Agile Demand-Supply Alignment

Responding to Demand Volatility and Supply Disruptions *After* Plans Are Set and Orders Placed

Part Three: ASDA Solution Assessments

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CHAINLINK RESEARCH

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Acknowledgement

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This is Part Three of our research series on Agile Demand-Supply Alignment (ADSA). We define ADSA as "*the capability to effectively realign supply and demand, during execution, in the face of demand volatility and supply disruptions.*" Regardless of how good companies get at planning, 'stuff happens' and companies then need to be able to rapidly adjust to the evolving actual situation on the ground. Part One describes the phases of supply chain planning and execution and lays out a framework for understanding the *Elements of ADSA*, as shown in Figure 1 below. Part One also includes examples of specific ADSA capabilities, such as In-Season Reordering, Agile Customer Mandate Compliance, and Opposite Hemispheres Strategy.

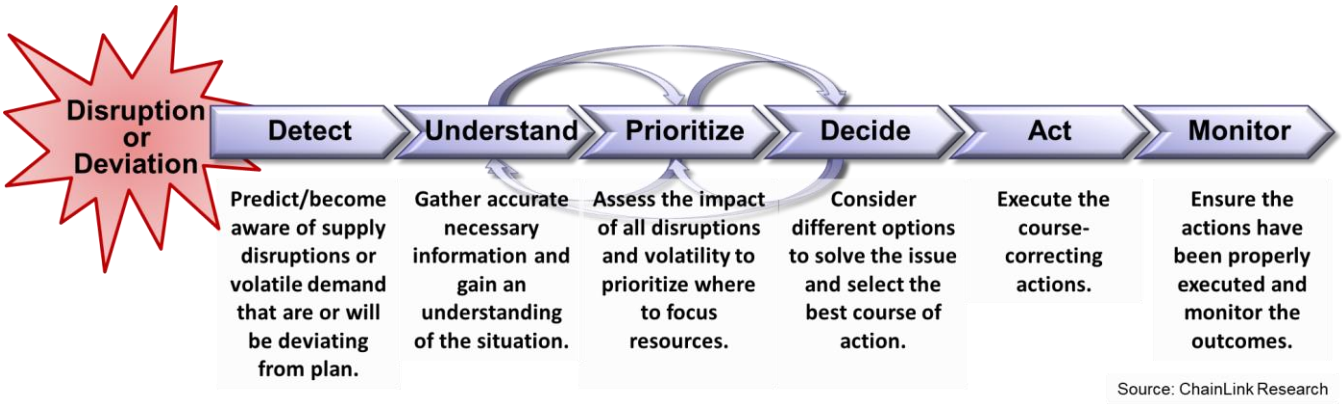

Figure 1 - Elements of Agile Demand-Supply Alignment

Part Two provides a framework for evaluating ADSA solutions, including what questions to ask solution providers, and how to shortlist providers. Here in Part Three, we assess nine different providers of ADSA solutions. This is not a complete market survey of relevant offerings, but rather a sampling of some important established and upcoming players. Each assessment is organized into five sections as follows:

1) *Target Customer Characteristics/Factors Driving Adoption*—Characteristics of typical target customers and what is driving their adoption of the solution. This includes a description of which industries and which size companies this solution focuses on, with a list of some example customers.
2) *User Roles Supported*—A list of the primary user functional roles that the solution supports (e.g., procurement, logistics, etc.).
3) *Functionality Supported*—Key functionality provided by the platform.
4) *Pricing, ROI, Time-to-Value*—The structure and basis for pricing, how ROI is achieved, services offered, and what is the typical implementation time and time-to-value.
5) *Who This Solution is a Good Fit For*—A short summary of what types of companies this solution would be most appropriate for.

Solution Providers Covered in This Report

- Alloy.ai
- Anvyl
- E2open
- Elementum
- IBM Sterling
- Infor Nexus
- Mercado
- One Network
- Zencargo

Alloy: *Plant-to-Store Inventory/Demand Visibility and Corrective Actions*

Alloy enables end-customer-demand-driven supply chain capabilities for CPG/FMCG[1] brands. This lets the CPG firm make replenishment and demand-shaping decisions that take into account the current actual end consumption and inventory levels throughout the down-stream network, rather than being driven solely by orders and forecasts from retailers.[2] Alloy provides CPG companies with SKU-location visibility across their downstream supply chain, all the way to the POS data from their retailer customer's stores, with alerts when inventory is predicted to be out of balance (shortages and excess), and tools to collaborate with retailers to resolve those imbalances.

Alloy uses current consumption and inventory data to show CPG firms what adjustments may be needed to current production and distribution plans. It helps them position inventory to the right points in the network. CPG firms can also provide valuable intelligence to their retailer customers and collaborate with them on jointly improving forecasts. It helps make CPFR actually work the way it was intended, and the CPG becomes a more trusted partner to the retailer.

The POS and downstream inventory visibility, modeling, and intelligence provided by the platform helps solve business challenges such as reducing stockouts and oversupply, thereby reducing the high cost of lost sales and excess inventory. It can reduce the constant firefighting by providing better visibility and more advanced warning of issues, in time to do something about them.

Target Customer Characteristics/Factors Driving Adoption

The Alloy solutions are aimed at consumer goods brands that have complex downstream supply chains, involving multiple DCs and a variety of channel models. This includes brands that have their own stores, sell direct to consumer via their own ecommerce site, and sell through retailer's stores and websites. Often these are fast growing brands, struggling to rapidly scale up their operational capabilities. Regardless of the speed of growth, CPG companies that are constantly firefighting, due to demand volatility and supply disruptions, would be a good fit for Alloy—especially when the cost of getting it wrong is high (i.e., lost sales, lost customer loyalty, and profit erosion from excess markdowns). Alloy is a good fit for those who want to use end consumer POS data to drive decision making. In contrast, a CPG company that is satisfied with driving their planning and execution using the orders and forecasts they receive from their retailer customers may not find a compelling enough reason to implement Alloy.

[1] CPG = Consumer Packaged Goods. FMCG = Fast Moving Consumer Goods.
[2] The stream of orders from retailers can be distorted by forward buys, unannounced promotions, and other factors.

Industry and Company Size Focus

Alloy focuses on serving CPG/FMCG brands, especially those in personal care/health and beauty, packaged food and beverages, high tech/consumer electronics, DIY automotive, and toy and hobby.[3] Their customers tend to be mid-sized enterprises with revenue between about $250M to several billion dollars. Alloy serves companies across a broad range of maturity of practices and processes.

Alloy Example Customers by Segment

- *Automotive Parts & Supplies*: Bosch, Valvoline
- *Personal Care*: Native, quip
- *High Tech*: eero, Anker, SimpliSafe
- *Toy and Hobby*: Cricut, Melissa & Doug
- *Packaged Foods*: Ferrero
- *Garden/Home*: Central Garden & Pet

User Roles

Users of Alloy tend to be customer-facing supply chain professionals in functional areas such as inventory management, supply chain planning, customer service, customer supply chain management, and sales/order fulfillment.

Functionality

Harmonizing Data from Multiple Disparate Sources

The Alloy platform ingests data from a variety of sources, including retailer's POS and inventory data. They have developed about 700 different pre-built data connecters that pull in and map data from major online and store-based retailers, ecommerce platforms, distributors, 3PLs, and ERP systems. Since the data comes in a wide variety of formats and semantic structures, the platform harmonizes the data into a single consistent canonical data model. This process includes things like: cleaning up master data so that product IDs, supplier names, and locations are consistent; converting units of measure to be consistent; mapping disparate product hierarchies into a single consistent set of product hierarchies; harmonizing product attribute data (e.g., names of colors, names of ingredients, types of fabric, etc.); and synchronizing calendars (e.g., fiscal vs. calendar years.)

Example Pre-built Connectors

- *Retailers*: Walmart, Target, Best Buy, Nordstrom
- *E-commerce*: Amazon, Magento, Shopify, BigCommerce
- *Distributors*: Ingram Micro, McLane, KeHE, Tech Data
- *3PLs*: FedEx, Expeditors, Flexport, DCL
- *ERPs*: SAP, Oracle, NetSuite, MS Dynamics

Building and Maintaining Accurate Master Data and Map of the Distribution Network

The platform uses transactional data (e.g., from POS, orders, and shipments) and hard-coded locations to build and maintain an accurate map of the distribution network, including lanes, carriers, DCs, and stores. This enables accurate maintenance of lead times and supply-from/to locations, enabling more precise modeling of network-wide replenishment needs, timing, and quantities. As new transactions come in, the map is updated, along with master data, such as when a new product appears in POS or shipment data. Accurate harmonized consumption and inventory data, combined with the accurate up-to-date network map, enables Alloy to predict shortages and excess inventory.

[3] Alloy does not focus on apparel/fashion or fresh and frozen foods.

Alerts, Drill Down, Recommendations, and Collaborative Resolution

Users are alerted when shortages and excesses are predicted by the platform. The alerts include information about which products are impacted, where the shortages are predicted to occur, and how many weeks of supply remain at each tier in the network (e.g., own DC, distributors' DCs, retailers' DCs, stores). Clicking on one of the products will drill down to show how that product flows through the network, including a view of days of supply at each trading partner (distributor or retailer) within each tier, and highlights of where the trouble spots are. It shows which distributors are supplied by each of the CPG's DCs, and in turn how many weeks of supply are left for each retailer through each of those distribution channels. The platform makes recommendations on adjustments to orders for each retailer through each distributor to compensate for the shortfalls or excesses. With a single click, all the relevant data for one of these trouble spots can be shared internally and with trading partners, along with comments and attachments, to discuss and agree on a resolution.

Pricing, ROI, Time-to-Value

Pricing Structure Encourages Usage and Collaboration

Alloy charges an annual subscription fee, paid upfront. The fee is structured to encourage maximum usage and data sharing across the organization; there are no charges based on the number of users or storage used. Instead, the subscription fee is based on several factors that approximate the value being realized:

- *Products used*—This part of the fee varies depending on which of Alloy's three applications are being used: Demand Intelligence, Inventory Intelligence, and/or Demand Planning.
- *Number of trading partners integrated*—There is a fee per integrated trading partner (retailer, distributor, 3PL)
- *Number and complexity of internal integrations (ERP systems)*— Most ERP data integration (customer orders and shipments, product masters, internal plans & forecasts, unit conversion) and D2C eCommerce data is included in the base product price.
- *Product/network mapping*—Mapping of the downstream network is included in the base product price—i.e., mapping each individual SKU to its independent locations and shipping lanes (from plants to DCs to stores).

ROI Realization Mechanisms

ROI is realized through a variety of mechanisms:

- *Prevention of lost sales*—by having inventory in stock at the store.
- *Reduction in spoilage and waste*—fewer markdowns and not producing product that will become obsolete or expired.
- *Increased sales*—When the CPG firm is highly reliable, always on time, and providing valuable intelligence to the retailer, the retailer has more faith and trust in that supplier and tends to give them more sales, and in some cases grants them a category captain role.
- *Reduced chargebacks*—increased OTIF compliance.
- *Reduced inventory carrying costs*—By optimizing the entire system, CPG firms can run leaner without sacrificing service levels, by not carrying inventory that won't sell.
- *Reduction in freight costs*—fewer expediting fees.

Services

Core implementation services (getting everything integrated and working, and training users) are included in the regular subscription fee at no extra charge. Other services on top of that are available on a time and material basis, such as extended training, advanced systems configuration, and process design. Alloy also offers managed data services or consulting services which includes data operations, client solutions expertise, and best practices on data analytics. Alloy employs a consultative selling process, identifying pain points and the use cases that Alloy can enable to address those pain points. For example, they may recommend that a CPG firm becomes more prescriptive with their retailer customers, instead of just being a passive order taker.

Rapid Implementation Enabled by Templates

Implementation typically takes about three months for the full solution, including the ERP integration. Individual POS integrations are quicker, sometimes in a couple of days or weeks, so the customers can start getting value sooner. As soon as the POS integration is validated, the customer starts getting visibility. Creating the network map takes a bit longer, but customers do not have to wait for that to start getting visibility.

To shorten implementation times, Alloy has templates aligned to specific use cases (e.g., out-of-stock, real-time plan adjustment, inventory management, collaboration, etc.) and specific roles (e.g., field sales, account manager, regional rep, demand planner, inventory planner, etc.). These role/use case-specific dashboards are starting points, which are modified, iteratively tailored via agile prototyping with the users. Alloy professional services will link together multiple dashboards and views to solve the specific problems.[4] A lot of these templates start with exception reports, showing the appropriate filters, with drill down available. An out-of-stock use case may start by showing predicted stockouts, with drill down to problem locations and links to affected customer orders.

