning is defined as automated prediction (plan creation) and automated prescription (plan judgment). The creation of a plan involves both these elements. There is the prediction or predictions about the future and then the prescription choice about which of these futures is most desirable. With autonomous planning, there is no direct human involvement in making the decision.

Why This Is Important

Autonomous planning is becoming more popular for companies that are digitalizing their supply chain planning. Autonomous planning replaces planner activity where human bias can degrade the quality of the decision being made which then degrades the quality of the overall plan. The increasing automation of planning is one of the key goals of digital planning.

Business Impact

Traditional planning is very manual. Automation allows companies to do more with fewer human planners. Allied with this is the ability to do things that could not be done before (e.g., running and comparing high numbers of multiple plans). Automation also reduces bias from planning decisions. Humans make biased decisions because of the way our brains work. Reduction of human involvement in decision making will help to alleviate some of this bias.

Drivers

- The notion of autonomous planning is emerging within supply chain planning, which is traditionally a fairly manual activity for most companies. For many companies, it is now more of a desire than a realistic goal. No company will have autonomy for 100% of its planning decisions. There will always be the need for human involvement and judgment in some planning decisions, no matter how much AI or machine learning (ML) a company applies.

- As companies strive for more decision automation, the focus of planning needs switches from being people-centric (low maturity), through process-centric (midmaturity), to becoming decision-centric (high maturity). With a laser focus on the planning decisions under consideration, a company can keep a close eye on its type and development, and therefore, how much automation should be applied at different times.

Obstacles

- Changing the cultural mindset to shift from people-centric through to decision-centric may be a challenging task. It may take companies several years to complete the transition.

- End-to-end supply chain planning automation and autonomous decision making requires an environment that offers extensive visibility across the supply chain network and through the value chain.

- Lack of an analytics transparency strategy may impede end-user trust of the output.

- Autonomous planning in the operational time horizon requires "zero" data latency. Updates from execution and/or the value chain network are occurring in real-time (less than 15 minutes latency).

- Highly granular data is required. This results in planning decision making at the event level, leveraging unstructured data, Internet of Things (IoT) sensory data, external disruption data, macroeconomic data, leading indicators, etc.

User Recommendations

- Align autonomous planning goals with your digital planning maturity.

- Be realistic about which planning decisions they can make autonomously. Only certain decision types will be suitable for full automation. Trying to fully automate the wrong type of planning decision will lead to failure.

- Apply a decision type framework that segments decision types into categories (i.e., simple, complicated, complex and chaotic) to help understand the current mix of decision types that exist in the SCP environment. This is then an indicator of which planning decisions are currently of the right type to be fully made autonomous.

- Provide good transparency into any new analytics being deployed will help to drive trust and confidence in these new approaches which will help allow the deployment of more decision automation.

Gartner Recommended Reading

Predicts 2023: Supply Chain Technology

SCP Outsourcing

Analysis By: Caleb Thomson, Amber Salley

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

The supply chain planning (SCP) outsourcing market is composed of third-party service providers that deliver SCP processes for their clients, which would otherwise be performed internally. Providers offer buyers outcome-based business process delivery. Business process outsourcing (BPO) providers offer buyers improved business process efficiency and effectiveness. SCP BPO includes business process as a service (BPaaS) that involves multitenancy often achieved by leveraging cloud services.

Why This Is Important

SCP outsourcing is an emerging business process outsourcing (BPO) service offering increasingly available from solution providers, systems integrators, contract manufacturers and third-party logistics. Organizations may employ these services to address expertise and technology gaps, or other process-related risks. SCP BPO currently has low levels of adoption, particularly as a BPO offering, but interest continues to grow.

Business Impact

The objectives for SCP outsourcing vary from more operational cost reductions and improved planning efficiency to more strategic goals that improve planning quality and business performance. SCP outsourcing can be deployed on operational time horizons, including: forecasting, demand management, and long-term capacity, supply network, production, materials and inventory planning. Organizations may seek SCP outsourcing as a stopgap to remediate near-term issues and other resource constraints.

Drivers

- SCP outsourcing has become much more feasible with the advent of cloud-hosted solutions and data environments that allow for easier access and data transport between solution environments.

- SCP outsourcing presents opportunities for existing service providers to extend their offerings and grow total account spend, particularly relative to recently deployed solutions or other resource gaps.

- Scarcity of internal planning talent may push supply chain organizations toward greater levels of outsourcing and optimization to drive continued performance improvements.

- SCP outsourcing is prevalent in the service parts planning segment, where organizations can outsource calculations and processes to external parties based on defined service levels.

Obstacles

- SCP outsourcing as a long-term BPO service line continues to grow, but organizations may be reticent to outsource a function so close to customer service.

- Planning is a mission-critical decision-making process for organizations; outsourcing critical decision making to an external partner may lead to suboptimal (unexpected) outcomes.

- An initial long-term SCP outsourcing or outsourcing agreement is unlikely to proceed without significant revisions to address lessons learned over the course of the agreement.

- Be mindful that some pain points can be solved in-house through process changes or more efficient use of existing technology.

User Recommendations

- When selecting a potential SCP outsourcing vendor, assess its ability to support organizations whose size and planning scope are similar to yours.

- Evaluate providers on methodologies and proprietary tools used to support outsourcing.

- Evaluate the necessity for SCP outsourcing by determining the drivers and objectives for outsourcing for your organization. Cost cutting shouldn't be the end goal of outsourcing.

- Design a balanced outsourcing strategy by equally valuing and recognizing the importance of overall business benefits and relationship longevity.

- Be selective in what you choose to outsource by identifying a pain point that can be optimally improved through outsourcing.

- Establish clear requirements for vendor management that are like those in place for other outsourced functions.

- Create clear governance and feedback models with outsourcing vendors by defining mutual roles and responsibilities (RACI), organization structure, processes and handovers, and key metrics.

Gartner Recommended Reading

Supply Chain as a Service Converges Physical and Digital Supply Chain to Deliver Revenue

Take Four Steps to Develop Your Supply-Chain-as-a-Service Strategy

Respond Planning

Analysis By: Tim Payne

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Respond planning refers to the ability to trigger short-term planning and/or replanning based on executional events (either demand side or supply side, enterprise or multienterprise, or internally or externally initiated). This capability is essential to ensure plans stay in step with execution and corporate goals as much as possible. Respond planning is essential to support sales and operations execution and is the R layer of the CORE model.

Why This Is Important

- Most planning vendors have traditionally focused on tactical (optimize) planning and so respond planning is fairly new to them. Most end users have traditionally deployed planning solutions that are tactically focused because this has addressed their biggest planning challenge.

- With end users wanting to be more agile, responsive and resilient, respond planning has increased in popularity — especially over the last three years with more uncertainty hitting many supply chains.

Business Impact

Respond planning has the following impacts:

- A key improvement area is in increased responsiveness to events and disruptions.

- Early adopters of respond planning are reporting a range of improvements, e.g., customer service improvements, inventory reductions and lead-time reductions.

- Reductions in planning nervousness can help reduce exception messages and give planners a means to focus on what really needs addressing.

- The advent of AI/ML is enabling more decision automation in the predictive and prescriptive elements of respond decisions.

Drivers

- Respond planning is one of the planning layers in the CORE framework. It is the newest of these and is increasing in hype, especially due to the level of uncertainty in supply chains presently.

- To improve their planning, organizations need to align planning decisions horizontally and vertically throughout the supply chain. Respond planning is one of these horizontal layers, and as such, acquiring an integrated end-to-end respond planning capability will be a key part of any company's SCP technology roadmap.

- As it is predicated on good execution visibility, several of the supply chain visibility vendors are getting into respond planning — typically in functional use cases (e.g., predictive order dates)

- New entrants to the market are coming from providers with big data and predictive analytics capabilities to try to fill the white space left unoccupied by incumbent SCP vendors.

- Respond planning recognizes that execution is unlikely to follow the optimal plan and that it needs to respond to these execution events in a way that keeps as close as possible to the corporate goals. Therefore, respond planning inherently has a focus on accuracy to better sense the event and determine an appropriate short-term response (i.e., a revised plan).

- Consequently, AI/ML increasingly focuses on respond planning to help improve prediction accuracy, automate decision making and allow nearer to real-time, granular data to be utilized in planning.

- The continuing convergence of planning and execution will take place at the interface between respond planning and execution/supply chain visibility. This will force planning systems of record to increasingly have to contain respond planning capabilities, with the associated technical architecture changes required to support it.

Obstacles

- For most SCP vendors, respond planning represents a significant departure from the way they have enabled planning for many years. Several have yet to fully embrace respond planning, while others have limited but expanding offerings.

- As a consequence, other vendors are entering the market (e.g., intelligent data platforms, supply chain visibility solutions), which can potentially complicate a company's technology landscape.

- Additionally, especially for larger companies that have built out internal data and analytics and data science teams, there is a growing desire to build in-house predictive models. There is a risk that these ML-driven analytics (that are often examples of respond planning use cases) are developed stand-alone and not integrated together with the other predictions across the supply chain.

User Recommendations

- Typically respond planning starts with functional use cases (e.g., demand sensing, predictive lead times, allocation) and then progresses to join these use cases up over time.

- Prioritize use cases in terms of how the uncertainty they are addressing invalidates the optimized plan. For example, if you have uncertainty in supplier deliveries that keeps breaking your S&OP plan, that may be a good place to initiate a respond planning use case.

- Often respond planning use cases emerge under the guise of digitization of the supply chain. It is important to recognize this and ensure that any respond planning use cases can eventually be connected.

- Users may have to use third-party solutions for initial pilots. Organizations should take this into consideration when evaluating their roadmap.

- Overtime, an emerging digital supply chain twin will be the mechanism to link together the different functional respond planning use cases. Ensure this is factored into your supply chain technology architecture.

