

Adexa / *The Electronics Supply Chain:
Winning in a Virtual Environment*



ADEXA

Executive Summary

Constant innovation and changing market forces have transformed the electronics industry into the most competitive business in the world economy. No other industry is challenged by a combination of mass customization, rapidly shrinking product life cycles, rapid inventory depreciation, supply and demand misalignment, complex multi-sourced supply chains, and rising expectations of retailers and consumers. With relentless pressure to create shareholder value and strengthen market share, electronics companies have increasingly turned to supply chain management to provide the improved speed, flexibility and superior customer service necessary to remain competitive.

Not surprisingly, the supply chain strategies that have been implemented and their results have been as diverse as the electronics industry itself. To help electronics companies assess the best potential supply chain strategies and develop a strategic vision for the future, this paper provides an overview of the electronics market and supply chain, as well as the challenges facing companies in the industry today. More importantly, it reviews the most common supply chain strategies in use and provides details on Adexa's **iCollaboration** solution.

Industry Structure

The electronics supply chain is a broad and complex \$600 billion industry that includes a variety of end-markets and participants ranging from providers of silicon raw material to OEM customers. Figure 1 shows a breakdown of the major segments, including types of products, worldwide market size and expected growth. Annual growth for the top players is expected to range from 10% to more than 25%, with contract manufacturing – the fastest growing segment within the industry – expected to exceed 25%.

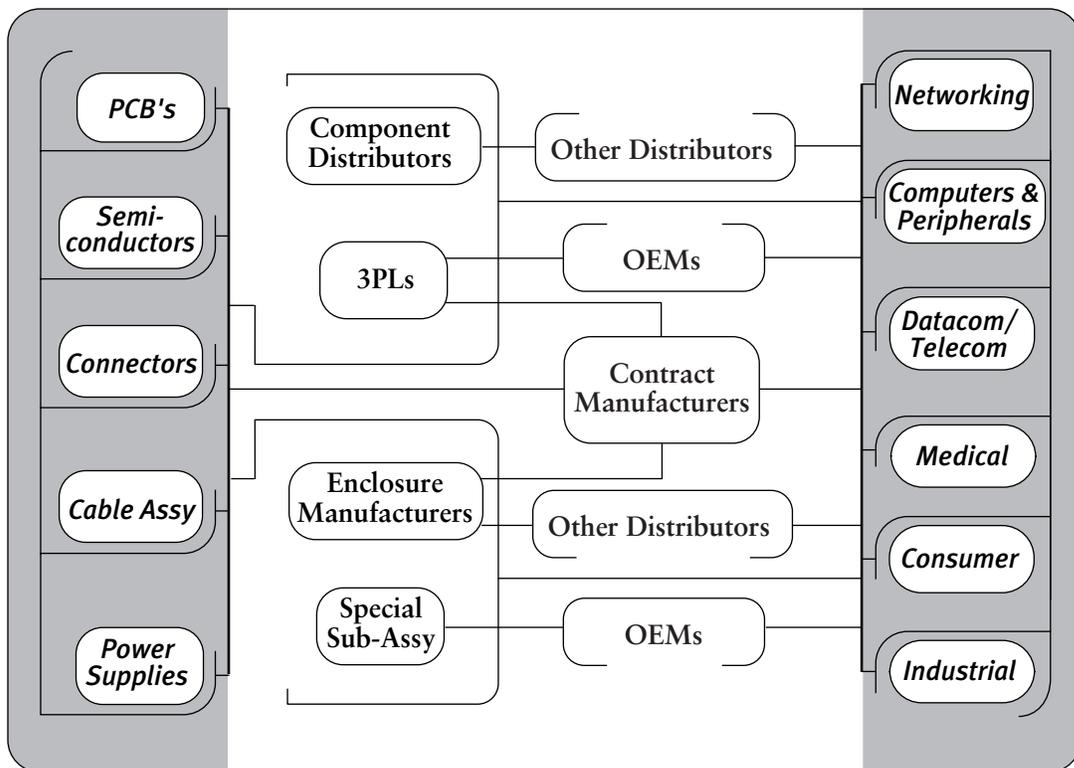
Figure 1 –Electronics Industry Overview

	Raw Material Suppliers	Component Manufacturers	Enclosure Manufacturers	Contract Manufacturers	Electronics Distributors	OEM/End-Markets
Product/ Services		Semiconductor Resistors/ Capacitors Connectors PCBs Power Supplies Other	Design Services Enclosure Fabrication System Integration Other	Design Services PCB Assembly Box Build Logistics Other	Semi- conductors Passives Electro- mechanical Computer Products Other	Computers Networking Telecom/ Datacom Industrial Consumer Other
World Market Size (\$ In Billions)		\$320-\$350	\$15-\$20	\$85-\$95	\$25-\$30	\$600 Total
Expected Growth		15%	15%-20%	More than 25%	10%-12%	More than 3 x GDP