Who Alloy is a Good Fit For

CPG companies looking to improve their downstream visibility and build a supply chain driven by end-consumer demand should consider Alloy to help them realize that vision.

Anvyl: *Integrated Production Management Platform with Pre-certified Network of Strategic Suppliers*

ANVYL

Anvyl is a young company, founded in 2017, providing a supply chain platform that offers well-integrated sourcing capabilities, management of purchase orders, outsourced production, inbound logistics tracking, and exception management. Anvyl centralizes all production data, automates processes and manual tasks, and provides insights into a variety of risk factors. Another key differentiator is their network of pre-certified

[4] Sometimes Alloy will take an existing spreadsheet, developed by a user at the customer, and use it as a model to create the workflow.

suppliers and team of sourcing and supplier management personnel on the ground in China and other geographies. The platform provides a dashboard for viewing and drilling down into information and exceptions on parts, suppliers, orders, and shipments. It includes a capable set of sourcing tools, simple standardized workflow, customizable automation of tasks, and in-context tools for collaboration between buyers, suppliers/manufacturers, and third-party service providers to resolve issues that arise.

Target Customer Characteristics/Factors Driving Adoption

Anvyl's customers are primarily emerging brands and retailers that are growing rapidly, as well as more established companies wanting to better deal with production-related supply chain disruptions. Anvyl provides a comprehensive platform for managing everything to do with production management. Another advantage smaller organizations (and some larger ones too) are often keen to leverage is the economies of scale (lower prices) inherent in Anvyl's pre-certified supplier network, as well as Anvyl's sourcing expertise and their personnel on the ground at supplier's factories. Building up one's own sourcing expertise and strategic supplier relationships can take a long time.

Companies often buy Anvyl to integrate multiple systems, organizational functions, vendors, and service providers into cross-functional, cross-organizational supply chain workflows. These companies are looking to automate their supply-side processes, replacing manual data entry and manual monitoring tasks to free up their scarce internal sourcing and supply chain experts to do higher value tasks. The automation improves the timeliness and accuracy of data.

Anvyl customers are often seeking to better collaborate across their enterprise and supply chain to create and execute more well-aligned optimal responses to issues and disruptions. They use Anvyl to execute a more globally optimal response, solve issues more quickly, incorporating input from all affected parties to understand chain-wide impacts.

Industry and Company Size Focus

The main industries Anvyl serves are:

- CPG
- Food & Beverage
- Pharmaceutical

Anvyl serves small and medium size companies with revenues from about $10M up to about a billion dollars.

Example Anvyl Customers

- *CPG*
  - Caraway
  - Native
  - Harry's
  - Manscaped
  - S'well
  - LOLA
  - Sock Fancy
- *Food & Beverage*
  - Organifi
- *Pharmaceutical*
  - Cabinet

User Roles

The users of Anvyl span the buyer, supplier, and third-party organizations:

- *Buyer Roles*:
  - Supply Chain/Operations: Procurement, Production, Logistics, Warehouse, Inventory Management
  - Finance: Accounts Payable
- *Supplier Roles*:
  - Account Managers and Sales Managers
  - Production Coordinators

- *Third-Party Collaborators Roles*:
  - Consultants and Supply Chain Experts
  - Freight Forwarders and Transportation Brokers
  - Auditors

Functionality

Anvyl's platform has a clean modern UI/UX that is easy to use, intuitively tying together parts, suppliers, outsourced production/orders, and logistics/shipments into supply chain dashboards with cross-functional, inter-enterprise workflows. It highlights exceptions and provides collaboration/messages, milestones, and task management. While the platform spans inventory, production, and logistics, its 'center of gravity' is production/supplier management where it has the richest functionality. The platform does not currently ingest historical demand, forecast, or demand sensing data. Thereby, the exception management is focused on supply disruptions—i.e., alerting when supply execution falls behind schedule or runs into issues—rather than detecting when demand volatility will cause a demand-supply mismatch. Major differentiators for Anvyl are its centralization of production data, automation of manual tasks and processes, and increased predictability of the production process.

Anvyl's top level menu items are Dashboard, Orders, Parts, Sourcing, Suppliers, and Shipments. These are interlinked views of a single database that combines multiple types of data, potentially from multiple sources, such as parts/BOM and orders (POs) data from ERP and PLM systems, supplier master data and performance data from supplier management and ERP systems, and shipment data from TMS systems and 3PLs. Smaller firms that do not have an ERP system can use Anvyl as the system of record for this data, thereby having Anvyl provide some of the functions of an ERP system. Since the data is all interlinked, users could start with a query about a part, see all the status of all suppliers, open orders, and shipments for that part, with exceptions highlighted, and the ability to drill down on any order or shipment. Similarly, the order view will show all parts on an order and associated shipments.

Anvyl has a data team that leverages the data flowing through the platform to generate insights to increase efficiencies, reduce errors, and anticipate issues. They also produce custom reports at a fixed fee, based on the scope of work.

Supplier Network, Sourcing Functionality and Services

While strategic sourcing is not part of the execution phase of ADSA, it is critical to the success of ADSA execution. Anvyl shines here too. They have a marketplace/network of 6,000 suppliers for multiple categories of products. They also have over 1,000 vetted suppliers which brings a whole different level than the typical supplier networks from other providers. These are essentially strategic supplier relationships Anvyl has built. Suppliers are evaluated on over 100 criteria in areas such as social responsibility, operations, quality, and finance. According to Anvyl, less than one in 100 suppliers that Anvyl evaluates passes their audit and vetting process. They also conduct recurring in-person audits and inspections of suppliers' factories and operations.

The Anvyl platform provides sourcing and procurement functionality, including supplier discovery (searching profiles that include geography, products, capabilities, lead times, MOQs, and customers), RFQ management (generate and mass send RFQs, response comparison tools, negotiation and awarding), and PO creation and management.

Out-sourced Production/Supplier Management

Anvyl's platform lets suppliers and outsourced manufacturers log in to participate in all phases of the relationship lifecycle, starting with self-service onboarding, RFQ response and negotiation, PO response and negotiation, updating of production and shipment status, invoicing, and payment processing. From the buyer's perspective, many of the routine tasks for this lifecycle can be automated, including no-code and low-code customizations to the workflows, for things like automated sending of RFQs, email reminders for the supplier to update status, and so forth.

Milestones, Tasks, Exceptions, Collaboration

Anvyl has standardized on five major milestones or phases: 1) Pre-production (RFQ, PO negotiations), 2) Production, 3) Pre-shipment, 4) Shipment, and 5) Delivery. This provides a standardized view of status and common site-wide navigation/UI scheme out-of-the-box.

Beyond the five standard milestones, Anvyl allows users to create custom workflows with unlimited numbers of tasks defined and monitored. From an ADSA perspective, this enables production status to be automatically[5] monitored and provides early warning when things are running late. This could include, for example, monitoring the procurement and receipt of raw materials and shipment of the finished component or assembly. The platform can automatically provide reminders to suppliers of upcoming or late tasks, and alerts to the buyer when tasks are imminent or running behind schedule. Similarly, logistics tasks and workflow can be defined such as load accepted, pickup at factory, consolidation, etc. This enables an automated and proactive approach to monitoring and preventing disruptions from happening and/or keep delays from getting worse, undetected.

When potential disruptions or delays are detected, the platform enables in-line/in-context dialogs between all necessary participants to resolve the issue. The user can invite other functional groups, suppliers, and third-party service providers into a discussion thread to gather information, agree on a course of action, and monitor execution of the resolution. Anvyl does not yet provide automated suggestion of resolutions, nor the analysis and comparison of the impact of different resolutions. However, it can provide automated execution of resolutions, provided the necessary integrations to the execution systems has been implemented.

[5] The monitoring of status is automated from the buyer's perspective. The supplier needs to manually update the status for 'off platform' execution, such as production milestones. For tasks performed on the platform, such as submitting an invoice, the supplier merely performs the task on the platform and the status of that task is automatically updated.

Pricing, ROI, Time-to-Value, Services

Simple Pricing Scheme

Anvyl has three different tiers of pricing: Starter, Professional, and Enterprise.[6] There are no per-user fees, allowing unlimited users. The base subscription fee includes maintenance, upgrades, training, and Anvyl's sourcing services. The subscription fee is based on size of company and expected number of Purchase Orders.

Anvyl charges suppliers a percent of revenue earned by the supplier through the platform. Those fees are similar in size to the fees and commissions that suppliers pay to traditional brokers.

Modest Fees for Integrations with Other Systems

Integrations with other systems are optional. There is a one-time charge for each integration implemented. The integration fees are generally quite low for integrations that are already built. Fees are higher for complex integrations and/or when the integration is unlikely to be reused by many other customers. There are a few pre-bundled 'self-serve' integrations included in the base subscription at no extra cost. This is where the user simply provides the login credentials for those systems and the Anvyl platform pulls in the needed data. Currently Mainfreight, Flexport, and QuickBooks integrations are self-serve.

Considerable ROI via Mutually Agreed Cost Savings Targets and Metrics Improvements

The size of the benefits seen by Anvyl's customers depends on the scope of their deployment and size of the customer. Their customers realize cost savings and performance improvements based on metrics that are custom to each business. Anvyl measures those metrics, reports on them, and has periodic discussions with customers around meeting the mutually agreed improvement goals. Anvyl told us their customers receive an annual ROI that is typically 10X to 20X the cost of the subscription service they pay to Anvyl. ROI is driven by Anvyl in three main ways:

- Productivity improvements, by reducing sourcing professionals' time placing and tracking POs, finding new suppliers, and organizing documents & communications related to production projects.
- Supplier performance improvements with fewer quality issues and higher OTIF.
- Lower direct material and services spend due to lower negotiated prices.

ROI is important in the ongoing account relationships. Anvyl has quarterly business reviews (QBRs) evaluating progress against mutually agreed customer success criteria. Anvyl's software measures many of the metrics that a customer wishes to track for success such as supplier responsiveness, on-time performance, accountability through completed tasks, order-level reporting, and reduction in supply chain disruptions. The platform compares the cost of sourcing through an Anvyl-certified supplier vs the customer's current supplier.

Implementation and Time-to-Value

Implementations that do not require an integration are fast—on average taking from one to seven days. During this time, Anvyl works with clients to ensure their parts and supplier data are uploaded properly, and parts are accurately linked to the corresponding suppliers. Once verified of its accuracy, the client can start using Anvyl

[6] Pricing information can be found here. As of this publication, Anvyl's Starter price is $500/month and Professional price is $1,500/month when billed annually.

without any missing data points. The main dependency for implementation time is the responsiveness of the client.[7] Training (typically about 30 minutes) is provided as part of the base subscription fee to users on both the brand (buyer) side and supplier side to ensure users are successful on the platform.

Value starts being realized as soon as a customer issues a purchase order. Suppliers are sent automated milestone prompts, allowing sourcing professionals at the buyer to spend less time following up and more time focusing on other strategic initiatives or issues that require attention. Additional value can be realized once integrations are completed, as described in the next subsection below.

Onboarding Suppliers and Integrating Systems

Supplier onboarding is included in the base subscription fee. This includes supplier training and importing SKU/BOM details and supplier information from .CSV files provided by the buyer and/or supplier.

Integrations are not required, but many customers opt to integrate their freight forwarder/logistics information for visibility, ERP, inventory management, and/or accounts payable system (for 3-way matching and/or sharing an invoice). If a customer has an ERP, they will usually integrate it with the Anvyl platform, so that information about SKUs, suppliers, and orders is synched over to Anvyl as new ones are added in the ERP system. Integrations also enable automated execution of changes for issues that arise where the resolutions are decided on the platform.

New Product Introduction Services, Quality Assurance, Custom Reports

Anvyl has a team that helps brands launch new products to market. The NPI service is priced at a fixed fee, based on the scope of work. Anvyl will source the items for the customer, return quotes, recommend suppliers, and when applicable, travel to the suppliers' factories with or without the client to verify quality and ensure the product meets the client needs. Anvyl also helps resolve quality issues at their suppliers.

Who Anvyl is a Good Fit For

Anvyl is a good fit for companies looking at improving the supply side of ADSA—monitoring and dealing with disruption in production and logistics—especially if they are also seeking integrated sourcing and procurement tools. When using Anvyl, the detection of demand-supply mismatches due to demand volatility needs to be done outside of the platform. As well, Anvyl does not yet provide automated resolutions or impact analytics. For customers who are willing to do those things off-platform, Anvyl offers the best out-sourced production management and strategic sourcing functionality and services of any of the platforms reviewed in this report. For companies looking to gain rapid access to sourcing capabilities and strategic suppliers, as well as automation of supply-side monitoring and management, Anvyl should be seriously considered.