Gartner Recommended Reading

Magic Quadrant for Supply Chain Planning Solutions

Critical Capabilities for Supply Chain Planning Solutions

DDMRP

Analysis By: Amber Salley, Tim Payne

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Definition:

The Demand Driven Institute (DDI) defines demand-driven material requirements planning (DDMRP) as "a multiechelon planning and execution method to protect and promote the flow of relevant information through the establishment and management of strategically placed decoupling point stock buffers." Gartner describes it as a basic form of respond planning capability that pulls through the supply chain using actual orders as the trigger aligned with decoupling stock buffers.

Why This Is Important

With the level of volatility that most companies have in their supply chains, getting an accurate-enough demand forecast to achieve the cost/service balance they require competitively is unattainable — hence the emergence of planning techniques such as DDMRP.

Business Impact

DDRMP can yield positive benefits in inventory reduction, service levels, and cycle time. It remedies problems with forecast-driven MRP. Mainly that the forecast is always wrong, and this signal is propagated up the supply chain.

But when compared to optimization-based SCP, the benefit is less clear. When there are supply constraints to consider, research shows superior performance for optimization-based SCP. DDMRP is seen as a simpler method that is easier to understand compared to optimization-based SCP.

Drivers

- DDMRP has been in the making for a long time (being born out of the MRP world) but only recently began to get noticeable traction in the market. Gartner is now seeing a steady stream of inquiries coming in for DDMRP. These numbers are still dwarfed by those asking about demand and supply planning, S&OP, S&OE, and AI/ML in planning.

- DDMRP is seen as an attractive option to companies at a lower level of supply chain planning maturity. Those challenged with extreme demand volatility over the past few years and have potentially unrepresentative demand history on which to base statistical forecasts may benefit from DDMRP since it relies less on a forecast.

- DDMRP is evolving with the associated concepts of a demand-driven operating model (DDOM), demand-driven S&OP (DDS&OP) and demand-driven adaptive enterprise (DDAE). These additions are currently less well-defined and understood than DDMRP.

- With the Association for Supply Chain Management (ASCM) now offering training in DDMRP, more companies are tempted to evaluate the approach. Gartner foresees that new AI-/ML-based planning techniques (e.g., resilient planning) will eventually supersede DDMRP.

Obstacles

- There is often confusion around DDMRP. The "demand-driven" part of the name gets confused with other "demand-driven" approaches. The claim that no forecasting is required with DDMRP causes confusion, as there is always a need to forecast future demand for a supply chain.

- If DDMRP is being positioned against forecast-driven planning for all or a large portion of the product portfolio, be prepared for significant pushback. Broad acceptance of a pull-based approach such as DDMRP requires a culture shift.

- The AI/ML analytics approach competes with the more simplistic pull approach of DDMRP. The analytics approach is leading as the preferred method.

- Enterprise-class software is required for broader rollouts of DDMRP. If using small consultancy tools or spreadsheets, benefits from DDMRP will be limited.

- If looking to move beyond a basic DDMRP deployment, apply healthy skepticism to vendor claims of supporting DDS&OP and DDAE, as requirements for these are far from clear or evolved yet.

User Recommendations

- Consider DDMRP as another planning technique for lower maturity organizations that could be applied based on the use case, just as you would apply statistical forecasting, optimization, lean planning and Kanban. Use segmentation to decide the most applicable concept to use. Pilot to prove the value, such as where there is a desire to decouple MRP from the forecast due to poor forecast accuracy.

- Discuss with your incumbent SCP vendor how they enable DDMRP and whether they will get certified by the DDI or go it alone. Several of the leading SCP vendors are certified for DDMRP by the DDI.

- If there is interest in shifting the planning paradigm toward a more pull-based approach, monitor how some vendors might be evolving their software to incorporate aspects of AI/ML/advanced analytics to help with the configuration aspects required. For example, the determination of decoupling points in a large E2E supply chain and use of ML to better select and size inventory buffer profiles.

Gartner Recommended Reading

Toolkit: Playbook for Inventory Governance, Metrics and Performance Management

Supply Chain Leaders Must Neutralize the Forces of Oversupply to Control and Optimize Inventory

Sliding into the Trough

Digital Supply Chain Planning

Analysis By: Joe Graham, Tim Payne

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Digital supply chain planning is defined as the use of digital technologies such as cloud, big data, RPA, graph databases, AI and/or ML to improve or transform the quality of the planning decision making in the supply chain. How digital the planning has become is characterized through seven dimensions: horizontal alignment, vertical alignment, automation, mix of decision types, data latency, data granularity and degree of bimodal planning.

Why This Is Important

Digital supply chain planning will enable organizations to transform the quality and speed of the planning decision being made, while also modeling and aligning vertical and horizontal business and operational strategies directly supporting planning visibility, risk, efficiency and automation.

Business Impact

Removing the human planning productivity constraint enables a company to do more with higher maturity capabilities, such as:

- Utilizing more granular data with improved data latency

- Increasing the speed of decision making, allowing for the use of scenario planning

- Aligning decision making horizontally and vertically across the supply chain

- Reducing uncertainty by converting it into understood variability

- Improving prediction and prescription accuracy and relevance through the use of ML

Drivers

- As organizations continue their digital initiatives, more companies have digital supply chain planning initiatives underway.

- SCP vendors are adding digital technologies to their solutions (especially RPA, ML, and graph database technology) at an increased pace.

- External events occurring at an increased pace has companies requiring a more resilient planning approach to be able to cope with rising uncertainty levels.

Obstacles

- Executing digital planning, especially at higher stages of maturity, is far harder.

- Digital planning is not solely about technology; rather, it relies on seven dimensions of digital planning progressing in reasonable balance.

- Digital planning is not about digital technology, per se, but rather, the appropriate and effective use of digital technology applied to planning as a company moves forward in its journey.

User Recommendations

- Leverage a digital planning framework such as Gartner's seven dimensions of digital planning to ensure the relevant capabilities are part of the company's digital planning roadmap.

- Assess each opportunity to deploy digital technology into SCP by asking which of the seven dimensions of digital planning it positively impacts.

- Start digital planning efforts by focusing on horizontal and vertical alignment of planning decisions early in a digital planning initiative. This helps ensure orphaned digital planning initiatives don't pop up and can't be easily integrated into the rest of the planning.

- Do not strive for autonomous supply chain planning in all planning decisions, but rather, focus on how to use digital technologies to drive more decisions (not all) toward simple end-to-end decisions that can eventually be automated.

- Balance digital planning initiatives by ensuring that, as progress is made, progress is reasonably balanced across the seven dimensions of digital planning.

Gartner Recommended Reading

Probabilistic Supply Chain Planning

Analysis By: Amber Salley, Tim Payne

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

Probabilistic supply chain planning (also known as stochastic planning) refers to the application of probability theory to create parameters and construct supply chain plans (for example, demand plans, replenishment plans, manufacturing orders and maximum and minimum inventory levels) that take into account the randomness of data and information in the supply chain.

Why This Is Important

Traditional supply chain planning relies on a deterministic plan based on a forecast. However, as more companies understand the true impact of variability on their supply chains and look for ways to better cope with it, probabilistic planning can be used to help improve existing planning practices through the recognition of the impact of variability on a complex system, such as a supply chain.

Business Impact

Supply chains are not deterministic, and are impacted by multiple sources of variability. Modeling a real-world stochastic process with a deterministic model always leads to a disconnect between the two, with the deterministic model being a poor representation of reality. Using probabilistic planning more accurately reflects the stochastic nature of the supply chain network. This drives the conversion of unknown uncertainty to known variability within the supply chain.

Drivers

- A basic form of probabilistic modeling has long been used in demand-planning systems to come up with demand forecast error. Progress has been made in the last few years in applying probabilistic modeling within supply planning (such as replenishment planning or production scheduling) that helps to determine plans that are more representative of variability.

- As the use of ML becomes more prevalent, users are identifying more sophisticated SCP use cases. Some vendors are now offering probabilistic forecasting and, to a lesser extent, probabilistic replenishment creating a range of plans that represent the relevant probability functions.

- As supply chains become more complex and their operating environments more unpredictable, the relevance of probabilistic planning will increase — especially as it is a key part of resilient planning. If used in the appropriate circumstances, it should yield value. It will help to determine more resilient plans and schedules, given the stochastic nature of the products and customers being planned, but only if it evolves more fully into resilient planning.

- Vendors are experimenting with AI techniques like neural networks and deep learning to expand the use cases for probabilistic planning in SCP.

Obstacles

- In many companies there is an incumbent view that planning should be done by developing a deterministic plan based on a forecast. SCP business leaders must demonstrate the value of using probability to account for risk and uncertainty.

- There is a lack of probabilistic planning functionality in existing SCP solutions. While there are some SCP-focused vendors that have used probabilistic planning for decades, there are many others that do not yet have it as a native capability in their platform.

- Planning teams may lack an understanding of probability theory making it difficult to think about the supply chain in terms of range of outcomes and likelihood of outcomes versus average outcomes.

User Recommendations

- Look for opportunities to build more probabilistic modeling capabilities in SCP as the company moves up in its digital supply chain maturity. Evaluate demand-sensing solutions that can support stronger probabilistic analysis of demand patterns as well as supply-planning solutions that use probabilistic-based algorithms to determine "replenishment tunnels" that provide a range of replenishment quantities.

- Target initial investigations into short-term planning processes, such as daily-level forecasting, finished-goods replenishment and production scheduling, or what Gartner calls respond planning capabilities, as this often has the highest impact in coping with variability.

- Focus on easy, manageable use cases before building out more complex use cases.

- Get started with range-based forecasting by creating a confidence interval of the best case and worst case scenarios for each forecast. Then expand into probabilistic forecasting and replenishment.

Gartner Recommended Reading

Video: Probabilistic Forecasting at Optimas

Stress-Testing R&D Portfolio Resilience: Scenario Planning to Anticipate Disruption

Probabilistic Opportunity Assessment (DSM)

Explainable AI

Analysis By: Peter Krensky, Sumit Agarwal

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Explainable AI (XAI) is a set of capabilities that describes a model, highlights its strengths and weaknesses, predicts its likely behavior, and identifies any potential biases. It can clarify a model's functioning to a specific audience to enable accuracy, fairness, accountability, stability and transparency in algorithmic decision making.

