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RESEARCH

Demystifying the value of composable architectures for supply chains

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The Bottom Line

Today's supply chains are under constant pressure from trade wars, demand shifts, supplier delays, and unexpected disruptions, making adaptability essential. Many companies struggle with outdated systems that require expensive upgrades to add new capabilities. Solutions built on a composable architecture address this by allowing organizations to add or upgrade supply chain functions such as forecasting, inventory management, and procurement without replacing their entire system or making large IT investments. Instead of waiting for months-long upgrades, companies can quickly deploy new tools that work alongside existing systems, improving decision-making and efficiency. When organizations deploy composable supply chain planning (SCP) solutions, Nucleus found they can reduce inventory holding costs by 8 to 15 percent, improve service level performance by 5 to 10 percent, and eliminate the need for large-scale IT project approvals, enabling faster adoption of critical capabilities without disrupting core operations.

The Value of Composability

The modern supply chain is more unpredictable than ever. Shifting trade policies, supply shortages, and labor constraints have made disruptions a constant challenge, forcing organizations to rethink how they manage operations. Organizations can no longer rely on static planning models or manual adjustments to keep up. They need to be adaptable in how they source, store, and ship products and in the technology they use to manage these processes.

Rigid, all-in-one supply chain systems slow down decision-making and force organizations to rely on costly manual workarounds when disruptions occur.

For many organizations, reacting to disruptions is slow and costly because their supply chain technology is built on monolithic systems, which are large, all-in-one platforms designed decades ago to support predefined processes. Without extensive system-wide updates, these systems lack the flexibility needed to adjust core functions like forecasting, inventory planning, and procurement. If an organization needs to modify lead times, scale operations, or integrate a new tool, they often face months of IT development, testing, and deployment before seeing results. This lack of agility forces organizations to rely on manual workarounds, excess inventory, or reactive decision-making, which drive up costs and limit their ability to adjust to market shifts.

Composable architecture is a structural approach that allows supply chain solutions to be built as independent components rather than part of a rigid, all-in-one system. These solutions are broken down into self-contained services that can be individually developed, tested, and deployed, allowing organizations to add, upgrade, scale, or replace specific supply chain functions without disrupting the entire system. Instead of waiting for a complete system overhaul, organizations can integrate targeted tools such as improved forecasting models, lead-time prediction, or automated procurement adjustments exactly when needed. Because composable architectures are cloud-based and API-driven, they enable faster processing of supply chain data and easier adoption of new technologies, such as machine learning models, without overloading existing systems.

Composable architectures allow organizations to integrate new tools—such as forecasting models or automated procurement—without waiting for full-system upgrades.

The real value of composability is that it allows organizations to avoid large-scale IT investments and long approval cycles, keeping the focus on operations rather than system constraints. Instead of navigating lengthy funding requests, internal reviews, and IT-led deployment projects, operations teams can introduce solutions that immediately address inefficiencies. This removes bottlenecks in decision-making, enabling organizations to respond faster to disruptions, reduce costs, and improve supply chain performance.

Typical Benefits

Nucleus found that organizations utilizing a composable architecture can typically realize the following benefits:

Nucleus found that organizations deploying solutions built on a composable architecture improved service level performance by 5 to 10%

Increased Operational Resilience

Nucleus found that organizations using composable supply chain solutions can more effectively manage inventory across multiple locations, preventing excess stock buildup and avoiding procurement cost spikes as they respond to shifting tariffs, import restrictions, and regulatory changes. These organizations typically realize an 8 to 15 reduction in inventory carrying costs. Monolithic systems make it challenging to adjust sourcing strategies quickly, as any change to logistics, tax, or tariff calculations often requires IT-led updates. Organizations can add new tools or swap mathematical models based on business needs through composable architectures. This allows them to optimize sourcing decisions, demand forecasting, and procurement planning without waiting for system-wide modifications. This makes it easier to adjust lead times, shift supplier orders, and reallocate inventory in response to disruptions, ensuring that supply chain decisions remain efficient and cost-effective. Nucleus interviewed an electrical distributor using a composable lead time prediction tool, which improved its ability to anticipate supplier delays and reduce supply chain uncertainty. Eliminating the need for excessive safety stock reduced inventory holding costs by 10 percent. The organization also lowered the financial impact of long lead times, as each additional day of lead time required an extra $7.5M in inventory investment.