[7] When a customer does not provide their parts library or supplier directory or does not ensure the accuracy of the uploaded data in a timely manner, this causes a longer implementation process.

E2open: *Acquisitive Integrator of Supply Chain Applications on an End-to-end Networked Platform*

E2open is one of the largest pure cloud[8] supply chain solution providers in the world, with the broadest suite of supply chain applications of any of the providers profiled in this report. It was founded in 2000 by eight of the largest high-tech companies at the time—Hitachi, IBM, LG Electronics, Matsushita, Nortel, Seagate, Solectron, and Toshiba—to provide a shared marketplace connecting their overlapping base of suppliers. It fairly quickly evolved into a networked supply chain application platform. E2open's strategy has been to methodically build out a continually more comprehensive, end-to-end, integrated suite of supply chain planning, execution, and channel management solutions, on top of their interconnected, multi-party network.

Over the past decade, E2open has grown through a steady stream of acquisitions (see sidebar). Recently E2open went public via a merger with the SPAC CC Neuberger Principal Holdings I, providing it with additional capital for further acquisitions. E2open excels at rapidly integrating the companies they acquire, maintaining and enhancing the best-of-breed applications, even as they integrate them into the platform. Most customers thereby will start with a single application, to solve a specific problem, but with the understanding that they can do much more down the road. That vision is compelling to many companies, even if they are not ready to implement a broader end-to-end suite immediately.

E2open Main Acquisitions 2013 - 2021

- *icon-scm* (2013)—Added rapid response planning to E2open's execution and visibility.
- *SERUS* (2014)—Visibility into semiconductor and contract manufacturing operations (WIP, yields, non-conformance) and coordination of ECO/BOM changes.
- *Terra Technology* (2016)—Demand sensing, multi-echelon inventory optimization, transportation forecasting for many of the world's largest CPG firms.
- *Orchestro* (2016)—Multi-retailer demand signal repository, harmonizes and analyzes POS data; highly complementary to the Terra acquisition.
- *Steelwedge* (Q1 2017)—End-to-end S&OP, demand and supply planning, exception management.
- *Zyme, Entomo, and Birch Worldwide* (Q4 2017, Q1 2018)—Channel data management, providing channel visibility and demand shaping through incentives and rebates.
- *Cloud Logistics* (Q4 2018)—Transportation Management System, including capabilities to sell to small and medium businesses (SMB).
- *INTTRA* (Q4 2018)—Ocean shipping network, founded by major ocean carriers, providing ocean booking and visibility. About a quarter of global container trade is booked on INTTRA.
- *Avantida* (Q4 2018)—Container tracking/optimization.
- *Averetek* (June 2019)—Through-channel marketing automation.
- *Amber Road* (July 2019)—Global Trade Management application suite.
- *BluJay* (June 2021)—Major transportation (TMS, parcel, dropship, mobile operations, LSP and forwarder platforms) and global trade compliance (declarations and filings) suite with its own network.

[8] There are larger supply chain solution providers, such as Blue Yonder, Manhattan, SAP, and Oracle, but a significant part of their supply chain revenue comes from non-cloud (on-premise or hosted) applications.

Target Customer Characteristics/Factors Driving Adoption

Most of E2open's clients are large (multi-billion $) companies. With the acquisition of Cloud Logistics two years ago, a number of smaller companies were brought into their customer base. However, most of E2open's application suite is still aimed at large complex supply chains and companies.[9]

E2open is most suitable to companies who have a long-term vision for a holistic integrated end-to-end supply chain and are currently seeking a best-of-breed supply chain solution with needs and characteristics such as:

- *Importer/Exporters*--companies that import or export a lot, especially high value goods with critical lead times.
- *FMCGs and others needing Demand Sensing*--large fast-moving consumer goods (FMCG) firms looking to improve forecast accuracy and get a better picture of end demand/POS data.
- *Multi-tier Supplier / Outsourced Mfg.*--companies in industries such as high tech, automotive, aerospace, and industrial that need to manage an extensive multi-tiered network of suppliers, outsourced manufacturing, and challenging inbound flows.
- *Multi-tier channels*--companies with complex multi-tier distribution channels seeking channel data/intelligence, channel marketing automation, and demand shaping/channel partner marketing capabilities.
- *Logistics and Transportation Providers*--organizations that historically move goods but are expanding beyond logistics to offer a wider range of services.

Industry Focus

Because of E2open's origins in high tech/ electronics, that is an industry where they have lots of customers and industry-specific capabilities. Other industries they have a strong presence in and industry-specific functionality include: CPG, Automotive/Industrial, Aerospace & Defense, Pharmaceutical, Retail (mostly hard goods), and Logistics Service Providers (see sidebar for example customers). Note that some of these customers and industries are focused around specific acquisitions and capabilities. However, E2open's primary strategy for growth is to expand the footprint of use of these customers beyond their initial entry point. Thereby, E2open has a strong incentive to make various parts of the suite applicable across the industries they serve. E2open also pursues a net-new logos strategy.

Example E2open Customers by Industry

- *Semiconductors/ECMs*: AMD, Microsemi, Nvidia
- *High Tech/Electronics OEMs*: Cisco, HP, Lenovo
- *CPG (Food & Bev, Hardgoods, Health & Beauty, etc.)*: Kellogg, PepsiCo, Unilever
- *Pharmaceutical/Life Sciences*: Biogen, Novus, GE Healthcare
- *Auto/Industrial*: Bosch, Schneider Electric, Johnson Controls
- *Logistics Service Providers*: Maersk, MSC, Hapag-Lloyd
- *Retail*: Gap, Walgreens Boots
- *Aerospace & Defense*: Boeing, Embraer, Air France

[9] We have observed it is very difficult for one software company to successfully span very small to very large companies. They require essentially different sales tactics, support structures, approaches to customization, etc. It remains to be seen how successfully E2open can serve such a broad range of company sizes effectively with their entire suite.

User Roles

E2open is used by a broad array of supply chain professionals, both internally within E2open's customers' organizations and externally within the ecosystem/trading partner's organizations. This includes roles such as:

- Demand planners and forecasters
- Sourcing and procurement professionals
- Logistics and transportation planners and managers
- Import/Export managers
- Inventory managers
- Channel managers
- Customer service reps
- Manufacturing professionals
- Quality control
- Supply planners
- Supply chain risk professionals

Functionality

Through their acquisition and integration of best-of-breed applications on a single platform, E2open has assembled a broad integrated suite of applications including:

- *Multi-tier Supplier Mgmt. / Mfg. Management*—Collaborative outsourced manufacturing and advanced procurement and supply management.
- *Transportation and Logistics*—Multi-mode capabilities including the largest ocean shipment network;[10] ground transportation; transportation forecasting; freight audit and settlement; container management; and various global trade capabilities.
- *Global Trade Management*—E2open has one of the best GTM systems around.
- *Demand Sensing*—Demand sensing, demand data aggregation and normalization, forecast, sales order and inventory collaboration, with proven record of substantial increases to inventory accuracy.
- *S&OP/Business Planning*—Best-of-breed S&OP, Supply and Distribution Planning, Allocation and Order Promising, MEIO.[11]
- *Multi-tier channel management*—Channel data/intelligence, channel marketing automation, incentives and rebates, and demand shaping/channel partner marketing capabilities, as well as a large network of distributors.

Control Tower Knits Together Deep Application Functionality

E2open's control tower functionality is one of the strongest amongst those we reviewed. They excel in providing a network-wide view, leveraging sizable networks of pre-connected suppliers and outsourced manufacturers (especially in their core industries mentioned above), logistics carriers and 3PLs, and channel partners/distributors. With this end-to-end view, they can peg specific customer orders back to specific inbound shipments, supplier inventory, and purchase orders. The end-to-end view helps provide early visibility

[10] Via E2open's acquisition of INTTRA. 22% of global ocean container bookings are initiated on the INTTRA platform, according to Crunchbase. A 2018 DVZ article states that E2open/INTTRA tracks 40% of all ocean container shipments and that 50% of all electronically booked containers are initiated on their network.
[11] MEIO = Multi Echelon Inventory Management

into detecting and predicting demand deviations from plan, manufacturing and quality issues, and international and domestic logistics delays. These networks and applications also provide the ability to collaborate with various partners to resolve those issues. The operating platform can gauge the impact of issues, help prioritize them, and provide ways to correct those issues including the actual execution of the resolution.

It is important to note that E2open does not have a separate control tower product per se. Rather, E2open's control tower capabilities are realized by a combination of their multi-enterprise network, E2open applications, and Harmony® analytics. The set of E2open applications that need to be acquired to achieve control tower functionality can be significant, depending on the objectives for the implementation.

Most control tower use cases start with two to three applications and can grow from there depending on the breadth of functionality required. For example, a company may start by focusing on better management of purchase orders. For that they may start with PO Collaboration, In Transit Visibility, and perhaps Manufacturing Visibility. Keep in mind that each of these applications provides a lot more than just control tower functionality. For example, the PO Collaboration application provides a lot more than just visibility into PO status. It provides a full set of procure-to-pay functionality,[12] and leverages E2open's existing network of suppliers.[13]

As part of an open platform, external non-E2open applications the user's organization might be running can also be incorporated, but of course these will require an integration project to connect those external applications (just as all the other control towers also require such an effort when integrating external applications). E2open's approach has the advantage of leveraging the very powerful set of applications they possess.[14] However, the user interface and task flow is not quite as straightforward or intuitive as some of the other organically created purpose-built control towers we reviewed. Below we drill into some of the areas where E2open provides exceptional functionality.

Network-wide View

E2open provides a multi-enterprise view across demand, supply, logistics/transportation, and global trade that reflects and tracks POs, manufacturing orders and status, shipment status,[15] invoices and payment, and more. They provide AI/ML-driven predictive ETA factoring in weather, port congestion, and historical data to predict late shipments. They provide downstream visibility into inventory and demand across multiple tiers of distribution, with consolidated and normalized view of retail POS demand; something only one other provider in this review offers.

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[12] E2open PO Collaboration provides automation of procure-to-pay (P2P) processes, centralized governance of all PO processes (including shipping instructions) for all suppliers, automated handling of MRP requests, management of individual POs, blanket POS, scheduling agreements, shipments, receipts, and invoices with automated matching, configurable order management workflows, and more.

[13] Furthermore, using E2open's pre-integrated applications and platform saves time and effort that would otherwise be required to build and maintain integrations of data from numerous other systems. As well, the data from E2open's applications will be more timely and accurate, compared to integrating data from external sources.

[14] Their 'Harmony' layer unifies the user interfaces of the various applications and their E2Net layer integrates the data and messages between the applications.

[15] Real-time status and location of shipments can be displayed in a map or table view, using data from logistics service providers on the network (carriers, 3PLs, port authorities, gov. agencies, etc.) as well as integrations with tracking networks and other sources (Project44, SMC3, Locus Traxx, DAT, Truckstop.com, Breakthrough Fuel, PC Miler, Rand McNally, and Uber Freight.

Visibility into Downstream Demand

E2open's Demand Signal Management application automates daily collection and harmonization of data (from multiple retailers' POS data and from syndicated data) and creates a single demand data repository for use by all enterprise applications. Their Demand Sensing application leverages the comprehensive data captured to generate daily SKU-level automated forecasts using AI/ML. Retail analytics provide execution visibility down to the store level, proactively identifying issues to respond to and prevent stock-outs. Its Channel Management solutions provide somewhat analogous capabilities for distributor and reseller channels, with the addition of channel-specific applications such as rebate incentives and marketing development fund management.

Predicting and Resolving Demand-Supply Imbalances

E2open's predictive analytics uses machine learning on data from various sources across the network to provide forward-looking exception alerts, such as predictive ETA or stockouts. Mismatches in supply and demand are displayed in a rolling time-phase view into future periods, showing where the problems are going to be. Planning and execution applications[16] are used to understand the impact of delays, early arrivals, and demand fluctuations on production and fulfillment plans and identify the corrective action that should be taken such as diverting or expediting loads. Overall inventory, revenue, and other impacts of a deviation and its resolutions are assessed to prioritize resolutions. E2open's business rules framework lets users prioritize customers, products, DCs or any combination of supply chain business objects in the impact analysis.

To help prioritize the use of available inventory and inbound materials, E2open supports end-to-end pegging (as well as traceability) at all stages of the supply chain. An OEM or brand owner can allocate units that are in finished goods inventory, in transit, in production, or on order. These can be allocated to specific customer orders and/or replenishment orders (e.g., for replenishing stores, DCs, factories). They can see how many unallocated units there are in each stage of the pipeline. As soon as units get allocated to an outbound order, those units are no longer available for a different customer (unless due the priority of the new order, you reallocate them and 'take them away' from the first customer).