Why This Is Important

XAI gives visibility into how a model arrived at a particular decision. This helps in building trust, confidence and understanding in AI systems. In highly regulated sectors such as insurance or banking, regulations directly or indirectly mandate the need for model explainability to properly manage model risk.

Business Impact

XAI is the responsibility of both vendors (data scientists and solution developers) and also of end-user organizations that consume them. Not supporting this capability puts businesses and decision making at risk. However, different levels of explainability are required for customers, the organization's IT and management, society, and regulators to direct AI governance.

Drivers

- The lack of model transparency or interpretability among model users, managers and consumers impacted by models' decisions severely limits an organization's ability to manage AI risk. Fairly or unfairly, consumers hold the originating organization responsible for the performance and behavior of AI.

- Not ensuring explainability invites model risk that can lead to financial loss, poor business and strategic decision making, or damage to organizational reputation.

- A lot of organizations are shifting to augmented decision-making capabilities with the use of AI models. As a result, they should be able to explain how an AI model arrived at a particular prediction or decision.

- XAI capabilities are prebuilt into both platforms and innovations in the open-source community to explain and interpret models are on the rise.

- Ethical and moral considerations need to be accounted for while relying on augmented decision making, often supported by thorough governance and auditing capabilities for these models.

- New regulations and legal interventions are taking place that mandate the use of explainable AI methodologies.

- Explainable models also help with attrition, so data scientists who quit the job do not leave black boxes behind them. Models that are interpretable help business audiences gain trust in AI.

Obstacles

■ Explainability is often confused with ML interpretability. Although the latter serves data scientists, the former applies to different personas interacting with the AI life cycle.

■ XAIs are often looked at as a task or a step required while creating AI projects toward the end of the AI life cycle, but they have to be continuous and tested throughout training, development and production phases.

■ An inherent lack of trust exists in AI systems that keeps organizations from adoption, since they're simply not aware of XAI techniques or frameworks.

■ Explainability tools are fragmented, and XAI is often consumed in an oversimplification such as showing feature importance to end users. Although that approach works in the beginning, XAI is much wider than that, and requires a deep understanding of the subject.

■ Organizations that focus on the accuracy of the models rather than on the interpretability stall their decisions on creating a more explainable AI.

User Recommendations

■ Define a range of actions that can be taken independently that identify unacceptable results and that flag those results for human intervention. Minimizing the number of incorrect results derived from AI is critical, because users will lose trust in a poorly performing system.

■ Educate, train and foster ongoing conversations with key stakeholders, including line-of-business managers, legal and compliance, to understand the AI model's explainability requirements, challenges and opportunities.

■ Strive for XAI for each model along the dimensions of business, data, algorithms, models and production.

■ Accept deficiencies in explainability as a natural consequence of systems becoming increasingly complex. Document notable deficiencies or potential biases so that they can be used to make corrections in the future.

■ Establish the role of AI model validator, a data scientist whose job is to ensure that models are explainable and robust, and meet all possible constraints.

Sample Vendors

Dataiku; EazyML; Fiddler AI; Google; H2O.ai; IBM; Microsoft; Modzy; Superwise; TruEra

Gartner Recommended Reading

Innovation Insight for Bias Detection/Mitigation, Explainable AI and Interpretable AI

Top 5 Priorities for Managing AI Risk Within Gartner's MOST Framework

Market Guide for AI Trust, Risk and Security Management

Incorporate Explainability and Fairness Within the AI Platform

Integrated Business Planning

Analysis By: Tim Payne

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Gartner defines integrated business planning (IBP) as the process that considers the long-term planning horizon. It is supported by S&OP (tactical time horizon) and S&OE (short-term horizon). IBP consists of a set of technologies that provide an environment to support the financial and strategic alignment, supply chain modeling, long-term demand sensing and trade-off capabilities that are required for long-term planning. IBP aligns with the configure planning layer of the CORE model.

Why This Is Important

IBP enables companies to model and align business strategies to operational strategies across supply chains. This ensures significantly improved supply chain and business performance (such as improved profitability, lower working capital, improved cash flow, higher customer service levels and higher probability of successful product launches) through the full implementation of tactics (such as segmented supply chains, demand shaping and capital investments).

Business Impact

■ Linking IBP, S&OP and S&OE is key to supporting the journey toward more holistic business planning, with connectivity between short-term, tactical and long-term planning.

■ For many companies, it is the missing link that will enable them to drive better decision alignment throughout the supply chain and into other parts of the organization.

■ It is a key pillar of being able to link strategy to execution.

■ IBP benefits tend to be business specific, such as revenue and profit improvements.

Drivers

■ The concept of IBP (also known as Level 4 or Level 5 S&OP maturity) continues to develop and embrace strategic and deeper financial modeling capabilities that leverage the underlying operational planning and S&OP processes, and that link into the organization's financial planning activities.

■ IBP often develops as a distinct capability that sits over the tactical S&OP process. Gartner defines the technology for IBP as advanced S&OP, which SCP vendors can provide natively or through partnerships.

■ Over the last few years, there has been a significant increase in the number of companies looking at IBP. For some, this is just a relabeling of tactical S&OP. For others, it is long-term planning vertically aligned with tactical and operational planning.

■ Consequently, most SCP vendors offer solutions for S&OP and very often companies are looking for solutions that incorporate both the operational and tactical planning layers to ensure consistency and closed-loop performance management.

■ The expansion of financial planning and analysis (FP&A) into S&OP/IBP (called Extended Planning and Analysis — XP&A) is also driving more interest from the CFO side of the business.

Obstacles

- Lack of clarity on the definition of IBP before buying technology risks a misalignment between business and technical requirements, which can stifle IBP progress.

- Trying to enable IBP using multiple vendors is problematic. Different vendors, with discrete models in the operational planning, S&OP and IBP layers will degrade the decision alignment between these various layers.

- Increasingly, Gartner sees non-SCP vendors such as financial planning and analysis (FP&A) providers getting into IBP/S&OP. These vendors tend to have less experience in the respond planning layer of the supply chain, which can result in degraded decision alignment from S&OP down into tactical and operational planning.

- As a company looks to progress further into IBP, some of the incumbent S&OP technologies will be lacking in areas, such as supply chain modeling, long-term demand sensing and depth of financial impact analysis.

User Recommendations

User recommendations for IBP vary depending on your organization's definition of IBP:

- Focus on a planning system of record (SCP SOR) if IBP means integrated tactical/operational planning such as demand, inventory, replenishment and production planning (short- to medium-term horizon).

- Consider the S&OP capability of your incumbent vendor if IBP means tactical S&OP.

- Require the capabilities as depicted by the CORE model if IBP means integrated horizontal and vertical planning. You will have to work with multiple vendors, so try to keep the layers of CORE as homogeneous as possible.

- Address each layer of CORE and apply a robust digital supply chain twin to drive decision alignment and automation if IBP is part of a digital initiative.

- Use an S&OP solution with a strong IBP roadmap if IBP is aligned with Gartner's definition. Consider non-SCP solutions (e.g., generic modeling platforms or financial planning solutions), as some of these will have stronger modeling and financial analysis capabilities.

Gartner Recommended Reading

Magic Quadrant for Supply Chain Planning Solutions

Configure Planning

Analysis By: Tim Payne

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

Configure planning refers to the technology that supports a company in making decisions and plans about the future configuration of its supply chain. The different configuration options are evaluated to see how they might support the company strategy (e.g., new products, new markets and new business models, new channels, new plants, new distribution centers). Configure planning is the C layer in CORE.

Why This Is Important

- Traditional network design applications tend to get used for fairly specific use cases (e.g., distribution center modeling) and are typically performed offline from the tactical and operational planning activities (e.g., optimize planning).

- Configure planning is the analysis of different end-to-end supply chain configurations (enterprise and increasingly multienterprise). A chosen configuration can then be operationalized through the optimize and respond planning layers.

Business Impact

- Configure planning is primarily centered on cost optimization and/or risk mitigation.

- Configure planning can assess changes driven by both internal and external events and is not necessarily tied to a specific time horizon.

- Configure planning allows building resiliency, supporting segmentation efforts and making investment decisions based on a more robust approach. This drives benefits in the allocation of capital, customer service, and cost and profitability.

Drivers

- Configure planning is one of the planning layers in the CORE framework. It is traditionally not seen as a planning capability, but it should be. However, leading companies are resetting their focus and understanding that they need to focus on all three planning layers. This puts the spotlight back on configure planning.

- The need to perform end-to-end decision making with regard to supply chain structural decisions is driving more interest in configure planning.

- The need to make configuration decisions in multiple time horizons (Hype Cycle longer-term horizon for long lead-time CAPEX decisions and shorter-term horizon for externally driven configuration changes such as arising from pandemics or severe weather events) is driving more interest in configure planning.

- The need to make configuration decisions that are more cognisant of the uncertainty in the real world is driving more interest in configure planning as a key plank of a supply chain resiliency strategy.

- The need to make configuration decisions that are cognisant of alternative resource usage (e.g., energy, carbon dioxide, water) is driving more interest in configure planning.

Obstacles

- The technology for configure planning is typically isolated from other planning solutions.

- Configure planning is not typically seen as part of Supply Chain Planning and consequently, the synergies between these two decision-making layers are missed.

- The data sources and models typically used by configure planning are abstracted from the realities of the real world, degrading the configure planning's ability to take suitable account of the uncertainty of the physical supply chain.

- Configure planning should be progressively getting its key data from the digital supply chain twin as this better mirrors the reality of the real-world supply chain, including uncertainty. However, few companies are that far along with their digital supply chain twin journeys yet.

- The lack of a common supply chain model (eventually to be the digital supply chain twin) being used by both configure planning and optimize planning limits the degree of vertical alignment between these two key decision-making layers.

User Recommendations

- Audit existing supply chain modeling capabilities to see how these can be utilized in an E2E configure planning context.

- Examine your incumbent supply chain modeling vendors' existing functionality and roadmap capabilities to identify how these might fit into a configure planning technology landscape with an E2E focus.