Source: U.S. Bancorp Piper Jaffray Equity Research – Electronics Manufacturing Supply Chain

The goal of supply chain management is to improve the coordination and flow of information, materials and financials across functional and enterprise boundaries in a way that benefits all participants involved. Although this approach is contrary to the traditional view of optimizing within functional and corporate silos at the expense of the greater supply chain, many companies are embracing this new model. As the electronics industry continues to abandon the traditional vertically integrated structure in search of greater efficiencies, flexibility and responsiveness, a variety of multi-stage supply chain configurations have evolved. Figure 2 illustrates the multiple links and interactions between participants across the electronics supply chain.

Figure 2 - The Electronics Supply Chain



Industry Challenges and Financial Performance

As Figure 2 shows, the electronics supply chain has continuously evolved from the traditional, vertically integrated structure of the past to a complex network of participants linked to multiple end-markets. During this evolution, the industry has faced – and is still facing – a variety of significant challenges:

- **Mass customization.** Customers increasingly demand electronics companies to produce highly customized-to-order products rapidly and at a low cost. As a result, there is a tremendous amount of pressure on electronics companies today to create responsive and cost-effective supply chains. Many companies have turned to postponement strategies: creating finished products by configuring subassemblies after receipt of an order.
- **Shrinking product life cycles.** As electronics become commodity items, manufacturers are forced to make regular new product introductions to command a premium price, sustain profits and preserve market share. This leads to very short product life cycles which complicate the prediction of consumer demand since these new products may have functionality or capacity enhancements that are as yet untested. Furthermore, most forecasting algorithms work best when they have a reasonable (at least one year) amount of sales history for similar products. Accordingly, manufacturers must work very closely with retailers and resellers. Market demand can only be managed effectively by getting closer to the customer and using collaborative planning techniques.
- **Managing inventories subject to a rapid depreciation.** Semiconductor and component manufacturers are constantly introducing enhanced functionality at lower price points. Not surprisingly, product manufacturers feel obliged to integrate these new components into products to maintain or gain a competitive advantage. At the same time, product manufacturers have to use the existing inventory as soon as possible to maintain margins. While the cyclical nature of the semiconductor industry presents significant challenges in aligning capacity with demand and maximizing return on investment, it can provide considerable benefits. It has been estimated that a ten-day reduction in inventory is equivalent to a 1% increase in profit.
- **Supply and demand misalignment.** The electronics industry is a material constrained industry. New products are constantly being introduced and older products are redesigned to use components with enhanced functionality. All of this occurs in an environment in which consumer demand is extremely difficult to predict. To succeed in this marketplace, manufacturers must work in collaboration with suppliers to fulfill demand, similar to how they need to work with retailers to predict demand. With ‘time-to-market’ being the cornerstone of success, manufacturers that use collaborative planning techniques are the ones best equipped to succeed.

- **Pressure from retailers and resellers** to supply products at the right place and the right time is placing a great strain on manufacturers. Although it is not always possible to provide the products exactly according to demand, it is critical to set the right expectations. This naturally requires collaboration and communication. Retailers and resellers need the manufacturer to commit to firm delivery dates in order to avoid failed promotions or the huge cost of fulfilling rain checks. Similarly, retailers need a window in the fulfillment process so that there are no surprises. In addition to collaborative planning early on in the process, manufacturers and retailers must collaborate on demand fulfillment.

Despite these challenges, companies that manage the supply chain effectively are better positioned to emerge as market leaders. In addition to maximizing profit, they will be able to deliver products on the date and hour requested by the customer, while maximizing inventory turns and the cash-to-cash cycle. In fact, effective supply chain management is already playing an increasing role in determining the financial success of companies in the electronics industry.

Table 1 – Financial Performance Profile by Segment

	Gross Profit Margin	Inventory	ROIC
Contract Manufacturing	11.1%	9.5	18.0%
Printed Circuit Boards	16.0%	7.2	7.8%
Computer OEMs	33.1%	9.0	26.7%
Network OEMs	58.0%	7.1	35.9%
Telecom OEMs	34.2%	4.9	18.4%

Source: U.S. Bancorp Piper Jaffray Equity Research – Electronics Manufacturing Supply Chain

Table 1 indicates how several key financial measures– including gross profit margins, inventory turnover, and return on invested capital– vary among selected industry segments. Network OEMs have the highest gross profit margins (GPM) and return on capital in the industry, at 58% and 35.9%, respectively. Much of their success can be attributed to high-margin, innovative networking products that provide the foundation for the fast growing Internet. In addition, the high ROIC can be attributed to a supply chain infrastructure that relies heavily on outsourcing. This strategy is in contrast to traditional telecommunication companies that own the majority of their manufacturing assets. As telecom and other electronics companies look to remain or become competitive, analysts predict a move towards more outsourcing of supply chain activities.