Once a resolution has been identified, it can be socialized within the application between the appropriate role(s), whether internal (logistics) or external (supplier), to collaborate on decision-making as needed. Resolutions can then be executed in the E2open applications. The E2open network collects data from these execution actions, which can be used subsequently for machine learning algorithms. The system observes and learns, to help automate responses in the future.

[16] Depending on the exception, business users may leverage a combination of 'intelligent engines' within the E2open applications including Transportation Management, Supply Planning & Response, Inventory Collaboration, and Manufacturing Visibility. Many of these applications have quite mature AI/ML optimization and algorithmic supply chain planning, in some cases developed over the past decade or more.

Origin Management, Logistics

E2open is one of the stronger providers in Origin Management, with very capable supplier portal, quality control, origin booking by supplier, and shipment approval workflow capabilities. They have very capable CFS[17] management (consolidation/deconsolidation), which provides added flexibility to do in-transit changes to destination when demand-supply imbalances are not discovered until after a shipment has left the factory.

Global Trade Management

E2open is the only provider in this review that has their own full Global Trade Management system and data team (the others rely on partners) and their GTM is one of the best in the market. E2open automates regulatory export and import compliance and transactional functions, including country controls, restricted party screening, trade agreement applications, license determination and tracking, document generation and filing.[18]

Supplier Management

E2open is quite strong in supplier management, including good sourcing and procurement tools, supplier discovery, exceptional SKU and product information management, and good new product introduction support. These provide options and resources to resolve issues that may involve finding new suppliers, understanding component interdependencies and provenance, and managing supply and demand mismatches during product launches.

Master Data Management

Comprehensive master data attributes for existing and new products are captured and stored centrally within the E2open data model. E2open's multi-enterprise MDM reconciles master data between ecosystems and enterprises. Supervised machine learning algorithms cleanse[19] masses of input data and then dynamically update E2open's Integrated Data Model.

Pricing, ROI, Time-to-Value

In July 2020, E2open announced that they are eliminating user, data volume, and annual connection fees from their pricing model. Their new pricing model is based on scaling factors such as revenue, spend, and freight under management.

The size of the scaling factor (i.e., $ cost of monthly subscription fee per dollar of revenue or spend) depends on which of the applications within each of these product families are used. The new pricing model encourages increased usage across the enterprise.

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[17] CFS = Container Freight Station

[18] Their GTM system validates every line of a sales order against the regulations of the countries involved. E2open's Global Knowledgebase covers trade regulations for more than 180 countries. They interface with government systems—US AES, US ACE, US ISF, US FTZ, DE ATLAS Export, BE PLDA Import & Export, CN GAC (CTM)—are all supported. All source data is consolidated in the platform. The system can automatically generate audit-grade compliance documents.

[19] A typical example is cleansing of partner entity names, e.g., "Foxconn", "FXN", "FX Shanghai", etc. may all refer to the same or related entities. These are automatically reconciled by machine learning algorithms and mapped to a common entity or parent as per the business use case.

Since E2open offers such a wide variety of capabilities, so too the ROI and payback period vary depending on what is being implemented and the starting point of the implementing company. Similarly, the ROI is driven by many different factors, depending on implementation. For example, the ocean shipment booking and tendering capabilities can provide ROI through benefits by reducing the time and labor cost of managing container shipments, reducing shipping costs by better visibility into spot rates, and provide better visibility into container and shipment status. Similarly, each of the other applications provides ROI in different ways. Demand sensing can provide benefits by increasing forecast accuracy, reducing out-of-stocks, and improving promotional uplift. Global Trade Management can speed up customs filing and clearing, reduce misclassifications and filing errors (and thereby reduce fines), and help compliantly reduce duties and tariffs.

The time-to-value for E2open implementations also varies greatly, depending on factors such as which modules and functionality are being implemented, how much integration with external systems is required, how many new trading partners (not already on the E2open network) must be onboarded, and the breadth of the initial rollout across an organization.

Who E2open is a Good Fit For

E2open has acquired many ADSA-relevant best-of-breed applications that have previously succeeded well in the market on their own standalone merits, such as multi-tier supplier and outsourced manufacturing management, transportation and logistics, global trade management, demand sensing, S&OP/business planning, and multi-tier channel management. Thus, those wishing to start an ADSA effort by focusing on one of the areas supported by E2open and then expanding to a more end-to-end capability should find E2open attractive for their purpose. E2open is especially well suited for companies that are committed to implement comprehensive end-to-end demand-supply alignment capabilities, particularly larger companies with more complex supply chains in one of E2open's target industries—high tech, CPG, automotive/industrial, aerospace & defense, pharmaceutical, hard goods retail, or logistics service providers.

Elementum: *Best of Breed Case/Incident Management and Issue Resolution*

Elementum offers a solution for tracking and collaboratively resolving issues and incidents. This can be useful in aligning demand and supply once an issue, such as a supply disruption or predicted shortage or quality issue, has been detected. The Elementum solution does not predict issues, nor does it provide recommendations for resolutions. Rather it enables collaboration between multiple parties – internal and external – for solving issues requiring human intervention, and it automates many of the tasks that would typically be done manually. The Elementum solution aggregates all information about past issues and how they were resolved into a single location in order to simplify trend and root-cause analyses for permanent corrective actions of systemic, recurring issues.

Target Customer Characteristics/Factors Driving Adoption

Elementum's customers tend to be larger companies (500 – 10,000+ employees), because the factors driving adoption tend to be the characteristics of larger firms. Elementum is useful for companies that have complex supply chains with many issues arising, where resolution of those problems requires multi-party collaboration across functional and enterprise boundaries. Companies with some of the following characteristics might find this solution valuable:

- A large number of SKUs;
- High transactional volumes;
- Rapid product lifecycles and many new product introductions being managed;
- Demanding regulatory requirements;
- Complex outsourced manufacturing relationships;
- Many quality, design, and manufacturing issues that need to be resolved across organizations.

Industries that exhibit these characteristics include CPG, Food and Beverage, Healthcare and Life science, and High Tech/Electronics.

User Roles

The software is used by anyone involved in resolving issues, which encompasses a broad range of operational functions such as:

- Customer service and support/contact center
- Engineering, quality control
- Supply chain, logistics, import/export
- Manufacturing
- Procurement/supplier management
- Finance/accounts receivable
- Compliance

It is used by front line workers in resolving issues, managers and executives to understand and improve the company's timeliness and performance in resolving issues, and by analysts to identify and address systemic, recurring problems.

Although Elementum's customers will use Elementum to manage a variety of issues, most customers will start with one area or team of higher priority, and then expand from there.

Functionality

Originally founded in 2012 as a supply chain control tower solution, Elementum refocused on issue resolution—enabling multi-party collaboration to solve cross-functional and inter-enterprise problems identified by other control tower solutions, other types of solutions, or manually by people. Their focus is now enabling teams to communicate internally and externally (across multiple tiers and service providers) and solve problems and issues that arise during execution. This could include things like production or shipment delays, material shortages, stockouts, quality and customer service issues, product launch issues, unexpected charges or penalties, and process improvements. In many if not most companies, these kinds of issues are solved using phone calls, email, spreadsheets, and texts, making it hard to assess status, leaving many 'cracks' for issues to

fall into. Elementum can provide a much more systematic approach, provided the organization has the discipline to use the system consistently and not revert to old habits.

Incident Detection and Resolution

Elementum does not monitor operations or events themselves to identify when issues arise, but rather relies on other systems or people to identify and enter/create the incidents. This is often done manually by a person creating the case or it may be done by an external system via API or other type of integration that automatically creates the issues. For example, late shipment incidents may be generated by a TMS system, tickets for customer problems may be generated by call center software, or demand/supply imbalance incidents alerted by a planning system. Most of Elementum's customers will upgrade to automated incident creation and resolution within the first 12 months of usage.

Each incident typically has a series of tasks, each task with a responsible person and due date. Alerts can be sent (via email, text, in-app notification) when task due dates are near or past due. Internal and external parties can be invited into the incident to help in resolution. Business objects (such as an order, shipment, company, product) can be linked by URL reference and attached files. Additionally, master data can be loaded into Elementum so users can directly attribute incidents to the specific business objects, such as specific products, carriers, and sites. Elementum's mobile app allows pictures to be taken and attached to an incident (for example of damage in transit, or quality issues). Dashboards allow viewing status and drill down across any filtered subset of all outstanding issues, filtered by number of incidents and by the dollar value of those incidents in different currencies.

Incident Analytics, Systemic Improvements

Built-in dashboards and analytics can be used to spot recurring incidents and systemic improvement opportunities. This can include things like recurring quality issues due to a design defect, recurring billing issues (like a supplier that consistently overbills), problems with a particular carrier, inadequate packaging leading to recurring damage, and so forth.

Pricing, ROI, Time-to-Value

Pricing is based on named users, with the cost per user varying for each of the three different editions offered: Essentials, Pro, and Enterprise.

Elementum reports the payback period is typically less than three months. That short payback period is enabled because most customers start small with one process that includes a small number (e.g., 5-10) of users. Users can be live with new processes running after only a single training session and IT involvement is not necessary for most initial processes. For simpler implementations, the starting monthly fees will be low, and fees for professional services will typically be waived. As a result, the value of benefits can exceed the monthly fee very soon, within a month or so after implementation, depending on how quickly employees transition onto the new system.

When the incident capture process is automated, the implementation takes a bit longer due to the integration required. For larger rollouts or for customers that want to start with APIs right away, implementation takes (in the neighborhood) of three to six months. When an automated capture process has been implemented, the

percent of incidents managed is often quite high almost immediately after go-live, thereby accelerating value realization soon after the integration is completed.

The benefits gained vary widely, depending on what type of issues are being addressed by the system and which functions are involved. Benefits can be realized as efficiency gains (e.g., headcount reductions or reallocation), cost savings (e.g., fewer chargebacks, reduced shipping damage, etc.), shorter cycle times (e.g., faster time-to-market), and systemic process improvements (e.g., improvements to on-time/in-full rates, reductions in stockouts).

Who Elementum is a Good Fit For

Elementum is a good fit for companies that have large complex supply chains with many issues arising, where resolution of those problems requires multi-party collaboration across functional and enterprise boundaries. It can be useful for companies that have many issues to manage due to having a large number of SKUs or transactions, many simultaneous and/or complex new product introductions, demanding regulatory requirements, complex outsourced manufacturing relationships, and/or lots of cross functional issues. This can be especially useful in CPG, food and beverage, healthcare, life science, and high tech/electronics companies.

IBM Sterling: *Inventory Control Tower Built on a Broad Suite of Supply Chain Software*

IBM's Inventory Control Tower (ICT) was launched in June 2020. ICT leverages a mature set of technologies developed over many years (see sidebar). Its core control tower capabilities have been used by IBM's clients for several years. The platform ingests data on production, logistics, inventory, and demand to predict supply disruptions and demand-supply imbalances. It leverages Watson AI to offer solutions with natural language conversations, smart alerts and digital play-books.

Inventory Control Tower is part of a broader suite of supply chain applications under the IBM Sterling brand that includes Supplier Collaboration, Inventory Management, Order Management, Supply Chain Insights, and Supply Chain Business Network. ICT is a standalone solution that can be expanded/enhanced with these other suite components.

ICT takes an inventory-centric approach, providing network-wide, time-phased, per SKU-location views of inventory levels. The granularity and scope of these views depends on the information fed into it. Unlike some of the other platforms reviewed, the ICT does not include logistics management or supplier

ICT Built on Several Technologies

The Inventory Control Tower incorporates several pieces of technology that IBM has developed over the years:

- *IBM Watson*—Watson is one of the top AI platforms. ICT uses Watson to detect and correlate external events, to learn from past issues, provide information in resolution rooms (see below), and create playbooks of suggested resolution for issues.
- *Resolution Rooms*—Introduced in 2017 as part of Supply Chain Insights, these are virtual meeting places for collaborative resolution of issues where conversations are recorded and progress on issues tracked. Within the resolution room, users can ask Watson questions using natural language queries like "*which customers are impacted by this shipment?*".
- *Playbooks*—Also part of SCI since 2017, playbooks allow for the definition of a set of actions to solve a specific issue. ICT uses Watson to recommend a playbook for an issue, as well as to learn from past resolutions to create new playbooks.
- *Distributed Order Management*—IBM Sterling (via Yantra, founded 1995, acquired 2004) leverages 25 years of IP for inventory management and allocation and algorithms for prioritizing execution decisions. ICT uses the Inventory Visibility offering from the DOM suite.

production management within the platform but relies solely on external sources for that data and for the management of those functions.