- Pay particular attention to how any configure planning capability supports integration to data sources such as an emerging digital supply chain twin and the optimize planning layer. This helps to drive the alignment of decisions vertically in the company.

- Link the configure planning capability to the integrated business planning (IBP) process. Configure planning technology is a key component of enabling a good IBP process in terms of utilizing alternative configurations over the tactical time horizon and leveraging configuration options (e.g., alternative suppliers, outsourced manufacturing).

Gartner Recommended Reading

Magic Quadrant for Supply Chain Planning Solutions

Market Guide for Supply Chain Network Design Tools

Supply Planning

Analysis By: Pia Orup Lund, Amber Salley

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Supply planning translates demand expectations into time-phased and quantified requirements of capacity, materials, labor and services across the supply network. Success is determined by the fulfillment of customer demand while efficiently utilizing capacity and minimizing waste in the consumption of labor, material, freight capacity, inventory and other resources.

Why This Is Important

Supply planning aligns operations across the network to deliver outcomes efficiently by ensuring the capacity and resources are available with the right quantity, timing and location. Absence of supply planning may result in manufacturing activities that are misaligned with business objectives or harshly subjected to inefficiencies imparted by the volatility of an unfiltered demand signal.

Business Impact

As manufacturers and suppliers strive to increase the strategic alignment and effectiveness of their decision making from S&OE through to S&OP/integrated business planning, supply planning is central to ensure that business tactics for maximizing financial results can be converted into feasible operating plans. Midterm supply plan models analyze key constraints to define key network resource requirements and inform the development of aligned individual site and functional operating plans.

Drivers

- The move toward multienterprise planning between manufacturers and suppliers will require a focus on collaborative supply planning across a supply network. As technology providers integrate more capacities for real-time data sharing across partners, this effort will transition into a mature mainstream capability.

- Increased emphasis on manufacturing operations agility drives manufacturers to increase the degree of synchronization between midterm supply planning, operational planning and detailed scheduling for postponed decisions that maintain more dynamic supply balancing with demand. This shift expands the focus from isolated midterm supply planning to multilevel orchestration of a volatile demand signal to an agile supply response.

- More mature supply planning capabilities, enabled by the right technology solutions, provide optimization modeling and simulation of what-if scenarios to analyze, visualize and socialize performance trade-offs quickly for more effective management of risks, opportunities and events.

Obstacles

- Many users have been limited in their capability development by a lack of investment in constraint-based modeling functionality.

- Within many companies, structural disconnects still exist between network capabilities, demand realities and customer expectations.

- Supply plan models reflect the complex details of product portfolios and supply networks, making master data setup and accuracy critical. Software tool deployment and model testing, as well as user training, are critical to success. Change management while migrating from legacy methods, such as spreadsheets, is imperative.

User Recommendations

- Approach improved supply planning as the path to enable more integrated supply chain decisions for improved overall performance.

- Align supply planning and inventory strategies, metrics and incentives with network capabilities and outcome objectives.

- Create feasible midterm supply network plans that balance decision agility with modeling precision. Monitor supply plan and production schedule adherence, but emphasize feasibility and fulfillment of performance outcomes.

- Align tactics with demand and product realities by applying the right combination of agile scheduling and optimized supply and inventory planning for each segment of the product portfolio.

Gartner Recommended Reading

S&OP Process: Design a Supply Planning Meeting That Delivers Business Value

3 Supply Planning Tactics to Swiftly Improve Material Supply

Machine Learning

Analysis By: Noha Tohamy

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Machine learning (ML) is an AI discipline that solves business problems by utilizing statistical models to extract knowledge and patterns from data. There are three major approaches that relate to the types of observation provided. These are supervised learning, where observations contain input/output pairs (also known as "labeled data"); unsupervised learning (where labels are omitted); and reinforcement learning (where evaluations are given of how good or bad a situation is).

Why This Is Important

ML can identify patterns, generate insights and predict future outcomes from massive amounts of text, video, image and sound data. This enables many supply chain decisions that were previously based on rudimentary manual analysis or traditional analytics techniques. In this way, ML can improve overall productivity, freeing up human resources to focus on higher-value tasks. ML needs are pervasive across supply chain functions, from planning to sourcing and transportation.

Business Impact

ML algorithms identify undetected patterns with fewer preconceived user assumptions or relation definition. They rely on data to identify patterns to generate insights and predict trends. These insights improve over time, as algorithms self-learn from prior performance. ML can be embedded in a number of supply chain processes, such as predictive maintenance, risk management or demand forecasting.

Drivers

- Interest in ML is driven by the surge in data — structured and unstructured, internal and external — and supply chain complexity, making traditional analytics techniques and manual analysis inadequate. With ML, supply chain organizations can take advantage of available data and rely on the algorithms to identify patterns and correlations, and predict outcomes to find the best course of action.

- Adoption of ML is driven by organizations' vision for an autonomous supply chain. Since ML is a prerequisite technique in AI, companies look to ML to further refine recommendations and continuously self-learn from previous performance.

- This past year, ML progressed along the curve, as organizations looked to respond and recover from conditions precipitated by the COVID-19 pandemic. With ML, they were able to leverage dynamic data from across the supply chain and business networks, consider external factors to predict future demand and supply trends, and plan resources and capacity to meet customer service requirements.

Obstacles

- Lack of good quality, available and representative, or unbiased data can deteriorate ML algorithms' output and recommendations.

- Lack of user trust in the logic and workings of complex models can limit adoption and take away from potential success.

- Lack of ongoing maintenance of ML models can render them obsolete, generating inaccurate insights and predictions.

- Inability to industrialize ML pilots can prevent organizations from demonstrating return on investment, further challenging broader adoption.

- Confusion over technology options and fragmentation of the market challenges organizations' ability to choose the best ML-enabled solution to support specific needs and best fit with their existing technology footprint.

- Lack of integration of ML insights in business process dissipates the ML-generated business improvements, which, in turn, makes it challenging to continue to secure funding and support for ML initiatives.

User Recommendations

- Gauge ML's incremental benefits, compared with more traditional techniques, such as time series analysis.

- Quantify the technical resources required to develop and deploy ML models. This includes data engineers and scientists to acquire and analyze data, and build and train ML models.

- Dedicate analytics coaches to train supply chain users on using ML output to augment and improve their decision-making process.

- Ensure the availability and readiness of the data that will be used by ML algorithms. Given that ML relies on training datasets to identify patterns and relationships, good contextual, representative data is paramount to the success of these techniques.

- Vet technology providers' claims to offer ML capabilities in their solutions. Due to the high level of interest in ML capabilities, vendors' marketing positions might sometimes outpace current capabilities.

Profitable to Promise

Analysis By: Pia Orup Lund, Tim Payne

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Profitable to promise (PTP) tools combine the capabilities found in available to promise (ATP) and capable to promise (CTP). They add the consideration of the projected profitability of fulfilling a specific customer order at the time of acceptance and promise, taking into account the opportunity cost of not consuming resources and leaving them for other requirements. PTP is defined as part of the respond planning category of the "configure, optimize, respond, execution visibility" (CORE) model.

Why This Is Important

PTP enables organizations to get a clear view of the true profit generated by accepting a specific order (or not accepting one in favor of a forecast order with greater margin). It can also indicate the impact on overall profitability at the customer and organizational levels.

Business Impact

PTP capability can be a key part of providing a profitable supply response to demand signals. Without this capability, organizations are left to accept orders based on available inventory and/or capacity, with a margin assessment based on absorbed costs and average selling prices. Given the prevailing circumstances of the supply chain, this doesn't provide a true view of the real profit generated by taking the order.

Drivers

- Variations of PTP have been around for years, usually in the form of sophisticated CTP systems with additional cost and pricing attributes.

- PTP will become more popular, especially because it can be a key capability in helping to execute on a segmented supply chain strategy in the short-term execution time window.

- Profit-generating policies can be devised and enacted in operations through the deployment of PTP — for example, executing on a segmented supply chain strategy where tailored supply chain designs have been devised for different customer segments.

- PTP brings the examination of what drives profitability to the executional and operational level, where it's often missing. How the supply chain is run has a significant impact on a company's profitability, but most detailed analyses of profit are backward-looking. Any forward-looking profit analysis is typically high-level and can be meaningless to operations.

Obstacles

- The demand for PTP has been low as companies struggle to implement ATP and CTP capabilities for their supply chains.

- Companies will look to PTP to help them make complex decisions in near real time. However, many of them will be disappointed because they won't have sufficient integration across the planning processes of their supply chains to respond and take advantage of the benefits of PTP.

- Many companies lack detailed and relevant-enough cost information to drive coherent and meaningful PTP calculations. They also lack the agreed-to business rules on how they want to prioritize orders in line with their business strategy and/or supply chain segmentation initiatives. This can result in aggregate-level or average-level cost information used to derive customer-level profitability analysis limiting the usefulness of the calculations in determining the true impact of customer-level activity on the supply chain.

User Recommendations

Users need to be practical in terms of what can be achieved:

- Have mature integrated planning and ATP and/or CTP capabilities up and running before jumping to PTP. ATP and CTP initiatives will quickly highlight issues with system or process integration and supply chain data availability and quality.

- Create clarity around the rules of business engagement for order promising.

- Carefully choose the right planning technology to support PTP upfront if you plan to leverage it in the future. PTP is hard to bolt on to existing planning systems.

Gartner Recommended Reading

Maverick* Research: It Is Time to Move Beyond Traditional S&OP — Introducing Decision-Centric Planning

Maverick Research: The Digital Era — The End of S&OP?

Advanced Analytics

Analysis By: Noha Tohamy

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Advanced analytics are techniques that examine data to predict what is likely to happen and prescribe what action to take to achieve objectives. Advanced analytics span techniques such as regression analysis, multivariate statistics, simulation, business rules and optimization modeling.

Why This Is Important

Advanced analytics span predictive and prescriptive, enabling organizations to predict future scenarios and proactively determine the best action. This allows organizations to move beyond reactive, rearview mirror performance analysis.

Predictive analytics are prevalent in use cases like demand forecasting, predicting supplier lead times and risk monitoring. Prescriptive analytics can be leveraged in inventory management, route planning and asset utilization.

