

# Beyond the Enterprise

## Increasing supply chain payback ratio In the age of contract manufacturing

In past years, companies made significant strides in improving the performance of their internal supply chains. Today, the challenge is to make contract manufacturers and suppliers as efficient and accountable as enterprise stakeholders. This white paper, "Beyond the Enterprise," details with maximizing return-on-assets in the global, extended enterprise.

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## Supply Chain Planning: The Enterprise-Centric View

In past years, companies made significant strides in improving the performance of their internal supply chains. Benefits include lower inventory, improved on-time shipping, better customer service, real-time available-to-promise (ATP) quotations, shorter cycle times for planning, and increased responsiveness to changes from execution systems and unexpected constraints.

Advanced Planning and Scheduling (APS) systems and Supply Chain Planning (SCP) systems were instrumental in achieving these benefits. By taking a macro view of enterprise operations, companies could retrieve information about the global supply chain and supplement it with other data stored in disparate transaction applications, including ERP and legacy systems. This information could then be aggregated and used to formulate more intelligent plans optimized around objectives such as cost, revenues or customer service.

These enterprise-centric planning systems saved time and money. One payoff was their ability to coordinate dates on work orders so that deliveries could be made on time while minimizing inventory levels. Demand from new orders could be propagated instantly throughout the supply chain across multiple manufacturing and distribution sites based on a single SCP run. The alternative was to run a series of local plant-level “solves,” which typically took days or weeks, to calculate and communicate required changes in supply and demand.

Some of these systems could also integrate disparate, yet mission-critical, internal data sources that were otherwise disconnected. Previously this process was highly time-intensive for propagating purchase and sales orders, which at best were electronic, and at worst paper-based.

That’s the history. Today, the challenge is to make contract manufacturers and suppliers as efficient and accountable as enterprise stakeholders

## ***Moving Outside the Enterprise***

The competitive edge has changed. Businesses now must take the gains that they have achieved with their internal supply chains and extend them outside the enterprise. Two related scenarios are driving this evolution: the extended enterprise and the virtual enterprise.

The extended enterprise includes customers, suppliers, suppliers' suppliers and beyond. It is a multi-tier value chain composed of companies that significantly impact each other in their ability to meet a demand. Each entity is an independently operating company, but they need to collaborate on plans and schedules to meet common demand. These extended enterprises exist in multiple sectors, including high tech manufacturing, aerospace, and other material-intensive value chains.

A virtual enterprise also includes customers and suppliers, but it differs from an extended enterprise in that it does not own any of the facilities that actually perform the manufacturing. It will collaborate on the development of schedules for these facilities, synchronized with plans. Examples include fabless semiconductor companies and "brand owners" within the apparel industry.

In both scenarios, the enterprise is severely impacted by the responsiveness and effectiveness of its suppliers. The customer service buck stops with the enterprise. To protect themselves, extended and virtual enterprises alike need the ability to manage supply chain processes beyond their four walls as an equal or dominant partner with members of the value chain. The objectives are the same as they were with first-generation SCP systems: reduce inventory, improve on time performance, improve customer service, eliminate costly shortages, and remove obsolete inventory from the system.

First-generation SCP systems are unable to address the more complex requirements of two or more enterprises that must collaborate and coordinate planning and scheduling. A new paradigm is needed.

## Intelligent Planning and Collaboration Across Enterprises

### Overcoming Barriers to Collaboration

To manage the extended enterprise companies must increase the flow of information and degree of collaboration with external trading partners. To accomplish this, the accepted first step up from fax, phone and EDI is the Internet. ERP vendors are now putting web front ends on their systems and moving transactions over the internet (Figure 1). This does enable a more rapid exchange of information between the enterprise and its partners, but it does not address the larger issue—collaboration on plans and schedules measured against constraints. With the web-enabled ERP system, you still have an enterprise system that does not support collaborative business processes for managing a supply chain.