Target Customer Characteristics/Factors Driving Adoption

ICT can be useful for any business with inventory and supply challenges but will provide the most value to companies that have complex global supply chains with critical inventory needs. This includes supply chains that have lots of stocking locations, many suppliers, numerous SKUs, with international logistics and where there are high consequences when inventory is out-of-stock.

Industry Focus

IBM is initially focusing on three industries: 1) healthcare providers, 2) grocery retailers, and 3) spare parts dealer networks and aftermarket parts dealers (in particular automotive spare parts). They also sell to industrial manufacturing and high-tech firms. IBM has not yet disclosed the names of any of their initial customers for ICT.

User Roles

ICT is typically used by supply chain professionals, such as inventory planners and managers, supply chain planners, and distribution planners and managers.

Functionality

The Inventory Control Tower (ICT) is one of several solutions in this report evolving towards autonomous supply chain capabilities. Currently that includes detecting external events leading to demand-supply imbalances (whether caused by supply disruptions or demand volatility), bringing together the information required to resolve it, providing collaboration tools, and providing suggested resolutions. ICT has the benefit of sitting atop proven technology but is still early in the adoption and refinement curve. Customers who adopt now may have the opportunity to shape the direction and roadmap for this product and will likely uncover things they want improved.

Network-wide View

ICT's network-wide view of orders, inventory, and shipments is driven largely by integrating data from various supply chain systems into a common data model, enabling end-to-end visibility, analytics, and AI, to find and resolve issues quickly. Inventory can be tracked across multiple enterprises, as is done in a spare parts dealer network. Real-time updates on shipments can be derived from tracking services, such as Project44 which is pre-integrated to ICT.[20]

As of now, there is no direct ingestion of IOT tracking data, such as from ELD/GPS units or AIS data from ships. This system can also ingest ongoing inventory and stock movements data in order to display daily SKU-by-location, including feeds from DCs as well as forward stocking locations like stores or stockrooms. Ingestion of retailer POS data is not pre-built. IBM does have open APIs that allow their Expert Lab Services team to work with clients integrating POS data, IoT data, or non-EDI data formats as part of the implementation project.

[20] As of this writing, real-time shipment status data from other tracking services has not yet been integrated. That data could be integrated but would require a custom integration project.

Time-phased View Highlights Upcoming Shortages and Overages

Forecasts are fed into the control tower where ICT matches supply and demand for each SKU/location combination to determine daily stockouts. The ICT provides a time-phased view that shows planned vs. actual inventory, supply and demand plan, on-order and in-transit inventory, and sales orders. This time-phased view highlights potential supply/demand mismatches that are upcoming but does not actively alert about those. It highlights SKUs that are predicted to breach upper and lower thresholds or that are approaching out-of-stock or excess quantities, showing average days of supply and excess days of supply. They also highlight expiring inventory.

Resolution Rooms

Once an issue is detected, companies can open a resolution room to manually collaborate, via online chat and sharing of online views of data about the issue. Resolution rooms can be used to communicate precise instructions and context to the person responsible for the execution to fix the issue (such as a transportation manager who requests expediting from the carrier). With precise instructions sent to them, the responsible person can manually execute the requested action with confidence, as well as confirm that the action has been taken.

Taking Action

Actions can be initiated from within the control tower provided that the necessary API integration to the appropriate execution systems has been implemented. Examples of actions that could be taken via API include transferring inventory, adjusting safety stock in a forward stocking location (to ensure inventory is available for walk-in sales or local consumption), turning online order fulfillment on or off from the specific node for the SKU having issues, and expediting or changing POs or shipments. Not all actions are done in the resolution rooms; actions like transferring inventory or adjusting safety stock in a forward stocking location (to ensure inventory is available for walk-in sales or local consumption) or turning on or off online order fulfillment from the specific node for the SKU having issues would be done in inventory screens rather than the resolution room. Users can also search for alternative suppliers.

Playbooks

While Resolution Rooms do not actually execute workflows, they do provide playbooks that list all the steps and actions needed to resolve an issue, as well as a list of the appropriate people that should be involved, and normal timelines for execution. Watson machine learning[21] analyzes past actions taken in resolution rooms and creates playbooks to resolve similar issues. For example, if a weather event causes a disruption in the supply chain, the user can open a resolution room, bring in stakeholders, and together they can figure out a solution to the problem.

After finding a solution, the user can use ICT's 'analyze resolution room' functionality through which Watson will analyze the room using natural language processing to determine the steps that were taken and the people that were involved to solve the issue. The user can then open that playbook, which contains the actions that Watson pulled from the resolution room, and manually edit the playbook to finalize it for others to use. The next time the same or similar issue happens, any user can use Watson to search for the playbook that best addresses the issue at hand. Playbooks can also be manually created by users from scratch (or by duplicating an

[21] IBM Watson's capabilities are included in the ICT solution.

existing one) to create new playbooks that reflect an organization's pre-defined steps to handle certain problems. Alternatively, playbooks can be created manually on the fly, once an issue or disruption arises.

Pricing, ROI, Time-to-Value

Pricing Basis

ICT is a subscription service, with the fee based on four factors: # of SKUs, # of Locations, Update Frequency (how frequently supply/demand data is updated), and # of Users. There is no extra charge for suppliers participating in Resolution Rooms. There is a relatively small one-time setup fee. Professional Services fees for implementation typically range from a quarter to two times the annual fee. Some of the pieces of a complete solution, such as IBM's supplier portal or their EDI network, are separate products, billed separately.

ROI

Since ICT was only recently launched, IBM did not yet have actual ROI data from customer implementations at the time of this research.[22] They shared some expected potential benefits from implementing ICT, organized by industry. Some potential benefits in healthcare applications include reduced nursing staff time spent on supply issues, reduction in procedures delayed due to lack of supplies, and reduced overall inventory levels. Potential benefits for grocery retailers include reduced out-of-stocks (thereby improving revenue and customer loyalty) and reduced expedited shipping cost. Potential benefits for spare parts and dealer networks include increasing service levels while simultaneously reducing overall inventory costs, early warning of end-of-life or expired items, and more productive shared use of inventory across the network.

Implementation Services and Timeframes

Initial implementation of ICT typically takes four to six months, with elapsed time depending largely on the amount of effort required to integrate external systems and data. IBM tries to take a phased approach to implementation to shorten initial implementation times. IBM provides four levels of deployment professional services for helping customers implement ICT:

- *Deployment Assurance*—IBM oversight for ICT implementations sold through resellers and Systems Integrators. IBM provides help in project planning, reviewing integration design, recommending best practices, consulting on data migration and testing, and a go-live readiness assessment.
- *Blueprint*—Similar to Deployment Assurance but more comprehensive, concluding with a tailored implementation proposal. Typically, about a three-week engagement.
- *MVP Lite*—Discovery, design, configuration, training, testing, and 'Hypercare' support. Typically, about a 15-week project.
- *Standard Implementation*—Same as MVP Lite, but with integration support, though the client does the actual integration. Typically, about 24 weeks.

Who IBM Sterling ICT is a Good Fit For

ICT is a good fit for companies that have large complex global supply chains with critical inventory needs—especially healthcare providers, grocery retailers, and spare parts dealers. This includes companies that have lots of SKUs and stocking locations, many suppliers, international logistics, and high consequences for inventory stockouts.

[22] IBM has published data on ROI for their control tower and inventory invisibility solutions, which have been around longer than ICT.

Infor Nexus: *Mature End-to-end Global Trade, Logistics, and Finance Platform*

GT Nexus was founded in 1998, merged with TradeCard in 2013, acquired by Infor in 2015, and renamed Infor Nexus in 2019. Designed as a multi-party networked platform from the start, Infor Nexus provides an end-to-end platform for global trade, with visibility throughout the purchase-to-pay process. The platform and applications were almost entirely developed organically (i.e., not via acquisitions) and as a result are well-integrated, purpose-built, with a good UX. The platform has a solid architecture, designed as a multi-party platform from the start, with multi-enterprise master data management, multi-enterprise security, and rapid supplier on-boarding capabilities. Infor Nexus offers strong data quality capabilities and services, including 24X7 monitoring and technical staff that helps detect and correct trading partner data quality issues.[24]

Owned by Infor—Acquisitive ERP Solution Provider

The parent of Infor Nexus is Infor, the third largest[23] provider of ERP software globally. Since they were founded in 2002, Infor has acquired over 40 software companies, including many vertical- and micro-vertical-specific ERP companies across manufacturing, distribution, retail, healthcare, and government sectors.

Infor Nexus has accumulated a lot of learning and specific IP and process knowledge from their 22 years of experience helping major brands, OEMs, and retailers with global trade. Their applications tend to become deeply embedded in their customers' operations who have major portions of their supply chains running on the platform. Infor Nexus is quite strong in supply chain finance, particularly differentiated by their pre-invoice and pre-shipment financing capabilities. The platform was largely developed organically (with very few acquisitions), which makes for a system that is focused and well-integrated. Infor Nexus launched 'Control Center' in 2018, providing a strong foundation and path towards autonomous supply chain capabilities.

Target Customer Characteristics/Factors Driving Adoption

Infor Nexus excels at serving companies with complex global supply chains, with characteristics such as:

- Multi-region, multi-site operations, and/or outsourced manufacturing, global network of suppliers
  - Typically, with long lead times and lack of visibility
- Global transportation, using multiple 3PLs and LSPs, long multi-leg, multi-mode shipments
  - Large ocean or air shipping volumes
  - Too many expedites and/or late shipments
- Multiple disparate, enterprise systems across business units and regions
  - Low fill rates, high stockouts, high chargebacks

[23] SAP and Oracle are the first and second largest providers of ERP software. Infor's revenues are about $3.2B. Since February 2020, Infor has been wholly owned by Koch Industries' private investment unit.

[24] Trading partner data quality can be a major headache for organizations that are connected electronically to lots of partners. Often a problem with data from a partner seemingly appears out of nowhere and is not noticed until it has negatively impacted execution in a material way such as delayed orders, delays at customs due to wrong information, wrong items or quantity have been delivered, or to wrong location. By monitoring data quality, the Infor Nexus platform can correct and prevent these issues before they impact execution.

They are not as good of a fit for companies that do mostly domestic/in-country sourcing, or who ship primarily high-volume parcel and/or via dedicated private fleet.

Adoption Drivers

Enabling growth is the main reason some customers adopt Infor Nexus. By automating tasks such as monitoring supply chains to detect issues, collecting information for resolving those issues, and investigating the impact of different resolutions, the skilled professionals running the supply chain become more efficient and can do more higher value tasks with less, enabling the organization to grow without adding headcount. Another driver is *profitability*. By reducing inventory, stockouts, and markdowns, expediting, and overall freight costs, profit margins are improved. Some adopt the platform to *improve continuity and flexibility of supply,* via early issue detection and resolution, as well as strengthening marginal suppliers by providing them with more affordable and accessible supply chain finance options. Some customers use the platform to *increase customer service reliability,* using the platform to receive early warning of demand-supply imbalance and to fix those issues, as well as ensuring more precise and reliable delivery.

Industry Focus

Almost half of Infor Nexus' revenue comes from fashion apparel and footwear. They have a strong presence in several other industries including general retail, CPG, automotive and industrial manufacturing, and logistics service providers. Some large 3PLs use Infor Nexus as the underpinning technology for their business and service offering. Infor Nexus's retail and manufacturing clients tend to be large, multi-billion-dollar firms. Some of their fashion brand clients are somewhat smaller, but still generally several hundred million dollars or more in revenue.

Infor Nexus Example Key Customers:

- *Retail*: Target, Restoration Hardware, GAP, Dick Sporting Goods, William-Sonoma
- *Fashion / Footwear Brands*: Under Armour, Puma, Levi's, Deckers, Guess, Ariat, lululemon
- *CPG*: Del Monte, Cargill, JM Smucker
- *High Tech*: HP, Molex, Medtronic
- *Pharmaceutical*: Pfizer, Baxter, Johnson & Johnson
- *Industrial*: Caterpillar, Komatsu, Carrier, Lear Corp, WW Grainger
- *LSP*: DHL, UPS, DB Schenker, Allport Cargo Services USA, CEVA Logistics, Kuehne + Nagel, FedEx Logistics

User Roles

Typical functions using Infor Nexus applications include:

- Supply Chain
- Sourcing and Procurement
- Global Logistics and Distribution
- Finance, Treasury, and Accounts Payable
- Operations, Manufacturing

Functionality

Infor Nexus has deep functionality in ocean logistics from their founding heritage. They have the strongest origin management and among the strongest overall logistics & transportation functionality of the reviewed vendors, though it doesn't contain deep domestic planning and optimization functionality found in leading TMS

providers. Their financial settlement and supply chain finance capabilities are differentiators, with major commercial banks and trade financial institutes integrated on the platform.