Business Impact

Predictive analytics improve organizations' ability to anticipate further conditions. Prescriptive analytics help organizations understand and execute the best decisions to achieve their objectives.

Anticipating and planning for future events can significantly improve the organization's ability to take advantage of business opportunities, better meet customer expectations and avoid disruption.

Drivers

- Supply chain organizations that have heavily relied on human domain experience are now looking to rely on data and analytics to understand trends and anticipate future environments and to make data-driven decisions.

- Advanced analytics have traditionally targeted problems in the strategic and tactical time horizon, like long-range forecasting or demand planning. Now, advanced analytics can be deployed in real time or the near-real-time horizon in areas such as dynamic pricing, asset performance and demand sensing.

- Due to the complexity of the supply chain, business users face millions of possible choices when taking action. Without advanced analytics, it is infeasible to expect human users to identify the best action to meet supply chain objectives.

- As supply chains become more distributed, spanning functions and regions and extending to external trading partners, business users cannot take into account all priorities, costs and constraints. This drives the need for advanced analytics to anticipate future events, account for potential choices and make the optimal trade-offs to balance conflicting objectives.

- Supply chain talent shortage is driving the need for decision-making augmentation and automation. The goal of automation is to free up human users to focus on qualitative priorities, such as collaboration with trading partners or team communication.

Obstacles

- Data availability and quality: The timeliness and accuracy of the data correlates to the accuracy and usefulness of the output of advanced analytics.

- Lack of analytics maturity limits successful adoption of advanced analytics: Many organizations are still focused on answering "what has happened?" without a forward-looking focus on the questions "what might happen?" and "what can we do about it?"

- Lack of technical talent to build and maintain advanced analytics models: Supply organizations might be challenged to recruit, define an attractive career path and retain advanced analytics talent.

- Low levels of data and analytics literacy: Many supply chain users are still more comfortable relying on Excel and domain knowledge to predict scenarios and make decisions.

- Lack of transparency of more complex advanced analytics models: Oftentimes, this results in users' resistance to the adoption of advanced analytics.

User Recommendations

- Identify the supply chain processes that can benefit from advanced analytics and clarify how their insights will be embedded in the processes and incorporated in users' decision making.

- Plan to allocate significant time and resources to capturing, cleansing and harmonizing required data.

- Continue to improve foundational analytics, spanning KPI definition and capture, building reports and dashboards, and providing the business users with data and analytics self-service functions. It is essential to establish a clear baseline of past and current supply chain performance.

- Educate your organizations on available advanced analytics technologies that can handle more dynamic data sources and satisfy requirements for faster response times.

- Secure the internal or external skill sets to create and deploy advanced analytics solutions.

Supply Chain Control Tower

Analysis By: Brock Johns, Christian Titze

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

A supply chain control tower is a framework combining people, process, data and organization, facilitated by appropriately combined technology elements. It establishes a central hub to capture and use data — structured and unstructured, internal and external — to provide enhanced visibility, predictions and suggestions for short-term and midterm decision making. This is accomplished predominantly for functional domains.

Why This Is Important

Gathering, analyzing and using data to drive effective supply chain decisions are the biggest challenges for functional supply chain leaders. To be successful, supply chains must act within a business ecosystem rather than as stand-alone and disconnected activities. Visibility is about building the foundation, providing data-driven insights as the basis for smart decision making at various levels of granularity and time horizons.

Business Impact

Fundamental control-tower-type, technology-enabled capabilities, such as exception alerts and interactive dashboards to support areas like capacity shortage, inventory shortage or late shipments, are now foundational and fairly standard to modern SCM solutions, allowing the business to anticipate and automate tasks. However, advanced capabilities such as broader E2E impact analysis, scenario simulation or a collaborative resolution/response room are lagging behind end-user expectations.

Drivers

- Frequency and magnitude of supply chain disruptions have been increasing in recent years, driving the need for more visibility and the ability to shift into a more proactive state for supply chains.

- Companies are looking to develop a set of appropriate actions and reactions, allowing them to enable visibility into current and predicted situations. This will enable companies to understand related impacts (financial impact or impact on other strategic and/or corporate metrics) and to provide options that identify suitable resolutions within a business ecosystem.

- Investing in control tower type capabilities will: help increase visibility, process orchestration and aligned decision making; allow scalable, timely and financially sound decision making; and increase performance (e.g., improved forecast accuracy, perfect order rates, inventory turns or customer satisfaction; reduced inventory, operating and expediting cost or costs of ownership).

- The need to develop and converge E2E-aligned decision making (aka planning) and E2E supply chain visibility will eventually drive the coalescence of the digital supply chain twin and a single E2E supply chain command center into which individual control towers will feed information.

Obstacles

- Control towers are designed as war-room-like environments that are focused on visualization and dashboards and are still more functionally siloed in their setup. They don't provide the anticipated E2E visibility, control and decision-making support (which we would then call a command center, a tool for cross-functional insights and response).

- Companies need to be mindful that they need to map out in their journey an E2E command center versus a more functional control tower approach.

- Companies need to be aware of major concerns, including: lack of clarity on span of control, resistance to breaking down functional silos, questions on actual data ownership, no consensus on build-versus-buy decision and the right technology requirements, and inability to identify sources and access to data elements.

- Confusion for buyers with the term control tower and that a control tower with E2E supply chain data can be purchased versus sourcing the data from other solutions and bringing them together in a command center.

User Recommendations

- Include control tower capability as part of the overall SCM technology landscape, and in alignment with your overall supply chain and business strategy. Assess your current application landscape to determine if existing tools and technology could be used for control tower capabilities.

- Be aware that effective control-tower-type capabilities come from an appropriate combination of people, process, data and organization, together with various categories of technology that have to combine in a suitable way. Distinguish between foundational capabilities (e.g., visibility, indicators, workflow) and advanced capabilities (e.g., simulation, recommendation and automation).

- Know that existing offerings serve limited use cases, often due to lack of intelligence capabilities, data and no support for E2E supply chain convergence.

- Utilize best practices from peers that have deployed functional control towers, especially in the areas of logistics and transportation, inventory or customer fulfillment.

Gartner Recommended Reading

Quick Answer: Defining Control Tower, Command Center and Digital Supply Chain Twin

Infographic: Insights on Successful Implementation of Logistics Control Towers

Quick Answer: Decisive Metrics for Supply Chain Control Towers

The Advancement of Supply Chain Control Towers

Business Case for Investing in a Logistics Control Tower

Integrated Supply Chain Planning

Analysis By: Tim Payne

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Integrated supply chain planning is a platform that enables a company to create, manage, link, align, collaborate on and share its supply chain plans across a supply chain. It spans from demand creation to detailed supply-side response and from operational to tactical-level planning. Integrated supply chain planning (SCP) is the single version of the truth for the end-to-end supply chain plan. It will typically cover most of the optimize layer of the CORE model.

Why This Is Important

Business value is determined by process maturity and, incrementally, by increasing maturity, which requires layering up of appropriate SCP technology starting with integrated SCP. Although the impact of an initial integrated SCP solution deployment is capped at what Level 3 planning processes can deliver, Level 4 planning maturity can only be fully realized with relevant advanced SCP capabilities layered on top of a suitable integrated SCP solution. Ideally, these advanced SCP capabilities should come from the incumbent integrated SCP vendor.

Business Impact

Integrated SCP solutions enable enterprises to make better use of resources by coordinating supply and demand, and by using analytics to help identify anomalies in demand and supply conditions across a complete supply chain. They will support the move to more global and extended supply chains, allowing for a strong foundation from which to build higher-maturity planning processes, process standardization and an environment in which it is easier to propagate best practices.

Drivers

- The globalization of supply chains requires the E2E planning of larger planning models.

- The need for a single version of the truth to align constrained resources to fulfill the demand signals.

- Increasing SCP process maturity and associated best practices to support improved supply chain performance.

- The need to support sales and operations planning (S&OP) processes.

- More complex and uncertain operating environments drive the need for higher-quality planning decisions.

- The increasing need to support more granular planning to get closer to execution.

- Increasingly, users will require planning SORs that can cover their extended multienterprise supply chains as well as their internal enterprise plans. This has pushed SCP vendors to move to software as a service/cloud technology and fast-planning capabilities (e.g., in-memory data models) as a means to support large, extended planning models.

- The typical justification for an integrated SCP solution includes inventory and cost reductions, customer service improvement and planner productivity increases. Most integrated SCP vendors have added some ML to their solutions to help enable some initial digital planning capabilities for their customers, especially in the realm of demand forecasting and decision automation.

Obstacles

- Currently deployed SCP technology may not support the evolution to an integrated SCP solution; in these cases, new technology solutions are likely required.

- Carefully evaluate SCP vendors to see whether they are able to support integrated SCP. This will mean more than the functional breadth and depth of the solution/modules. It is paramount that the architecture of the SCP solution is appropriate in that a single model of the supply chain is leveraged by the different planning analytics (demand, inventory, production, etc.).

- Companies trying to use their legacy integrated SCP solutions are often hitting scale and integration issues, and lack of usability and future-proofing.

- Adoption of integrated SCP is a key issue for companies and needs to be mitigated as an obstacle.

■ Lack of user training and/or change management can have a negative impact on the success of an SCP SOR implementation.

■ Companies are trying to build their own SCP solutions and not succeeding in driving sufficient integrated planning, leading to suboptimal decision making.

User Recommendations

■ Evaluate integrated planning if you want to standardize SCP technology to leverage skills, integration and best practices.

■ Evaluate integrated planning if you are looking to improve the S&OP process as it is foundational to a strong S&OP process that is linked to operations and execution, as well as other domains in the company (for example, financial, labor, new product and suppliers).

■ Evaluate integrated planning if you want better data and process integration, supported by a single version of the truth, improved plan visibility and strong internal collaboration to ensure alignment and consensus.

■ Evaluate integrated planning if you are looking to mature planning processes through the acquisition of additional planning functionality, but within the context of an integrated operational planning environment so as not to create islands of process, data, optimization or ERP integration.