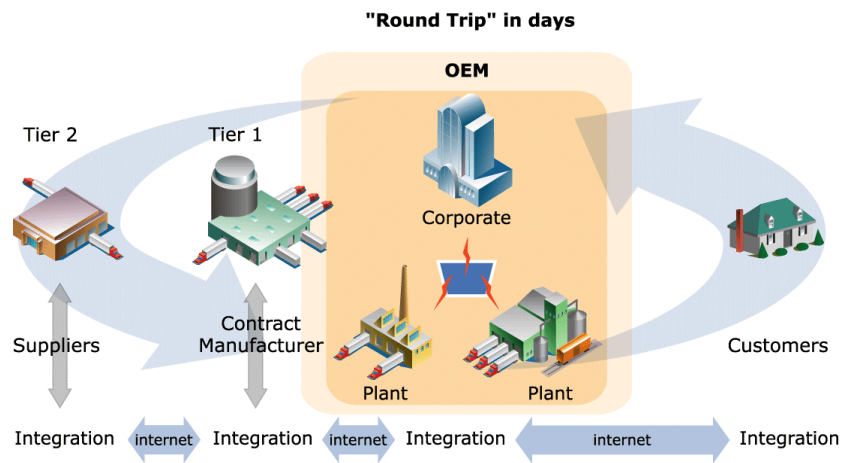


Figure 1.

## **Building an Intelligent Collaborative Solution**

In order to gain the benefits that were obtained with enterprise SCM solutions in the extended enterprise, we need to understand the differences between inter-enterprise (collaborative) and intra-enterprise planning (Advanced Planning and Scheduling). For each of these scenarios to gain the benefit we need to do the following:

- Model the Supply Chain
- Provide Visibility to the Supply Chain
- Provide intelligent decision making with the data
- Integrate to systems of record to get transactional status and post changes to plans
- Communicate the plans and schedules

How we accomplish these goals inside the enterprise and between enterprises is different. In the enterprise the model of the supply chain data is provided by one company, centrally administered and secure. Some people are allowed to work with the data and others are not. There is no need to separate views by stakeholder.

With the inter-enterprise collaborative system data administration needs to be distributed and divided for each trading partner. Who receives access to what data must be defined.

Visibility in the enterprise can be provided behind the security of a firewall, and the system does not need to adhere to the standards of Internet computing. Users can view and make manual changes to the plan.

In the inter-enterprise example, visibility needs to be provided using the Internet and system must be web native to assure scalability. Users must also be assigned permission to affect the types of changes to the plan that are in their specific area of expertise.

In the enterprise supply chain, there is a centralized optimizer that takes the entire model and runs a calculation or routine to come up with a plan for the supply chain. This works fine for an enterprise with central planning power.

In the inter-enterprise system there is no centralized plan. Each stakeholder makes decisions with the data that they are allowed to “see” from the other stakeholders. The decision logic is localized and is used to make small changes to the plan very quickly. Intelligence in the inter-enterprise system is handled by “planning agents” that act on behalf of a stakeholder to speed intelligent decisions.

Communication with and integration to enterprise supply chain systems is accomplished with API's to data bases, message buses, other programming API's or middleware.

In the inter-enterprise system connectivity needs to be accomplished with b2b systems that use XML technology and the Internet.

These differences make it necessary to employ a system that is built from the ground up for inter-enterprise intelligent collaboration; otherwise, the enterprise owner could end up in an endless professional services engagement that might never deliver the expected results. Further, the system should leverage the investment the enterprise owner has already made in existing ERP systems, by

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taking data from them and making it available to all stakeholders, as required. The result is an extended enterprise environment that provides event based updates, visibility of shared data, real time alerts of supply chain imbalances and intelligent responses to problems. The value chain changes from a series of enterprise systems that are connected by the internet, to an intelligent collaboration system that allows business processes to be established across extended enterprises (see figure 2).

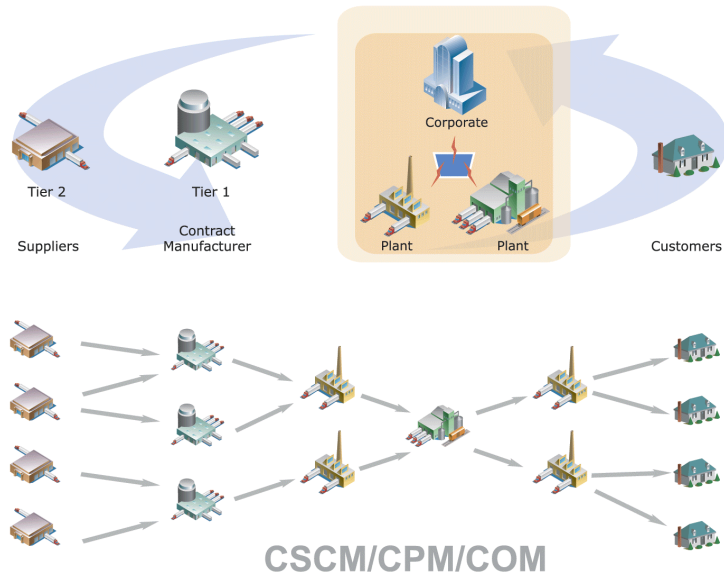


Figure 2.