Improved Service Level Performance

By eliminating the need for full-platform upgrades, organizations lowered IT maintenance costs and freed up resources for higher-value innovation.

Nucleus found that organizations adopting composable supply chain solutions improved service level performance by 5 to 10 percent. When organizations can easily incorporate better forecasting models or more precise lead-time prediction tools, they can anticipate demand shifts earlier and adjust procurement strategies accordingly, ensuring the right products are available when customers need them. Without the constraints of rigid systems, organizations can respond faster to supply chain disruptions, reallocate inventory where it is needed most, and prevent service failures caused by outdated or inaccurate planning methods. By enabling faster adoption of the right tools at the right time, composability helps organizations improve order fulfillment, reduce missed shipments, and maintain stronger service commitments even in volatile market conditions.

Reduced IT Costs

Organizations that adopt a composable architecture reduce capital expenditures by eliminating the need for large-scale system overhauls, allowing them to add new capabilities without requiring extensive IT resources. Instead of full-platform upgrades, organizations can target specific areas for improvement, lowering long-term maintenance costs and ensuring IT investments align with actual business needs. The ability to scale individual components independently prevents unnecessary spending on system-wide changes. Composability also allows implementations to be self-funded, removing the need for complex business case approvals and enabling organizations to introduce incremental, high-impact improvements as needed. One organization that deployed a composable solution for lead-time prediction found that its IT team did not need to be involved in the implementation, eliminating the usual challenges of securing IT resources and budget approvals. Rather than requiring a full-system upgrade, the solution was bolted onto the organization's existing environment, seamlessly integrating with its supply chain operations without disrupting workflows. The organization avoided external consultants and lengthy IT projects, allowing them to adopt capabilities faster while keeping IT costs low.

Organizations should prioritize vendors with strong API-first integration capabilities, allowing seamless connectivity between ERP, WMS, TMS, and other supply chain systems without heavy customization.

Areas to Consider when Adopting

Nucleus found the following key factors to consider when selecting a vendor for composability. Organizations should evaluate how well a solution aligns with true composability principles, system interoperability, data security, and proven ROI to ensure they invest in a scalable and future-ready platform.

True Composability in Architecture

A genuinely composable solution should be cloud-native and built on microservices, not a monolithic application hosted in the cloud with composability layered on top. Vendors should offer independent, microservices-based components that handle specific functions such as forecasting or inventory optimization rather than bundling broad capabilities into a single application. Organizations should ensure that each function can be deployed and upgraded separately, allowing for more flexibility without requiring full-system updates. Vendors leveraging MACH architecture (Microservices-based, API-first, Cloud-native, Headless) often provide stronger composability and adaptability.

Interoperability and Ecosystem Support

The ability to seamlessly integrate with existing supply chain systems is critical. Vendors should support API-first connectivity to ensure data flows efficiently between Enterprise Resource Planning (ERP), Warehouse Management Systems (WMS), Transportation Management Systems (TMS), and planning tools without requiring extensive customization. A strong partner ecosystem is also important, enabling organizations to integrate third-party AI, analytics, and automation tools as needed. Look for pre-built connectors and open APIs that reduce integration complexity and minimize deployment time.

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Data Governance and Security

A composable solution should maintain data accuracy, consistency, and accessibility across all services, particularly when integrating external data sources like suppliers and logistics providers. Vendors should offer robust security protocols, identity management, and role-based access controls to protect sensitive supply chain data. Additionally, version control capabilities allow organizations to maintain multiple versions of services without disrupting operations, ensuring smoother transitions when updating or modifying components.

Demonstrated ROI and Use Cases

Vendors should provide proven case studies demonstrating how their composable architecture has delivered measurable benefits, such as cost savings, operational efficiency, and improved forecast accuracy. Organizations should ask for evidence of fast deployment timelines, typically weeks rather than months, to ensure solutions provide immediate value while remaining scalable for long-term adoption. Evaluating the vendor's track record with organizations of similar size and complexity helps ensure the solution can scale effectively and meet the business's specific needs.