■ Link the acquisition of an integrated SCP solution with your overall maturity journey as it forms a key foundation for further digital planning transformations.

Gartner Recommended Reading

Magic Quadrant for Supply Chain Planning Solutions

Critical Capabilities for Supply Chain Planning Solutions

Optimize Planning

Analysis By: Tim Payne

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Optimize planning refers to the ability to create an optimal plan given the current resources and configuration of the supply chain. It is focused on creating optimal demand and supply plans, taking account of any constrained resources to best achieve the goals of the company. It is the O layer in the CORE model. The decisions that optimize planning supports will be aligned across the end-to-end supply chain.

Why This Is Important

- Optimize planning is typically focused on the tactical time frame. It is the area of planning that most SCP vendors grew up in. Hence it is well-represented in the market.

- Most companies have some form of optimized planning in their technology landscape covering demand, inventory and supply planning.

- It is currently being expanded to cover other resource types/assets that should be considered when developing a feasible tactical plan (e.g., workforce, transportation, finance, carbon dioxide).

Business Impact

Optimize planning has the following impacts:

- It produces a feasible plan for the optimal use of key resources to achieve supply chain goals such as service, cost and profitability.

- It is key to supporting a strong S&OP process — both level 3 and level 4 S&OP maturity (aka IBP).

- At level 3 maturity, the benefits focus on improving internal measures such as inventory turns, customer service and cost.

- At level 4 maturity, the focus switches to improving external measures such as profitability and market share.

Drivers

- Over the last few years, companies have been progressively trying to deploy their optimize planning capability through end-to-end approaches to support a balanced, integrated plan across at least the enterprise supply chain.

- With the evolution of cloud-based SCP solutions, in-memory computing and single data models (eventually to become digital supply chain twins), this integration of functional planning is becoming easier to achieve.

- Ensuring the optimal use of scarce resources is driving more interest in stronger optimize planning capabilities.

- With the gradual improvement in the quality of the digital representation in the supply chain planning solutions (e.g., better representation of uncertainty), companies can start to move to probabilistic planning and increase the degree of resilient planning they perform.

- Due to this, companies often start their gradual journeys toward a digital supply chain twin in their optimize planning layer.

Obstacles

- The technology for optimize planning has been around for many years, typically encapsulated in the planning system of record.

- The lack of a single data model at the supply chain level will impede any efforts toward optimize planning as it needs to enable aligned decisions across an E2E supply chain. Separate functional models (e.g., the demand network and the supply network) will prevent the necessary degree of alignment and synchronization of demand and supply decisions inherent in optimize planning.

- Traditionally, optimize planning solutions (aka supply chain planning solutions) have supported decisions regarding material and production machine capacity. Increasingly, companies face with other scarce resources they need to consider, such as transportation, labor, finance and energy.

- Lower quality optimize decisions can result if the planning solution model (the digital representation) is not reflective of the realities of the real-world supply chain, especially in terms of uncertainty. This can result in the plans being quickly broken in execution.

User Recommendations

- Align planning decisions horizontally and vertically throughout the supply chain. Hence, acquiring an integrated end-to-end optimize planning capability should be a key part of any company's SCP technology roadmap.

- Evaluate commercial SCP software already in place to determine whether the incumbent solution can support integrated E2E optimize planning.

- Acquire the right capability for a planning system of record, as getting a feasible, balanced tactical plan is the starting point for most companies.

- Ensure that the solution chosen has the appropriate predictive and prescriptive analytics for the target supply chain (such as heuristics, optimization and/or ML) and that the vendor has a roadmap for a digital supply chain twin.

- Enable co-planning with suppliers and/or customers, ensure that the optimize planning capability is cloud-based and scalable so that it can be stretched out to key trading partners.

Gartner Recommended Reading

Magic Quadrant for Supply Chain Planning Solutions

Critical Capabilities for Supply Chain Planning Solutions

Supply Chain Segmentation

Analysis By: Michael Dominy, Marco Sandrone

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Definition:

Supply chain (SC) segmentation is the design, implementation and management of strategies applied across the end-to-end (E2E) supply chain for distinct customer experiences, from order through services, or targeted to a role, function or process. Each segment has two to five distinct operational outcomes and standard procedures, different targets for relevant metrics, defined flows through the physical and digital SC, and required behavioral changes across and outside SC-owned activities.

Why This Is Important

Segmentation techniques can help SC leaders deliver the best outcome, balancing cost, growth, efficiency and complexity. SC segmentation improves alignment of SC designs, processes and performance to better meet varying customer needs. Segmentation can also enable a shift to an outside-in value focus that is required of high-maturity SCs. Historically, SC segmentation has been ad hoc, not linked to metrics and performance. Successful implementations should have a repeatable, standardized playbook and ongoing segmented governance.

Business Impact

SC segmentation allows organizations to effectively handle complexity via two forms of segmentation:

- E2E segmentation efficiently supports product, market and channel expansions that add to SC complexity. It helps plan change roadmaps, and shift the cultural focus toward customer and business value.

- Targeted segmentations realize near-term value through smaller-scale differentiation within specific functions (such as new product introduction, procurement, planning, manufacturing, inventory, logistics and customer service).

Drivers

The Hype Cycle position represents an average of adoption of the two extremes of segmentation complexity, and has maintained its previous position on the Slope of Enlightenment. This has been driven by:

- **E2E segmentation:** Over the last two years, leading SCs in most industries have successfully embarked on E2E segmentation. SC maturity of Level 3 and above is critical for successfully sustaining implementation. E2E segmentation would be positioned on the Trough of Disillusionment because many organizations struggle to move from functional to E2E segmentation.

- **Targeted segmentation:** Smaller-scope targeted segmentations (categorizing suppliers, ABC inventory categorization, fulfillment channel) are common and feasible for virtually every SC organization. Successful implementation examples can take weeks or months in organizations of maturity Level 2 and above. There are identified use cases for each SC function.

- **Complexity:** Disruptions and growing complexity in customer requirements have increased interest.

- **Standardized approach:** We expect it will be two to five years for a consensus and a formal segmentation approach to be documented that will enable full mainstream adoption with explicit ties to financial and operational metrics.

Obstacles

- **Maturity:** Many implementation attempts fail due to lack of SC maturity. Having an effective sales and operations planning (S&OP) process in place is crucial because segmentation requires more complex trade-offs than basic supply and demand trade-offs. Targeted segmentation can commence at lower maturity, but E2E segmentation entails highly complex changes, taking two to three years to implement.

- **Ineffective design:** Segments are too conceptual, without enough detail or analysis to implement. Segmentations are informal, lack differentiated metric targets or governance by segment. Business dynamics prevent implementation of designs.

- **Stakeholder roadblocks:** Vague discussions create stakeholder fear that needs will not be met. Project teams may lack influence or ability to create incentives that will drive required behavior changes.

- **Inadequate results:** Designs do not identify new sources of value and just rehash existing assumptions.

- **Insufficient cost and profitability analysis:** Constraining the number of segments requires demonstrating which segments are not attractive to establish.

User Recommendations

- Standardize a segmentation playbook by appointing a leader to develop it and drive continuous improvement.

- Create an E2E segmentation aspiration by moving from "one size fits all" to a menu of E2E customer-need-based operating models.

- Develop prerequisites by creating a multiyear roadmap: Level 3 or above maturity, cost-to-serve analysis, common metrics and collaborative decision making.

- Ensure segmentations are relevant and warranted, by identifying and quantifying the impact to financial and operational measures.

- Refine and govern segments by revisiting the service menu, as business and customer needs change.

- Ensure behavior changes by specifying and justifying when, why, and how resources must choose between ways of completing a task.

- Ensure segmentations are sustained by refining and maintaining the number and types of segments during strategic planning and events (such as new product launches, new routes to market, or acquisitions).

Gartner Recommended Reading

Segmentation 101: Apply Supply Chain Segmentation to Serve Diverse Needs and Reduce Waste

Part 1 — Enable Competitive Advantage With End-to-End Supply Chain Segmentation: Segment Based on Customer Order Needs

Create Cost-to-Serve Model in 6 Steps, Part 1 — Scope Data Analysis for Action

Short-Term Demand Sensing

Analysis By: Amber Salley

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Demand sensing provides real-time visibility and predictive insights into channel demand, and is enabled by advanced technologies that incorporate channel data into a set of strong foundation planning, modeling and analysis practices. Pattern recognition, performance analytics, simulation and optimization, and scenario management support short-term and midterm demand and account management.

Why This Is Important

The integration of a demand-sensing capability in supply chain planning is growing as organizations seek methods to differentiate their demand management approach and to get a more accurate signal for supply planning.

Business Impact

Companies invest in short-term demand sensing to create higher quality, more granular shorter-term forecasts and improve short-term supply planning decisions. It enables value chain partners to be more responsive to consumers' changing needs and preferences. Short-term demand sensing is an effective tool in understanding sell-through activities and the impact to product mix and customer mix for margin and profit enhancement as well as support inventory and service objectives.

Drivers

- Demand-sensing technology has been in use since the early 2000s and the technologies are maturing to include the use of simulation and optimization. This capability has been used primarily in B2C environments with a focus on near-term forecast enhancement, and efforts are being made to extend demand sensing to midterm planning horizons. The integration of unstructured data into demand management activities incorporates consumer sentiments from social networking websites.

- Demand sensing within industrial B2B models has relevance since manufacturers attempt to gain visibility to demand through indirect wholesale and distribution channels.

- The integration of causal data and unstructured data into demand-sensing activities incorporates consumer sentiments from social networking websites. The impact to supply planning and scheduling is that real-time sensing can replace rule-based consumption of weekly or monthly demand forecasts.

- Vendor-managed inventory (VMI) is one form of collaboration with direct customers that can offer the potential for increased demand visibility which can then be used by demand sensing algorithms to more accurately predict demand.

Obstacles

- Establishment of scalable, sustainable demand-forecasting and demand-planning capabilities is essential to effectively support demand sensing. This includes having a mature demand-planning process with appropriate governance and accountability frameworks in place.