In this extended enterprise, companies are free to do whatever planning they choose in private, publish results to the intelligent collaborative environment, and then, based on real time events, monitor and adjust the plans, either manually or with planning agents. For example, a supplier may have committed to an enterprise that they will supply up to 1000 units of a part for one month. This commitment would be entered into the collaborative system. If a demand is subsequently entered by the enterprise for 300 units, an intelligent agent in the collaborative system can immediately reply with a commitment to meet the demand. The intelligence in the system helps reduce lead times in the value chain, and provides better answers with intelligent decision making.

## Application of Multi-Tier Intelligent Collaboration

The intelligent collaboration systems described in this document will allow enterprises to realize business benefits that were not possible with enterprise systems and traditional b2b connectivity. The following case study shows how these systems can be put to work to bring business value. The OEM in this value chain supplies electronic assemblies to the market place. The supply chain is shown in figure 3.

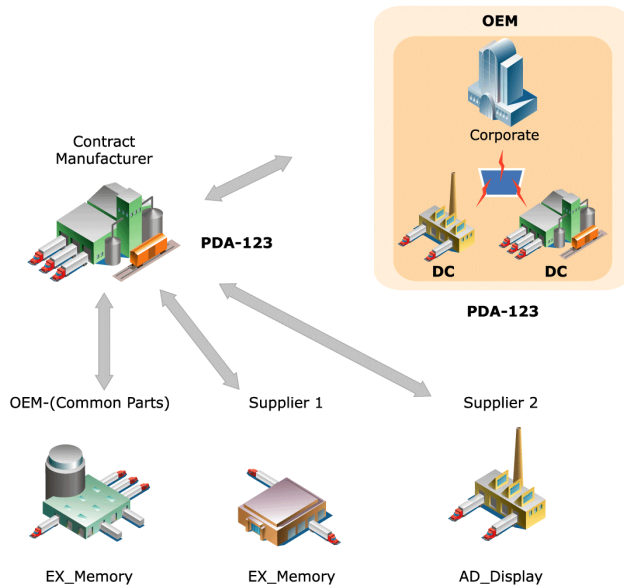


Figure 3.

The supply chain is made up of a contract manufacturer and its suppliers. A few years ago, the OEM assembled the device, but this work has since been contracted out. In the past the OEM owned the manufacturing facility so it had visibility and control over the assembly process, and could monitor the suppliers. That degree of scrutiny is no longer possible without a collaborative environment in the extended enterprise. Here are some problems that need to be addressed:

- long lead time on parts that have high value.
- obsolete parts and high inventory in the system.
- possible opportunities to share parts between similar product lines
- possible savings from special OEM supplier arrangements
- the ability to increase customer service levels.

## **Solution Requirements**

In order to achieve the savings and meet the specified business objectives, the OEM created a requirements document for the proposed system. First, the system needed to provide visibility to the contract manufacturer, its suppliers and the OEM. This multi-tier visibility was required to reduce inventory levels in the value chain, and enable rapid coordination of actions. The OEM wanted to know all the parts (assemblies and components) that were required, the promise data on the parts, and to be alerted if there was a problem with quantities or dates. As transactions were sent by the various systems (PO's, ASN, Goods receipts) the collaborative system would be automatically updated with the status.

The OEM also wanted to regain control of the requirements for component materials as exploded through the BOM, and the ability to substitute its oversupply of common materials for parts that the contract manufacturer would otherwise have to purchase from a component supplier. For parts with special pricing agreements, the OEM wanted to monitor how many of the specially priced components were needed and purchased. Further, the OEM sought to compare the amount ordered by the contract manufacturer to an independent calculation of how many are required by exploding the total assemblies ordered down through the BOM.