Origin Management

Nexus has a suite of products that manage the supplier engagement process, from onboarding through forecast collaboration, production tracking, packing and labeling, shipment booking, invoicing, and payment, with embedded financial services available throughout the process. Infor provides a strong set of tools to ensure suppliers comply with retailer's or OEM's unique, comprehensive compliance rules (e.g., retailer-specific labeling, packaging, documentation, routing guides, etc.). The Nexus Factory Management solution will take the packing requirements outlined in the PO, calculate carton weights and measurements, and enforce the actual packing of the physical product. These can be detailed requirements, such as "*pack one M, two L, and one XL in store-ready format.*" These can be enforced via RFID or barcode scan to confirm the correct sizes and quantities while the system generates the right retailer-specific packing labels.

Suppliers can request transportation either via a forwarder in the form of a vendor booking, or request transportation bookings directly with carriers on the Nexus platform using the enterprise's contracted rates. The request can go through a buyer workflow to allow configurable supplier fulfillment validations. Once approved, the transportation request can be booked directly with the LSP or the platform can automatically execute a booking directly with the carrier using the enterprise's carrier contracts.[25]

Optimizing Transportation

Once a number of these requests are received, an automated scheduled job can be run using the Infor Nexus Planning and Optimization Engine. The optimization engine looks at the number of carrier options, lanes, legs, service level, equipment type, transit time, rates, mode constraints as well as other constraints, to recommend the least cost, best service level option respecting promised delivery dates on the order. Contracts can be fed into Nexus's rating engine for least cost/allocations-driven automatic plan creation. Maximum equipment utilization is at the core of the optimization algorithms. It can enforce constraints like whether temperature-controlled equipment is required, separation of hazardous materials, and stackability of shipped units, if that information is provided to the system. A user can manually create loads or take an optimized load plan and manually change it to suit inventory or other needs. Infor Nexus's Freight Pay and Audit application uses pre-compliant contract-based invoices generated from the platform as a basis for a carrier invoice audit.

Supplier Quality Assurance

Infor Nexus's Quality Assurance application includes a mobile app that lets suppliers capture details of quality defects, with photos, right there on the factory floor, and then upload those details along with any required documentation. Quality issues that arise can be collaborated upon within the QA applications or with Nexus's Issue Management application.[26]

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[25] Ocean, Air, and Truck contracts are supported today.

[26] Their Issues Management application includes more comprehensive workflows and escalation logic than the QA app.

CFS Management and Optimization

Infor Nexus supports Container Freight Station (CFS) functionality. A cross dock or transload facility can be brought up quickly, processing freight accurately, with inventory visibility. Basic put away and picking of inventory to/from named locations as well as allocation orders for "virtual" warehouses are supported. Third party WMS systems can be integrated. Built-in logic can decide which orders to consolidate into a Shipping Order with provisions to control which equipment is used for container loading, taking into account the costs associated with the selected equipment and load capacity utilization. If the loading violates the defined capacity utilization, then the system can either warn the user or stop further processing. An approval/rejection process is available for the shipping plan. Arrival details, along with date/place can be made visible at a container level using ASNs. The warehouse receipt application can turn vendor booking and shipments into inventory receipts, using visibility into on-hand inventory to fulfill demand allocations.

Intuitive, Advanced Control Tower (aka Control Center)

Infor Nexus calls their control tower a "Control Center," to differentiate it from a visibility-only control tower, with the ultimate goal of providing autonomous supply chain capabilities. While not yet quite as functionally rich as the control towers of two of the other providers[27] we reviewed, we think it is the most intuitive control tower of the those we looked at, bringing together all the right information in ways that make sense, and thereby enabling higher productivity in resolving issues. One reason for this is their use-case-based paradigm, classifying issues according to the type of 'Situation' that is happening. When it detects a specific situation, the platform then provides exactly the right information, diagnostics, workflows, and resolutions specifically designed for that situation, to help the user understand and resolve it. Examples of Situations they have developed responses for include '*late arrival to final destination*' and '*projected inventory shortage,*' with plans to build out a broad library of other Situations.

Infor Nexus is taking a methodical approach to developing these Situations and the user experience for resolving them. They have been working closely with a few early adopter customers, talking to inventory planners, supply chain planners, transportation planners, and warehouse managers, observing how they work and interviewing them about what information they need at their fingertips to solve various problems. They find that each of the roles needs different specific data, presented in a specific way for each type of situation. From what I have seen, this approach is yielding results. One of their customers said they used to spend 80% of their time detecting problems and finding and organizing the information they needed, so that only about 20% of their time was left to actually solve the problems. Infor Nexus reverses that ratio so that monitoring and information gathering activities take much less effort, and most of the time can be spent on problem solving.

Accurate Network Model Maintained Based on Actual Transactions

The Infor Nexus platform automatically creates and maintains an accurate, up-to-date model of each of their customer's physical multi-tier supply and distribution network. Rather than using data from enterprise systems (such as supplier addresses), which is often inaccurate or out-of-date, they use data from the transactions flowing through their network, such as shipment bookings, bills of lading, and customs filings. These specify precise actual ship-from and ship-to locations as well as shipment item/product information. Thus, the network

[27] i.e., E2open's and One Network's control towers

model continually evolves, reflecting the real world, as ship-to and destinations change, and as new types of items are shipped.

Improving Real-time Tracking Accuracy

That platform provides live tracking of ocean, air, and truck shipments, fine-tuned for each mode, fusing together multiple streams of tracking data to provide more accurate tracking. For example, for ocean they may use AIS data, carrier milestones, and machine learning observations (e.g., impact of port congestion, historical patterns). For road shipments, in addition to connecting directly to carriers, they partner with Project 44 to offer real-time road visibility. Over 60 pre-shipment, shipment, and post-shipment milestones are tracked out-of-the-box. Machine learning capabilities learn from historical milestone data to generate future predictions of ultimate arrival based on most recent real-world trends.

Visibility, Issue Detection, Collaborative Resolution Capabilities

The platform provides visibility based on forecasts, production status, inventory in all supply chain nodes, shipments, and orders. Using this data, it detects supply/demand misalignment, providing a time-phased view of inventory levels and highlighting the problems. Infor Nexus has some of the best visualizations of supply chains, especially for highlighting issues and quickly understanding them. Users can see a map view, with trade lanes and waypoints (ports, CFSs, DCs, factories, etc.) color-coded (green, yellow, red), highlighting trouble spots. Situation-appropriate details pop up when hovering over a lane or waypoint. Alternatively, a Sankey diagram view can be shown. Time-phased graphs appear when highlighting specific items. Single-click filtering updates all data displayed so the user only sees the status for the items of interest to them, such as only items destined to a particular retailer or location, or only a specific SKU.

Users can see revenue and margin at risk from each incident. In-house users, trading partners (suppliers and customers), and service providers (carriers, 3PLs, brokers, etc.) can then collaborate on resolving issues with a shared view of the situation. They can suggest and initiate changes to POs and shipments directly from the application. Options are shown such as stock at other locations that might be transferred, feasible options to ask suppliers to increase or expedite production, transportation expediting options, and so forth. Information about the cost and impact of different resolutions helps users decide on the best one.

Idle Process Monitoring

The platform uses process mining techniques to gain an understanding of all the steps of long-running processes, such as procure-to-pay, and learn what is the typical time-period for each step. The purpose is to detect stalled processes—i.e., something that was supposed to happen by now but did not. This involves learning all the different process variants; the different paths and steps that may be taken, and different typical time periods per step for each variant. This includes physical moves, such as how long is typically spent getting through a particular port. When a step is delayed, the system can generate an alert, such as sending an email to the supplier asking, "*Did you begin the staging process?*"

Open to Buy/WSSI support

Infor supports multiple methods for OTB and WSSI processes, via Infor Retail Assortment Planning for Fashion and Infor Retail Item Planning. These are separate Infor products, not part of the Infor Nexus suite. For seasonal/collection-based or frequently transitioned goods, Infor offers Merchandise Financial Planning and

Item Planning solutions to manage sales/margin planning, Open to Buy, promotions and transitions. For retailers selling consumer packaged goods, where transitions can be made at any time, Infor offers a suite of Category Management solutions that support sales, margin, promotional, and assortment planning capabilities.

Pricing, ROI, Time-to-Value

Infor Nexus uses subscription-based pricing, typically with three- to five-year terms. They use different metrics as the basis for pricing the different products. Their pricing metrics are reasonably aligned with value:

- Transportation solutions' pricing is based on the number of shipments or freight spend
- Financial solutions are based on value of spend
- Product solutions are based in inventory/goods value

Suppliers may pay a transaction fee as well, depending on the functionality being utilized. For small volumes, the fees are nominal.

ROI Drivers

ROI drivers include reduced landed cost, reduced COGS, higher OTIF (resulting in reduced chargebacks, higher customer satisfaction and retention), freeing up working capital for other investments, reduced duties and tariffs, reduced freight costs, less expediting, and reduction in stockouts.

Quick Start vs. Custom Deployments

Infor Nexus has Quick Start (QS) implementation methodologies, which implement preconfigured best practices for specific processes, bypassing most of the initial design and customization work.
QS implementations typically take three to four months. Examples include QS Procure-to-Pay and QS Factory Visibility. Custom deployments are still the most suitable for larger more complex customers with multiple regions and multiple ERPs. These are typically 6-7 months for each phase of the custom deployment. Value starts being realized once the first orders are flowing.

Implementation Resource Requirements, Post-Deployment 'Hypercare'

During the implementation, customers typically commit about four FTEs including a project manager, business lead, IT lead, IT developer, and various associated SMEs. Infor Nexus will provide another four FTEs including project manager, solution architect, systems engineer, and a consultant who does a lot of the configuration. Infor Nexus provides what they call 'Hypercare' for ~30-120 days after deployment. This is a period of very intense support by the same team that did the deployment to ensure the supply chain is flowing and everything is working properly. This ensures a smoother startup and handoff to the customer, using the same team that has been deeply involved with the project for several months.

Implementing Higher Value Cases First

Infor tries to take a value release approach, implementing the highest value features first. For example, if the customer is looking to retire a system, there may be big value in replacing that first. Or if 60% of imports come from one origin port, they may implement that port first. A lot of that prioritization is figured out during the sales process.

After the initial phase, the value continues to ramp up over time. For example, if someone plans on changing their deconsolidation network, they might do one node first. Then they might start analyzing the flows and

figure out the downstream impact of which node to do next. In another case, they might start with inbound visibility, to ensure on time delivery and ability to quickly respond to notice issues, then next add demand signals to better predict stockouts.

Who Infor Nexus is a Good Fit For

Infor Nexus is a good fit for companies with large, complex international supply chains, who use multiple 3PLs and LSPs to manage long multi-leg, multi-mode shipments. They are good for firms who do a lot of ocean or air shipping between multiple regions and sites, such as from outsourced manufacturers and a global network of suppliers—especially if the company has challenges with long lead times, lack of visibility, excessive expediting and/or late shipments, low fill rates, high stockouts, and high chargebacks. Infor Nexus is especially targeted for fashion apparel and footwear, as well as general retail, CPG, automotive and industrial manufacturing, and logistics service providers.

Mercado: *Import Management-Focused Supply Chain Application Network*

Mercado is a supply chain application network/platform connecting retailers with suppliers, forwarders and brokers, carriers, and other service providers in the order-to-delivery process for imports. Mercado refers to their system as an 'Import Management System.' Founded in 2018, Mercado is a young company, building out their platform functionality with the latest UI and technology as a foundation.[28] They provide functionality to improve the first mile of the supply chain through automation. Their scope includes vetting suppliers, ensuring supplier's compliance with standards, specifications, and order specifics, monitoring production, and managing shipments from suppliers throughout the end-to-end logistics process.

Mercado, which means 'marketplace' in Spanish, is envisioned to include a marketplace of service providers, such as other logistics and supply chain networks (e.g. FourKites, TOPL, OpenTrack), origin services (e.g. packaging, inspections), value-add services (such as labeling, kitting, repack), and logistics services. While they are still a quite young company, with much functionality remaining to be built to achieve a broader footprint, Mercado plans to leverage their partner-centric marketplace model to grow an 'extended footprint' relatively quickly on top of the solid core they have already built. Among the many different areas they expect to address in their marketplace, Mercado has expressed a particular passion for supporting socially responsible supply chains and sustainability enablement services.

[28] Their leadership team comprises industry veterans and practitioners with a combined 65 years of experience managing import supply chains in companies such as Michaels, Lilly Pulitzer, Lumber Liquidators, Footlocker, Target, and Five Below, to name a few.