- The value of demand sensing comes from having infrastructure in place to collect and cleanse data, and having good analytics to translate data into better demand forecasting inputs.

- Demand-sensing tools are part of a structured supply chain planning (SCP) technology platform. For demand sensing to improve supply chain responsiveness, there must be an adequate supply response capability built into the technology environment.

- While the technology for enablement is available for industrial B2B models, alignment of incentives to foster collaboration with indirect channel partners remains a challenge.

User Recommendations

- Start with the end in mind. Identify use cases for the improved forecast before engaging in a demand-sensing initiative. Consider potential improvements to perfect order performance, customer service, and more efficient production scheduling.

- Prioritize vertical industry experience when evaluating technologies for demand sensing and the types of downstream data supported. Choose a vendor that has a defined roadmap of uses for downstream data by evaluating what types each vendor is capable of supporting today and within the next 12 to 24 months.

- Be aware of possible Internet of Things (IoT) initiatives that can enrich the demand-sensing capability as different elements within the IoT can prove to be a very valuable input to the demand-sensing algorithms.

- Consider using a business process outsourcing (BPO) or business process as a service (BPaaS) model as an alternative if investment in the technology is not possible or if there are concerns with upskilling demand planning resources.

Gartner Recommended Reading

Understand Digital Practices in Supply Chain Planning for Better Results

Use-Case Prism: Artificial Intelligence for Supply Chain

Data Lake

Analysis By: Roxane Edjlali, Michele Launi

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

A data lake is a collection of data storage instances combined with one or more processing capabilities. Most data assets are copied from diverse enterprise sources and are stored in their diverse formats, so they can be refined and repurposed repeatedly for multiple use cases. Ideally, a data lake will store and process data of any structure, latency or container (files, documents, result sets, tables, formats, BLOBs, messages, etc.).

Why This Is Important

Data lakes enable advanced analytics and complement traditional data warehouses. For example, the massive repository of source data in a data lake supports broad, flexible and unbiased data exploration, which is required for data mining, statistics, ML and other analytics techniques. A data lake can also provide scalable and high-performance data acquisition, preparation and processing, either to be refined and loaded into a data warehouse, or for processing within the data lake.

Business Impact

A data lake can be a foundation for multiple forms of business analytics. For example, data science is a common first use case for a data lake, which leads to predictive analytics that help a business retain customers, execute impact analyses, and anticipate issues in maintenance, logistics, risk and fraud. Similarly, using a data lake for self-service data access is a growing business use case that contributes to programs for business transformation and digitization.

Drivers

- User organizations are increasingly driven by data and analytics. This is so they can achieve their goals in business transformation, digitization, data democracy, operational excellence and competitiveness. A data lake provides data and supports analytics for these high-value goals.

- Organizations need to expand their analytics programs. Established forms of analytics will continue to be relevant — namely reports, dashboards, online analytical processing (OLAP) and statistical analysis. Hence, organizations must maintain these while expanding into advanced forms of analytics, such as data mining, natural language processing (NLP), machine learning, artificial intelligence and predictive analytics. A data lake provides the scale, as well as the structure-agnostic storage and processing options, that advanced analytics require.

- Data exploration and data engineering has become a common practice. This is true for many user types, from data scientists and analysts to business end users who are capable of self-service data prep. A data lake, when designed properly, can provision data for the diverse exploration requirements of multiple user types and use cases.

- Data lakes can expand the data warehouse and address additional use cases, such as data exploration on data. In these cases, the warehouse and lake are integrated by shared refined datasets, platform infrastructure (DBMS brands and storage, whether on-premises or cloud) and architecture components (data landing/staging).

Obstacles

- Data lake best practices are still evolving. There is still much confusion about how to design and govern a data lake, plus how to optimize a lake's data without losing its purpose as a repository for data science and advanced analytics. An emerging practice clears this obstacle by designing the internals of a data lake as a series of data zones for business use cases (data science, exploration and self-service) and technology architectural components (data land/staging and special data structures or latencies).

- The first data lakes, built on Hadoop, were for data science only, and they lacked metadata, relational functionality and governance. Today's data lake is on cloud, it has different data storage types, and it supports multiple analytics techniques (not just data science). Data governance is crucial and cannot be neglected; it includes data quality, data catalog, data security and data life cycle management.

User Recommendations

- Build a competency in data science and advanced analytics by first building a data lake as a foundation.

- Staff the data lake for maximum value by hiring data scientists, data engineers and analysts who have the skills required to conduct data exploration and analytics with the lake's data.

- Create business value by designing a data lake that addresses multiple high-value business use cases, such as data science, analytics, self-service data access or customer 360.

- Enable broad data exploration, multiple analytics techniques, and machine learning by populating a data lake with broadly collected data in various structures, formats and containers.

- Modernize the whole data architecture to extend the data lake. Consider logical data warehouse and lakehouse concepts.

- Keep each data lake from becoming a data swamp by governing the use of data in the lake, curating the data allowed into the lake, and documenting data via metadata and other data semantics.

Sample Vendors

Amazon Web Services (AWS); ChaosSearch; Cloudera; Databricks; Dremio; Google Cloud Platform (GCP); Infoworks; Microsoft; Snowflake

Gartner Recommended Reading

Building Data Lakes Successfully — Part 1 — Architecture, Ingestion, Storage and Processing

Building Data Lakes Successfully — Part 2 — Consumption, Governance and Operationalization

Data and Analytics Essentials: Data Warehouses, Data Lakes and Data Hubs

Market Guide for Analytics Query Accelerators

Network Design

Analysis By: Vicky Forman

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Network design is the creation of a supply chain model to optimize the network for chosen strategic objectives. These efforts may include a network that is highly responsive to changing customer needs, cost-efficient, flexible to handle demand variability, rationalized after an acquisition or one that is resilient. Developing pragmatic scenarios defined on known network attributes and testing for sensitivity to changes in key variables are necessary to successfully execute on a design.

Why This Is Important

Today's volatile business environment, marked by rapid shifts in demand, supply and logistics constraints and geopolitical upheaval, is one where network configurations of the past are being questioned. Organizations that invest in an analytics-driven approach to supply chain design can better assess the trade-offs between cost, service-level requirements, resilience and sustainability, among other factors, to optimize footprint, capacity and network flows for these conflicting priorities.

Business Impact

As supply chains balance customer experience, capacity constraints, shifts in demand channels and geopolitical challenges, the role of supply chain network design has grown in prominence. Intentional design of the physical footprint can fine-tune trade-offs between cost efficiency, growth and resilience. Optimizing product flows through a network of suppliers, factories, warehouses or retail outlets can improve utilization of existing capacity while prioritizing the customer experience.

Drivers

- Organizations looking to move away from low-cost models to risk-balanced and cost-optimized ones are being pummeled by ongoing uncertainty in global supply chains. Balancing near-term cost efficiency against resilience and long-term total cost to serve is complicated by inflation and other disruptions.

- The need to respond to repeated demand and supply disruptions across ecosystems, manage transformative growth in online sales and remain agile while doing so.

- Aligning footprint, capacity and product flow with business model changes, such as a regional manufacturing model or optimizing the network for growth in multichannel fulfillment.

- Given the shifts in trade policies around the world, optimizing global manufacturing capacity and extended supplier networks in response to trade policy fluctuations is an essential capability.

- Investments in analytics to democratize insights and improvements in decision making through better scenario-planning capabilities are critical to help organizations respond to fast-moving trends. Pragmatic scenario analysis can help with placing considered strategic bets amid uncertainty.

- Creating a suitable design early in a product life cycle, before functional constraints are in place, allows for better optimization of the total costs.

- Ensuring a physical configuration that enables appropriate trade-offs between inventory, cost and service-level requirements through period testing of fulfillment options and policy settings.

Obstacles

- Designing supply chains requires a focus on long-term objectives that are often not easy to decipher and can be obscured by immediate operational challenges.

- Given the specialization and geographic concentration of many supplier ecosystems, diversifying the network may be a task of enormous cost, complexity and time.

- Implementation risk driven by lack of buy-in for network alternatives that weigh cost benefits against network impact and execution complexity.

- When there are multiple conflicting priorities for the network, determining the relative importance and gaining buy-in can be complex and time-consuming.

- For organizations deploying in-house network design solutions, the availability of skilled resources that understand business objectives can be a limiting factor.

- Complexity presents a need for dedicated analytical resources, and the learning curve for technology limits mainstream adoption of software tools.

User Recommendations

- Make network design a mainstay of analytics initiatives within the supply chain. For large projects, define network objectives, project scope and delivery expectations in a robust early planning phase.

- Align scenarios and prioritize for the network to meet business objectives and the ability to change.

- Design and shortlist scenarios with stakeholders. Create the baseline and provide trade-off analysis for selected scenarios. Conduct sensitivity analysis to explore creative options around the optimal solution.

- Select the final "to be" design on its expected performance to the chosen objectives, as well as on qualitative criteria. These criteria include complexity of implementation, social and environmental impact of policies, and brand value of the ability to mitigate or avoid disruptions.

Gartner Recommended Reading

Market Guide for Supply Chain Network Design Tools

Global vs. Regional Supply Chains — Identifying the Right Approach for Your Network

Multiechelon Inventory Optimization

Analysis By: Joe Graham, Tim Payne, Pia Orup Lund

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Gartner defines multiechelon inventory optimization (MEIO) as a supply chain planning (SCP) system of differentiation that supports Stage 4 inventory planning. Most MEIO products use optimization-based technologies with some business intelligence and analytics capabilities. Over time, they are incorporating event-based and discrete-event simulation, as well as probabilistic techniques, to enable companies to model uncertainty factors.

Why This Is Important

MEIO helps users improve response and tactical management across a multilevel supply chain by enabling them to identify appropriate inventory and postponement protocols, taking all echelons in the supply chain into account in the optimization. It helps users look beyond inventory optimization and toward broader facets of the supply chain (for example, sourcing and replenishment strategies) so that they can support segmented response strategies for different customers, categories and channels.