## Solution Proposal

The OEM had considered using a new web front end and b2b connector that had just been released by the vendor of its ERP system. It also looked at utilizing the web front end of the APS system that that was already in house. *But putting a web front end on an enterprise system does not create a collaborative solution.*

The OEM chose the intelligent Collaborative Supply Chain Planning solution from Adexa. The business process for the solution is outlined in diagram 5 . The Adexa system is shown in the center of the diagram, with the OEM, the Contract Manufacturer, an open priced supplier and a supplier that has a negotiated price with the OEM. Each of these companies has its own enterprise systems, and each enterprise system is connected to the collaborative system.

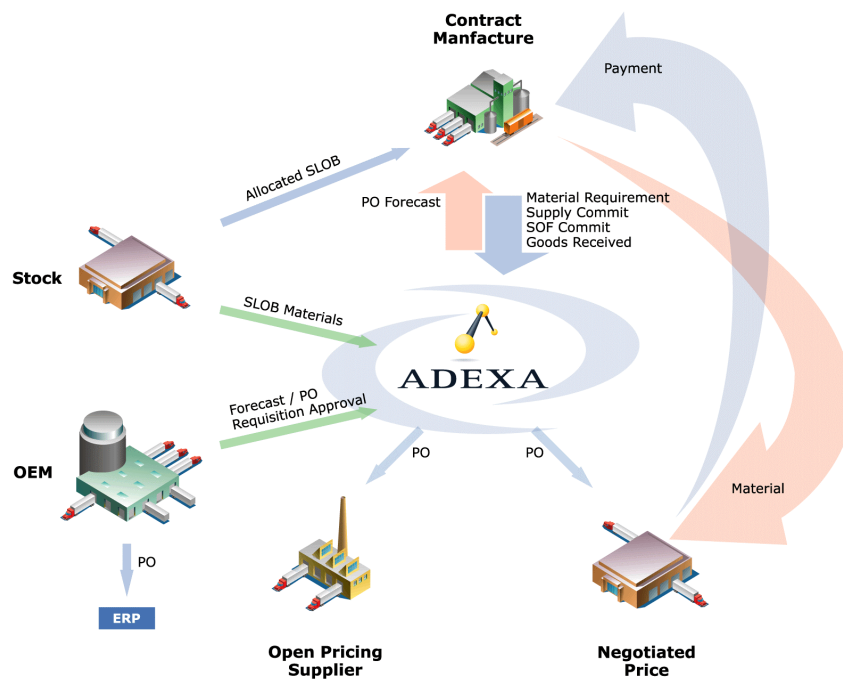


Figure 4.

The process starts with the Adexa system receiving data from the OEM and Contract Manufacturer. The initial data is the Sales and Operations Plan (SOP) commitment from the Contract Manufacturer to the OEM, which defines the total amount of volume the contract manufacturer has agreed to produce over the year, by period. Next, the OEM enters the demand for assemblies, both forecast and ordered, into the system. The OEM also enters on-hand component inventory for parts that are common to other assemblies, but moving slowly, or pose a risk of becoming slow moving or obsolete (SLOB). The OEM reviews the demand information and looks for orders that may be above forecast and sourcing splits, if more than one contract manufacturer is used for the same product. The information can be analyzed at the bucketed planning level for the forecast and forecast deviation comparison, and at the order level for the release of firm PO's into the system. The demand information is then automatically published to the contract manufacturer using the intelligent agents of the system.

The second step shows the planned requirements and PO's being released to the contract manufacturer. The system is capable of handling both forecasted and firm demands, and it can net orders from the forecast to show a net total demand. For the demand streams that are firm, the contract manufacturer will have authorization to make finished goods. For the forecasted demands the contract manufacturer will order component materials. The Adexa system is unique in its ability to be able to handle both forecast and actual orders, and compare the two, over time, for exceptions. Again, all visibility and alerts are handled by agents, and if nothing is outside of pre-specified normal parameters the information will be handled automatically.

In the third step of the process, the Contract Manufacturer will provide commitments against the orders for the devices, and also perform a BOM explosion to create dependent demand for the component materials. The Adexa system can automate the commitment cycle based on agreements, as well as enable multi-tier collaboration on the component materials. The commitment of devices can be automated based on available planned supplies uploaded to the system by the contract manufacturer. The system can also hold supply agreements and monitor commits against the agreements, either automatically or manually.