Target Customer

Characteristics/Factors Driving Adoption

Mercado primarily serves retailers, distributors, and brands who lack automation, workflow, transparency, and visibility during the critical first mile during production—importers who struggle with the complexity, volatility, and difficult to forecast demand. They are typically mid-sized importers who have long-lead-time international supply chains. Mercado has some substantive early proof points with customers, including a $12B retailer. Over time, executing a larger number of mature implementations will help them refine and prove out their business model and value.

Industry Focus

Mercado focuses on retailers, distributors, and brands selling products who want to eliminate complexity.

User Roles

Mercado serves users on both the buyer and supplier side.

The users on the buying side of the relationships are those responsible for the inbound supply chain, such as:

- Sourcing and procurement professionals
- Import compliance
- Transportation and logistics managers
- Supply chain professionals
- Finance professionals
- Inventory management professionals

The users in supplier companies are those responsible for production, the outbound supply chain, and customer-facing operations. This includes roles such as:

- Client/customer-service delivery managers
- Outbound operations managers
- Production managers
- Supply chain professionals (customer-facing)

Functionality

Mercado is built on a modern platform with a clean, simple, intuitive UI and UX. They have built solid supplier management and PO management tools and useful logistics tracking functionality.

PO, Supplier Integration

Mercado has prebuilt integrations with SAP, Oracle, NetSuite, QuickBooks, ABS, and RollMaster. These integrations can ingest POs from the buyer's ERP system. The platform can then provide PO tracking, document generation (based on data from the PO), and tools for collaboration throughout the PO lifecycle. PO change requests can be made within the platform (or ingested from an external PO management system) and the reasons for the request are recorded in the system. The supplier/manufacturer can then agree to the request or suggest an alternative plan. The platform keeps a permanent record of these negotiations and what was

finally agreed. Modifications made to POs within the Mercado system can be written back to the ERP PO management system, provided that integration has been implemented.

Mercado's platform lets suppliers log in via the web and operate with the same feature set as buyers (within the limitations of what each party is authorized to see and do, of course). Mercado creates all documentation from validated orders. All data is kept digital to dramatically reduce mistakes, delays, and expense. Integration into the customer's AP system to automatically receive the invoice can be done by request.

Supply Chain Visibility

Mercado provides a standard set of preconfigured dashboards out-of-the-box, including supplier, order, product and logistics-oriented dashboards and reports. During the onboarding process, Mercado works with clients to understand customer-specific reporting needs. Customer-specific report templates are then configured. Data visibility is managed with Tableau. Mercado has preconfigured reports for orders, shipment booked, departed/in transit, container details, vendor overview, port details, carrier allocation, container type, and utilization. They do not yet ingest vehicle location data directly from vehicles' GPS/ELD devices or from ships' AIS data, but they do accept status updates from carriers.

Milestones, Events, Process Compliance Tracking

Mercado provides a set of standard built-in milestones/tracking events such as PO issued, PO received, PO Accept/Reject, Booking Requested, Booking Complete, Shipped, Arrived, Customs Cleared, and so forth. All milestones are configurable. Customers can create their own custom milestones to track progress. Milestone/ tracking data can be captured through manual input or via API or file integration with suppliers and third-party service providers (such as 3PLs, carriers, inspectors, etc.).

The milestone engine supports date/time offsets before or after an event. For example, a milestone might occur three days after a PO is issued or two days before a shipment is due to arrive. The engine can generate an alert when a milestone is missed, like a vessel did not arrive when expected, production was delayed, or container not loaded.

The system can also store specification documents and confirm that the supplier received them and actually looked at them. It can track when samples are sent, confirm that they were received, confirm that feedback on the sample was received, and order approved. An inspection by a third-party inspector can be requested on the platform, and the inspector can attach a certificate of inspection once completed. In general, the platform can help ensure that descriptions of all relevant procedures were sent, received by supplier, followed by supplier, and verify that they were done properly.

Quality Management

Mercado can be configured to track quality and compliance activities at suppliers' sites using event tracking, milestones, and direct integration from any service providers that may be managing QA and/or regulatory functions. Mercado has a mobile app that allows users at the supplier's factory or other site to perform functions such as upload files (for example report of problems found or photos showing the problem), manage quality resolution milestones, and send messages to the appropriate multi-enterprise team members to resolve the issues.

Customers can configure their own custom milestones to track the resolution of issues. For example, a customer may track milestones when inventory is quarantined/put on hold, root cause discovered, fix proposed, fix tested and approved, fix implemented and so forth. Mercado helps customers set up custom milestones during initial implementation.

Collaborative Issue Resolution

A chat session to resolve an issue can begin within the PO or shipment. In that case, all communications in that chat session are directly linked to the order or shipment being discussed. Mercado does not have a separate case management system per se, but users can collaborate on PO changes, missed milestones, quality, and resolving other issues within the context of the PO or shipment.

Pricing, ROI, Time-to-Value, Services

Pricing and ROI

Mercado charges an annual subscription fee, based on the number of POs processed by the system. There is typically a modest upfront implementation fee, usually about 20% of the annual fee. Mercado told us their customers are receiving an ROI of about 3X to 6X per year, with a payback in three to four months.

Mercado tries to minimize the amount of professional services they need to provide. The upfront basic implementation service they provide consists of three integrations: 1) the customer's ERP/financial system (primarily to get and put purchase order data), 2) forwarders' systems (usually CargoWise or Descartes AES), and 3) supplier integration which is done via supplier self-service through the supplier portal, with an approximately 30-minute training session over the phone. Services beyond these basic integrations are provided by referral to partners.

Time-to-Value

Mercado follows a structured, prescriptive implementation methodology. Mid-sized firms typically take about six weeks to implement; larger firms up to 12 weeks. Mercado told us they are working to substantially reduce the implementation time. Time-to-value ramps up during a relatively short period where Mercado and the customer are trying and testing out the system in a limited scope—such as for a single country, subset of suppliers, or subset of users—making sure that everything is working well. For small to mid-sized firms, this validation period can be as little as a week or two. Larger firms may take up to three months or more for a complete rollout.

Educational Services and Tools

Mercado offers a rich set of self-service educational materials and tools for their customers. They have established the Mercado Institute of International Trade (MIIT), which offers access to experts, online courses, and certification for sourcing, procurement, logistics, and trade compliance.

Who Mercado is a Good Fit For

Mercado should be considered for the shortlist for importers with long-lead-time international supply chains and who want to minimize complexity, volatility, and difficulty to forecast demand. This includes retailers and brands who want to improve their time to market, reduce expenses, and improve sales.

One Network Enterprises: *A Scalable Multi-Enterprise Platform with Substantial Supply Chain Application Functionality and Leading Architecture*

Founded in 2002, One Network (aka ONE) was architected from the start to provide a flexible and scalable multi-enterprise platform, with a broad set of well-integrated supply chain application functionality under the overarching umbrella of intelligent control towers for autonomous supply chain management. Their multi-tier, multiparty digital platform is designed to help companies optimize and automate planning and execution across the entire supply network and all trading partners, from inbound supply to outbound order fulfillment and logistics. The platform and suite of applications were entirely developed organically within One Network (i.e., not brought in via acquisitions), hence the applications are tightly integrated with a consistent user experience, single data model, and unified transaction backbone. Their platform excels at complex, multi-enterprise and multi-functional optimization and automation such as optimizing transportation, inventory, and service levels together or optimizing upstream production, taking into account downstream inventory and consumption. In recent years, the company has also made substantial investments in machine learning and intelligent agent technology, called NEO, that provides real-time predictive and prescriptive analytics to help companies optimize for high services levels and product quality at the lowest cost.

In our assessment, ONE has the most sophisticated/elegant architecture among the solution providers in this report. Their unified architecture provides deep flexibility for customization; flexible multi-enterprise master data management; a distributed agent architecture providing highly scalable multi-enterprise constraint-based optimization; as well as configurable division of labor between their system and existing legacy systems. ONE calls the latter a 'tunable system of control,' which are essentially fine-grained microservices that enables ONE's customers to do a gradual step-by-step migration from legacy systems—starting by implementing a specific contained set of functionality and then over time shifting more and more responsibility from legacy systems onto One Network's Platform (called NEO) at a pace that suits the customer. This provides a systematic path to digital transformation for companies with complex, fragmented, and siloed legacy systems. ONE's multi-level approach to customization also allows enterprise-specific customizations that are broadly useful across the network to be made available, over time, to a wider group of ONE's customers, once those customizations are proven.

Target Customer Characteristics/Factors Driving Adoption

One Network implementations often start at the 'anchor tenant' in a supply chain—i.e., a large OEM or major retailer that drives the entire supply chain. These tend to be more advanced companies, often global, with multi-party challenges, complex siloed business units, and a vision for multi-tiered integration on the upstream and/or downstream side. The anchor tenant connects their suppliers, co-manufacturers, and logistics providers to the network and then a subset of those suppliers may also become One Network customers. One Network is often used to provide multi-enterprise integration that ERP cannot provide. For example, they can plan and

optimize incrementally and continuously across multiple nodes, which may be important for big players in a supply chain.

The NEO Platform is also used to integrate the business and functional units of large complex organizations including vertically integrated companies whose divisions need better coordination and integration, as well as the DoD and various branches of the military integrating with each other and their joint supply base. ONE can be less compelling for a smaller company with simpler problems, such as when a company is just trying to solve a single function, without a broader vision for an integrated supply chain. One Network's architecture supports ambitious long-term visions, while their ability to implement in small pieces lets people get started right away, capture value, and gain support for future projects.

While ONE has customers in many industries, the main industries they serve are grocery, CPG, defense, automotive, retail, manufacturing, and logistics. Some of their key customers in those industries include in Logistics: XPO; in Grocery: Albertsons, Coles, Tom Thumb, Safeway; in CPG: PepsiCo; in Defense: US DoD, Air Force, Marines, Navy; in Non-grocery Retail: Argos, Dollar General, Target; and in Automotive: Cummins, Dana.

Typical User Roles

The NEO Platform tends to be used mostly by supply chain planners, buyers/sourcing and procurement professionals, suppliers, customer service reps, transportation teams, and IT.

Functionality

Broad Supply Chain Suite

One Network offers a broad range of supply chain planning and execution functionality including Logistics (TMS, Transportation Planning/Execution, Telematics, Dock Door, Yard Mgmt., Global Trade Mgmt., Freight Financial Reconciliation); Demand Management (Forecasting, Demand Sensing, Order Mgmt., Fulfillment, VMI, Multi-tier Replenishment and Inventory Mgmt.); Supply Management (Inbound Supply, Procure-to-Pay, Production Planning & Scheduling, Supplier Order Mgmt., Multi-tier Replenishment and Inventory Mgmt.); Integrated Business Planning+ (S&OP, Business Continuity and Risk, Sustainability); and Supply Chain Control Tower.

Configurable Milestone Processes

One Network's NEO Platform allows configuration of 'milestone processes,' a set of steps that should be met at specific thresholds or time frames. Milestones can be set and tracked for orders, delivery schedules, or shipments. Customers can create any milestones they want to match any business rules required. Milestones are satisfied when specific events occur, such as when a tender is created, or carrier pickup occurred. NEO tracks the estimated and actual time of the event. It understands the ripple effect of delays and cascades those effects throughout the end-to-end flow. For example, if a container arrives at the port 12 hours late but makes the sailing, there is no impact. If it missed the sailing, the impact will be a lot more than a 12-hour delay in arriving. The system understands the current position and average travel speed of ships and vehicles, traffic, weather, port congestion, etc. using those to predict if a milestone will be on time or late or early.

Strong Control Tower Functionality Especially for Multi-Tiered Supply Chains

One Network has a robust control tower with autonomous supply chain functionality that can provide multi-tier demand-supply alignment. NEO's sophisticated architecture enables multi-party, constraint-based supply chain optimization and execution, with the ability to balance multiple competing objectives. Their agent technology, called NEO intelligent agents, allows real-time and near real-time monitoring across thousands of nodes in a supply chain to detect and predict supply/demand imbalance for every item at each node, including

projected stockouts, and projected below mins and above maxes. A time-phase view of the demand and supply matching can be provided for every item at every node. Customers can see and link orders, inventory, and shipments throughout the entire process across multiple tiers. For example, the platform can track raw materials running late inbound to the supplier's factory and highlight the impact on production and thereby which purchase orders will be impacted and by how much. It can show the original plan, the deviation, and the impact to outbound side.