Business Impact

MEIO solutions enable enterprises to use supply chain assets — people, equipment, inventory, money, suppliers, routes, locations and promises — more effectively, while realigning or segmenting the use of these assets across multiple customer, product and channel categories. Long-term business, what-if evaluations and scenario planning will eventually be commonplace to support any number of strategies and tactical possibilities.

Drivers

- MEIO is one of the more popular advanced planning capabilities for companies to develop as they look to improve supply chain (particularly, service and inventory) performance.

- Access to MEIO capabilities has become much easier with the absorption of both operational and tactical inventory optimization capabilities into SCP suites as part of an end-to-end SCP solution.

- Organizations are increasing their SCP maturity levels, with MEIO tools being required for higher maturity (Stage 3 or higher) inventory planning processes.

Obstacles

- MEIO tools require more mature inventory optimization processes and, therefore, are referred to as planning systems of differentiation. As such, an effective planning system of record with a strong digital twin of the supply chain is required to get the full benefit from MEIO.

- Inherently, MEIO will move the strategy of inventory optimization to a networkwide decision-making level versus regional or local decisions, resulting in adoption challenges.

- Fewer independent MEIO vendors remain in the market, because SCP and ERP vendors have developed or acquired the capability to offer MEIO as part of their application suites. However, a small group of specialist vendors aims to offer MEIO for spare parts planning.

User Recommendations

- Distribution-intensive industries (e.g., Consumer products, retail, aerospace and defense, utilities, and telecommunications) should use MEIO and SCP tools (implemented at Stage 3 SCP maturity, where end-to-end planning is initiated) to extract the greatest value from inventory and supply chain assets.

- The more scale and complexity your supply chain network (production and distribution network) and demand profile have, the higher the potential benefits can be achieved through MEIO. Exploiting this value, however, requires careful management of user skills and competencies.

Gartner Recommended Reading

Combine SKU Segmentation With Inventory Calculation to Optimize Supply Plan
Alignment

Operationalize Inventory Reduction Targets With Integrated Supply Plan Proposals

Orchestrate 3 Decision Layers for Inventory Excellence and Supply Chain Performance

S&OP

Analysis By: Pia Orup Lund, Tim Payne

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

S&OP is mainly focused on operational and tactical reconciliation, typically focused on balancing demand and supply. Technology needs to support the aggregation and harmonization of operational and tactical plans. However, the most prevalent technology for S&OP is still the spreadsheet, albeit supported by ERP and integrated planning solutions. S&OP focuses on the midterm time horizon. At higher maturity levels, S&OP is accompanied by integrated business planning (IBP).

Why This Is Important

S&OP's objective is to create a forward-looking plan that considers forecast demand, projected supply, and financial objectives. By not having a forward-looking plan, organizations keep on reacting to what is coming. This can come at the sacrifice of cost and consequently on profitability.

Business Impact

S&OP technology can help companies make better use of resources by balancing supply with demand. It can also deliver improved collaboration throughout the organization, as well as what-if simulations and scenario management capabilities. This can help in the evaluation of alternative operational options and some reconciliation of operational plans to financial plans and budgets. S&OP has a focus on achieving better results within the constraints of the current operating model and resources.

Drivers

- Interest in S&OP from end users is strong. Many are reexamining their processes and trying to determine how to make them more effective and deliver value in achieving both the business strategy and financial objectives.

- Interest is driven by the need for better visibility and scenario management in the supply chain to help evaluate different potential outcomes and effects arising from increased uncertainty on the supply and demand sides.

- SCP vendors are expanding their capabilities, in general, to include S&OP capabilities along with a closer link to the operational planning layer to ensure plans are executed. ERP vendors have introduced S&OP capabilities that are oftentimes designed as functional-specific applications.

- Specific S&OP technology, as opposed to comprehensive SCP solutions, is also maturing, with some vendors adding more capability in order to bring a stronger financial analysis dimension to the process.

Obstacles

- Successful adoption of S&OP has been limited by organizational issues and by the inability of technology to support a truly cross-functional process with integrated what-if scenario planning and execution capabilities. Today, however, the organizational aspect is more limiting than the technology aspect due to rapid development within cloud solutions to support supply chain planning.

- Early maturity S&OP lacks formal process steps, metrics, forward-looking views and cross-functional participation. This limits the ability to maximize opportunity and mitigate risk over the midterm and long-term horizons through profitable trade-offs for the successful execution of the business strategy.

User Recommendations

- Evaluate the different tools in the market to support early-stage S&OP process initiatives. Pay attention to how they support the different stages of S&OP maturity — not just the data aggregation and representation requirements. S&OP is a trade-off management process, so the tool must help visualize the trade-offs. Understand that the demand planning, sales planning, or supply planning solutions that have been extended with S&OP screens and reports will help. However, these won't necessarily support all the process requirements and financial impact analyses of S&OP.

- Do not look at S&OP as a stand-alone decision process, but evaluate the different S&OP tools keeping in mind the connection to other planning layers.

- Consider SCP solutions that can support a mature S&OP process with the additional capability to support IBP when the business is ready, if there is a goal to get to a more mature S&OP

Gartner Recommended Reading

Build the Right Foundation for a Successful S&OP Process

Design an Effective S&OP Process Beyond the Mechanics of the Four Steps

Improve S&OP Decision Making Through Scenario Planning

Appendixes

See the previous Hype Cycle: Hype Cycle for Supply Chain Planning Technologies, 2020

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 2: Hype Cycle Phases

(Enlarged table in Appendix)

Phase ↓	Definition ↓
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
Trough of Disillusionment	Because the innovation does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the innovation's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the innovation are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the innovation to reach the Plateau of Productivity.

Source: Gartner (July 2023)

Table 3: Benefit Ratings

Benefit Rating ↓	Definition ↓
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics.
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise.
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise.
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings.

Source: Gartner (July 2023)

Table 4: Maturity Levels

(Enlarged table in Appendix)

Maturity Levels ↓	Status ↓	Products/Vendors ↓
Embryonic	In labs	None
Emerging	Commercialization by vendors Pilots and deployments by industry leaders	First generation High price Much customization
Adolescent	Maturing technology capabilities and process understanding Uptake beyond early adopters	Second generation Less customization
Early mainstream	Proven technology Vendors, technology and adoption rapidly evolving	Third generation More out-of-box methodologies
Mature mainstream	Robust technology Not much evolution in vendors or technology	Several dominant vendors
Legacy	Not appropriate for new developments Cost of migration constrains replacement	Maintenance revenue focus
Obsolete	Rarely used	Used/resale market only

Source:Gartner (July 2023)

Document Revision History

Hype Cycle for Supply Chain Planning Technologies, 2020 - 12 November 2020

Hype Cycle for Supply Chain Planning Technologies, 2019 - 29 October 2019

Hype Cycle for Supply Chain Planning Technologies, 2017 - 18 December 2017

Hype Cycle for Supply Chain Planning, 2016 - 9 November 2016

Hype Cycle for Supply Chain Planning, 2015 - 25 November 2015

Hype Cycle for Supply Chain Planning, 2014 - 27 October 2014

Hype Cycle for Supply Chain Planning, 2013 - 22 November 2013

Recommended by the Authors

Some documents may not be available as part of your current Gartner subscription.

Understanding Gartner's Hype Cycles

Applying AI — Business Domains

Maverick* Research: It Is Time to Move Beyond Traditional S&OP — Introducing Decision-Centric Planning

Predicts 2023: Supply Chain Technology

Functional Focus Is a Key Reason We Can't Get Enough Value From Our Supply Chain Digital Investments

Acquire and Mature a Digital Supply Chain Twin With a Gradual Approach

Quick Answer: Defining Control Tower, Command Center and Digital Supply Chain Twin

Research Roundup: Achieve Better Business Outcomes With Digital Supply Chain Twin Tech in 2023

Market Guide for Analytics and Decision Intelligence Platforms in Supply Chain

---

Table 1: Priority Matrix for Supply Chain Planning Technologies, 2023

Benefit	Years to Mainstream Adoption			
↓	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational		Decision Intelligence	Deep Learning for SCP Digital Supply Chain Twin Generative AI Integrated Business Planning	Artificial Intelligence Digital Supply Chain Planning Resilient Planning
High		Integrated Supply Chain Planning Network Design Optimize Planning Short-Term Demand Sensing Supply Chain Control Tower	Advanced Analytics Autonomous Planning Configure Planning Data Fabric for SCP Explainable AI Graph Analytics for SCP Machine Learning Probabilistic Supply Chain Planning Respond Planning Simulation in SCP Supply Chain Segmentation	Composable SCP Decision-Centric Planning Decision Engineer
Moderate	S&OP	Data Lake Multiechelon Inventory Optimization Supply Planning	Long-Term Demand Sensing Natural Language Generation Profitable to Promise	Edge Analytics and AI for SCP SCP Outsourcing

Gartner

Benefit	Years to Mainstream Adoption			
↓	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Low			API Marketplaces in Supply Chain Planning	

Source: Gartner (July 2023)

Table 2: Hype Cycle Phases

Phase ↓	Definition ↓
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
Trough of Disillusionment	Because the innovation does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the innovation's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the innovation are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the innovation to reach the Plateau of Productivity.

Phase ↓	Definition ↓

Source: Gartner (July 2023)

Table 3: Benefit Ratings

Benefit Rating ↓	Definition ↓
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics.
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise.
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise.
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings.

Source: Gartner (July 2023)

Table 4: Maturity Levels

Maturity Levels ↓	Status ↓	Products/Vendors ↓
Embryonic	In labs	None
Emerging	Commercialization by vendors Pilots and deployments by industry leaders	First generation High price Much customization
Adolescent	Maturing technology capabilities and process understanding Uptake beyond early adopters	Second generation Less customization
Early mainstream	Proven technology Vendors, technology and adoption rapidly evolving	Third generation More out-of-box methodologies
Mature mainstream	Robust technology Not much evolution in vendors or technology	Several dominant vendors
Legacy	Not appropriate for new developments Cost of migration constrains replacement	Maintenance revenue focus
Obsolete	Rarely used	Used/resale market only

Source:Gartner (July 2023)