The next step of the process is requisition approval. The purchase of some components by the contract manufacturer is permitted, and the purchase of other components needs approval from the OEM. The approval cycle can be automated based on the OEM's overstock levels of those parts. This uses up slow moving inventory and prevents it from becoming excess and obsolete. If no available supplies are found, then the purchase requisition is automatically approved and sent to the component supplier.

The rest of the collaborative process deals with event management and monitoring of the execution. Any changes to the dates on commits are sent to the Adexa system, and if there are any problems, automatic notification is sent to the responsible planner. When components or assemblies are shipped, ASN's are sent to update the system with the expected arrival dates. Other transactions are processed to track the receipt of goods and a final payment ok can be sent, if desired.

Supply Chain Management has experienced a number of paradigm shifts over the last decade. Initially, planning was a task conducted unilaterally by multiple individuals, without collaboration. Then, planners started exchanging hierarchical information, such as strategic guidelines for plant-level material and capacity planners, but that was about it. Finally, it was accepted that the development of more accurate plans required input from multiple people. This current paradigm requires sophisticated sharing of a plan.

Sharing of the plan can take many forms. It can be performed within an enterprise, between an enterprise and its customers or vendors (typically called a "private exchange"), and between enterprises acting as peers (typically called a "public exchange"). To provide a common platform for sharing these plans globally, Adexa uses the Internet. However, firewalls, which limit communication for security reasons, may exist on the client and/or the server side. Firewalls typically limit communication to a specific protocol (usually HTTP) and a specific port (usually #80). HTTP does not allow persistent connections; that is, a client makes a request, the server responds, then the connection ends. With these restrictions, it may be difficult for planner B be

notified when planner A makes a change to the plan held by the server. The approach that Adexa has taken for notification, when communication is restricted to HTTP, is to apply a polling mechanism within the client that will periodically check for notices generated on the server.

The Adexa Collaboration function provides the following features to facilitate sharing among multiple planning partners:

- A common store for the plan
- A multi-threaded, multi-user environment (session persistency)
- Services for notification
- Services for personalization (based on locale); for example, the Collaborative function provides language-specific user-interface, use of familiar part numbering, and conversion to local time zone.
- Security

The Adexa Collaboration function provides the following options for delivering information to the user and receiving information from the user:

- By itself, since it is a web-enabled application (web server not necessary)
- Through a web server plug-in (for those environments where there already exists a web server).
- Through an Application server Enterprise Java Bean (EJB) plug-in (for those environments where there already exists an application server; for example, BEA).

The Adexa Collaboration function provides the following options for presenting the information to the user in a web browser:

- Through DHTML (Jscript/Javascript-HTML-Cascading Style Sheet) components
- Through Java applets (when the use of Java and Java plug-ins is permitted by the enterprise IT organization)

The following illustration shows how iCollaboration facilitates the sharing and delivery of information for multiple users through the use of the Internet.

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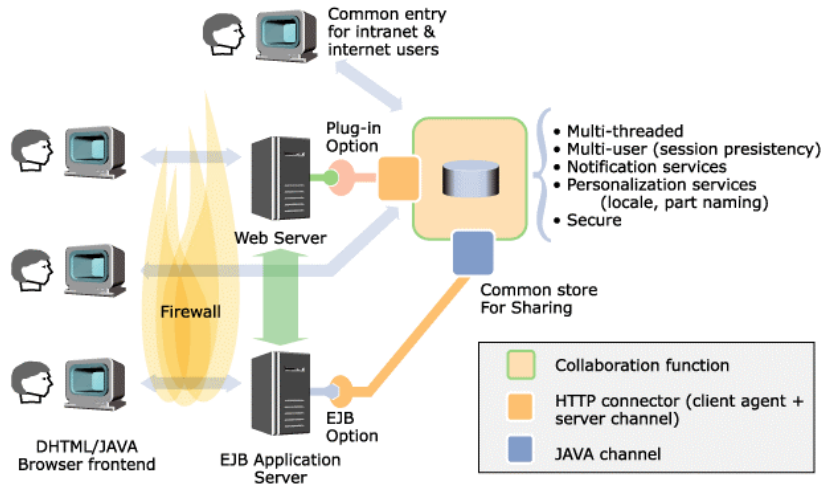


Figure 5.