The control tower can absorb a customer's forecast, the amounts required by location per day, and then monitor real-time consumption and predict the impact of deviations from plan, by day. For multi-tier distribution, it can leverage POS data and calculate the impact back upstream through the supply chain, taking into account existing inventory, orders, and production schedules throughout the supply chain. In a retail setting, store managers can input casual factors and local events or impediments such as nearby construction or a local street fair. The platform can also do 'last minute allocation'—i.e., if scarcity of supply arises, the platform can calculate where the biggest need and the biggest gain is, and the cost of shifting the supply there, and decide where limited supply should be used for the most value. This is done at the network level with advanced analytics to optimize service levels and costs overall, rather than resolving exceptions sub-optimally on a case-by-case basis one-at-a-time.

Of course, all of this is dependent on getting the accurate up-to-date data (e.g., inventory levels, production schedules, consumption data, etc.) from across the tiers of the supply chain. That can be a pretty big challenge, particularly for data from those trading partners that are not already integrated onto the network. The value of that data is an incentive for companies to convince upstream and downstream partners to join and integrate into the network. Once that initial integration work is done, it enables more of NEO's powerful capabilities.

Automated Demand-Supply Imbalance Resolution

If all required data is available and a demand-supply imbalance can be fully resolved, NEO agents will recommend the best resolution action for that issue. Otherwise, it displays a partial resolution and waits for additional input to continue to address the imbalance issue. As NEO determines available resolutions, it can act on them or provide multiple choice options (e.g., expedite vs. transship vs. allow stockout). It shows the impact of the different choices, cost vs. gain of each one. If desired, the user can drill down to see the impact on service levels and other details and then decide which recommended action to execute.[29]

NEO can calculate the impact on holistic profitability for each recommended resolution, taking into account all costs (e.g., total landed cost, value added service contracts) and other factors such as lead times or customer service level requirements. For example, it may consider the freight costs, carrier contracts, the pack out of the vehicle (to maximize profit when there is not enough room in a container or vehicle), determining what quantities can be shipped. Supply chain constraints can be configured or inferred, such as vehicle capacity, warehouse labor availability, and service level thresholds/SLAs by customer.

[29] Some customers let the system decide automatically, while others want the user to do a verify step, to accept or override the recommended action. Over time, they can loosen the thresholds that determine which actions get auto-approved (decided without verification). Thereby the customer can migrate to increasing levels of autonomous supply chain functionality, at their own pace, as their confidence in the system's recommendations grows.

Global Optimization

With accurate real-time data, the platform can optimize globally[30] across the supply chain. Knowing end demand, it can drive execution and optimize holistically across the network. It looks at what each subsystem must do to get to the top-level optimization. For example, it understands both WMS and TMS, and can look at all the transport and labor constraints to schedule arrivals optimally; looking at hundreds of trucks and doors, it can move things around to the best slot. The network can absorb each individual plan and optimize across them.

Multiparty Issue Resolution

Customers or the system can create a multiparty issue, aka as a 'problem' or 'case.' The alerting framework can also auto-generate a problem based on an alert, such as a shipment that is running late. Manual steps that need to be done can be configured for each specific problem type. All the relevant data needed for a specific problem type is aggregated and presented to the users by the system. For example, if a shipment is late, it could show what orders and items are on that shipment, which suppliers and carriers are involved, alternate inventory available, and so forth. Users can collaborate in real-time or via asynchronous messages. Resolution codes can be defined and tracked. All the data for these issues/cases flows into ONE's analytics tool, enabling their customers to analyze what kinds of problems are occurring, how often, where, what the resolutions were, etc.

Prescriptive workbenches are available to resolve exceptions, using AI-based and other advanced algorithms. Instead of looking at exceptions one-at-a-time on a first-come, first-served basis to identify resolutions, the NEO prescriptive analytics optimize choices and evaluate trade-offs at the network level, at each point in time, to maximize service levels and minimize costs for the network as a whole. The ability to find globally optimal solutions is a differentiated capability that should help firms find and deploy better resolutions. Prescriptive analytics helps them do so more quickly.

Pricing, ROI, Time-to-Value

One Network's pricing has several components which, while making pricing a bit more complicated, helps align the ongoing fees paid with value derived and services used: 1) base platform fee, 2) transactional fee—# of shipments, # of orders, 3) user fee—number of users in the customer's company (not counting users at their suppliers), 4) network services fees—there is a fee for each network services used, such as transportation management, order collaboration, etc. There are hundreds of fine-grained services, so this is a 'pay only for what you use' approach. There is also a nominal onboarding fee for each new supplier brought onto the network, but there is no onboarding charge if the supplier is already on ONE's network for another customer.

[30] Most optimization engines optimize within some local domain or functional area, such as the transportation or inventory needs of a single firm, without regard for the impact outside of its domain. However, a plan that is optimal for transportation may overrun the capacity of the DC, such as having too many arrivals at or near the same time. Similarly, a plan that optimizes inventory for one company may place an even greater inventory burden on a trading partner. Thus, global network-wide optimization can generate greater value and performance for the supply chain as a whole. One Network is the only solution we know of that does this level of global supply chain optimization.

According to ONE, their typical payback period is 10 to 14 months. Value is achieved in many different ways, depending on the customer and what they implement, but is typically realized in lower cost of goods sold (COGS) through transportation, staffing, and other cost savings and lower waste, improved revenue through higher service levels and on-shelf availability (plus less product switching by consumers), and an improved balance sheet through lower inventories, asset redeployment, and related costs. For example, by automating their scheduling function, one very large grocer customer redeployed about 80 people from their scheduling staff, reducing that function from 85 personnel down to 7. Another grocer cited how the platform enabled them to maintain service levels during the pandemic when demand rapidly surged to well over 50% above normal levels.

Time-to-value differs for each customer. For focused functionality and rollout, like say transportation management in North America, implementations are typically three to six months to go live.[31] A total transformation project may be a multi-year effort, but ONE works with the customer to determine the long-hanging fruit with the fastest time to payback to implement first. This way value is realized within a few months which helps justify and fund the rest of the rollout.

Who One Network is a Good Fit For

The ideal customer for One Network is one that is driving towards a vision of multi-tiered (upstream and/or downstream) integration and continuous optimization. This could include large complex multi-division or global organizations looking to integrate their own business and functional units in ways that ERP systems are unable to. ONE is a good fit for customers in grocery, CPG, defense, automotive, retail, and logistics industries.

Zencargo: *Digital Freight Forwarder Providing Control Tower Capabilities*

Zencargo is a digital freight forwarder, founded in 2017, predominantly serving the UK and Europe, but also Asia and North America. In addition to offering traditional freight forwarding services, Zencargo also provides control tower software that can be used with their forwarding services or used separately as a standalone platform, independent of Zencargo's forwarding services. Zencargo gathers SKU-level data from their customer's ERP systems, augmenting that with data from suppliers, and then compares the current situation on the ground against plans. If the supplier's factory or already in-transit shipments are going to be late, Zencargo works with the customer collaboratively on how to mitigate the effects. Through various means, they can help in reducing stockouts, better leverage inventory, and optimize container shipments.

This ability to perform the logistics execution differentiates Zencargo from the software-only platforms reviewed in this report. Parts of Zencargo's control tower leverage human logistics professionals, the same

[31] Some customers with limited scope have gone live in as little as a month or two. If integration mapping is needed, it takes more time.

experts that are already providing their freight forwarding service. Thus, Zencargo can augment their customers' internal logistics and supply chain staff to solve demand-supply imbalances.

Zencargo's platform-service combination can rapidly respond to changes in commercial requirements by executing the logistics on the platform. They already have logistics experts who are executing, monitoring, and optimizing the international logistics flows for their customers—those same resources can add human intelligence to the machine intelligence of Zencargo's platform.

Target Customer Characteristics/Factors Driving Adoption

Zencargo's target customers are primarily mid-sized retailers and consumer goods brands, in particular fashion and luxury apparel, footwear, cosmetics, health & nutrition, furniture, homeware, sporting goods, building supply and home improvement, and home and garden. Zencargo's customers often have complex and volatile supply chains and are typically fast-growing businesses with a big ecommerce presence or a desire to move rapidly to ecommerce. Companies that are vertically integrated and do their own manufacturing inhouse, rather than outsourced, would not be as good a fit for Zencargo.

User Roles

Zencargo users are typically in one of four roles:

- Supply chain
- Logistics
- Merchandiser or commercial buyer
- Finance

Functionality

Zencargo offers control tower functionality, integrated with their freight forwarding services as described below.

Good Upstream Logistic Visibility, Basic Milestones

Zencargo's control tower provides some basic production status visibility, and more advanced upstream logistics and inventory visibility. They do not yet have inventory or logistics visibility for further downstream, from the warehouse to the consumer. They gain visibility into milestones at ports via integrations with 3rd parties. They have support for direct use of onboard GPS/ELD data from vehicles for tracking purposes, but no integration yet with third-party tracking networks (e.g., MacroPoint, Project 44, etc.). The platform comes with PO- and shipment-level milestones out-of-the-box. There are no customizable milestones yet, but that capability is coming soon. More detailed, industry-specific milestones are also in the works.

Exception handling and corrective actions

Zencargo's intelligent rules engine raises issues, notifying customers of exceptions, and providing a collaborative environment to resolve them. They provide some root cause analytics to understand what is driving the issues and allow for business process improvements where relevant. The platform provides information and tools to help manage production, logistics, and inventory. The logistics dashboard is a central part of Zencargo's offering. There is a comprehensive exceptions section for logistics colleagues to view specific disruptions.

Supplier portal and booking

Zencargo provides a supplier portal where suppliers and manufacturers can respond to requests, update the manufacturing and fulfillment status of each PO, upload relevant docs and information, and collaborate with the customer. Suppliers can raise a booking request relating to a specific PO. The application can support freight paid at destination or origin. There are workflow tools for approval to ship (PO level & Shipment level), allowing the buyer-importer to approve shipment plans/requests from the supplier before they are executed. The platform can provide instant quotes for Ocean FCL, although it is rarely used, as most of their larger customers have fixed rates. They have online quoting functionality, but it is not instant.

Document Management

The platform can store all types of documents and automatically generate documents including shipping labels, invoices, and packing lists. They can show landed cost that includes duties, taxes, and transport.

Pricing, ROI, Time-to-Value

Pricing

Zencargo's visibility and order management software is packaged into the price of their freight forwarding services. An alternative pricing structure is available for instances in which the freight service is bought direct from the carrier.

ROI Metrics

Zencargo tells us that by using their platform, their customers typically increase revenue by about 1%, reduce their freight costs by about 5%-10%, and reduce working capital by over 1%. The main metrics Zencargo measures and targets to improve include:

- *Container utilization*—how full the containers are vs. maximum for a given SKU, thereby reducing the number of containers shipped for same volume of product
- *LCL used*—ship more FCL, less LCL
- *Lead time*—average node-to-node lead times
- *OTIF*—improve supplier ship timeliness and logistics performance
- *Supplier performance*—OTIF shipments, as well as data accuracy and timeliness
- *Data accuracy*—from all sources
- *Inventory turns*—reduce amount of inventory while maintaining or improving service levels
- *CO2 emissions*—via higher container utilization and other means
- *Landed cost reduction*—today primarily by reducing logistics costs; in the future by reducing tariffs and duties as well

Implementation, Time-to-Value

Implementations, without any API integrations, typically take a matter of weeks depending on the complexity of the supply chain in question, during which Zencargo makes sure the data flows are correct, onboards suppliers' factories, provides training, and maps exceptions. During this period, Zencargo and the customer

together build an SOP[32] and SLA[33] to define how they will operate together and what the service level expectations are. Zencargo also offers implementations with API integration.

Regarding time-to-value, small to mid-sized companies will usually have many functions being used broadly across the organization within a few months, with adoption expanding in a phased approach. For larger customers, it depends on the speed and scope of the rollout. Within a single business unit, they may see time-to-value in a similar timeframe as a mid-sized company. It typically takes longer to roll out across an entire large enterprise.

Who Zencargo Is a Good Fit For

For mid-sized retailers who do significant importing, Zencargo provides an interesting option that combines control tower capabilities with freight forwarding services. This might be the right combination for those looking to simplify their solution provider relationships and have a single point of responsibility. The savings and revenue impacts that Zencargo touts are compelling.

[32] Standard Operating Procedure

[33] Service Level Agreement

About ChainLink Research

ChainLink is a recognized leader in custom research and advisory services, with a focus on supply chain, Internet of Things, and blockchain. Founded in 2002, our emphasis from the start has been on inter-enterprise interactions and architectures ('the links in the chain'). We have conducted over 75 primary research projects, interviewing and surveying over 10,000 executives and professionals. Much of our research focuses on industry-specific use cases, business cases and ROI, and drivers/inhibitors of technology adoption, and business change. As a result, we have developed a deep, multi-industry practice, founded on real-world, validated, supply chain-wide, end-to-end perspectives that have helped our clients understand, plan, and succeed as they move into the future.

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