Unlike the network OEM end-market, the printed circuit board segment of the industry has one of the lowest GPMs and return on capital. This performance is indicative of the components segment in general and can be attributed to a high contribution of mature products or commodities with relatively low margins. In addition, the components segment is challenged by the cyclical nature of the semiconductor industry which presents significant challenges in managing capacity to align with demand and ROIC.

While the variances in financial measures can be attributed to a variety of factors—including product maturity, market trends, marketing strategy and other internal and external factors – a recent supply chain study by KPMG concludes that much of the gap in financial performance between companies can be attributed to the impact of supply chain best practices. The following section explores several supply chain strategies and “best practices” that can help companies gain a competitive advantage in the electronics industry.

Winning Supply Chain Strategies

As many suppliers, manufacturers and distributors in the electronics industry embrace supply chain management to improve bottom line performance and provide a competitive advantage, several winning strategies have emerged. These range from structural changes to the physical supply chain to entirely new channel strategies and re-engineered business processes. Many take advantage of advances in visibility and decision support offered by next-generation supply chain management systems.

The following are seven winning strategies and the next generation solutions that support them:

1. Engage in Collaborative Supply Chain Planning

Collaborative supply chain planning involves improving the coordination and information sharing for all activities, from design to delivery, across functions within an enterprise and across enterprise boundaries. As companies engage in collaborative planning activities, the results are decreased lead times, lower inventory levels and improved responsiveness. In addition to coordinating activities across the entire product life cycle, collaborative planning involves a comprehensive solution including changes made in alliance strategy, business process, performance measures and technology.

Exploiting the Internet for collaborative supply chain planning provides a critical link for sharing information, planning and scheduling supply chain activities, and improving coordination within the design process. As customers share demand plans with upstream suppliers, these suppliers have more accurate visibility of future demand requirements from customers. This increased visibility enables the suppliers to better plan their business while providing commitments back to customers for product availability. In addition, customers and suppliers can better plan and coordinate design activities, leading to improved time-to-market.

Additionally, as product life cycles continue to shrink, managing product transitions and end-of-life events requires collaboration within and across enterprises. When products reach full maturity, make or scrap decisions must be made based on inventory availability, market demand, available capacity and profit margins, as well as new product launches for superceding products. These decisions can have a major impact on profitability, and affect several participants up and down the supply chain.

Planning systems with business rules and optimization techniques are available to evaluate various alternatives for managing product retirement and end-of-life decisions. Significant opportunities for improving financial performance can be realized through this form of optimization.

2. Outsource Supply Chain Activities

One of the most significant strategies embraced by the electronics industry is the outsourcing of manufacturing and logistics. As described in Piper Jaffray's recent report on the electronics manufacturing supply chain, "Outsourcing is the electronics manufacturing corporate fitness program." The motivation for outsourcing is driven by several factors such as increased speed, flexibility, agility and focus. When achieved, reduced time-to-market is the result, which is always a key competitive weapon. Outsourcing also enables OEMs to increasingly focus on the design and marketing of new products, leaving delivery to the contract manufacturer. In addition, outsourcing provides greater operating and financial flexibility, leading to higher ROIC. This type of "virtual supply chain" has helped companies like Cisco, Hewlett Packard and 3Com gain a significant competitive advantage.

The availability of sophisticated information systems that allow OEMs to be electronically linked with their providers has been a key enabler of the outsourcing model. In some cases, these electronic links can provide an OEM with detailed operational information from the contractor's factory, just as if the OEM owned it. Contract manufacturing has become the fastest growing segment (25% CAGR) in the electronics industry.

3. Evolve From MTS to BTO

Gone are the days where a fairly predictable environment supported the viability of a make-to-stock (MTS) business model. Mass customization, shrinking product life cycles, rapidly decreasing prices, and high inventory costs have forced companies in the electronics industry to re-engineer their business models. The fundamental challenge is how to postpone the production of finished goods until an actual order is received. This approach helps to minimize inventory and related obsolescence costs while at the same time providing acceptable product lead times and customer service. Where appropriate, electronics companies are shifting their production and inventory strategy from make-to-stock (MTS) to build-to-order (BTO).

Companies such as Dell Computer and Hewlett Packard have pioneered postponement strategies designed to provide mass customization while minimizing inventory risk. For example, Dell's direct channel postpones the assembly or configuration of a computer until an actual customer order is received over the Web. Hewlett Packard was a pioneer in postponing the final configuration of printers, including country-specific power supplies and manuals, based upon actual orders.

However, moving from MTS to BTO requires planning systems that can explode customer orders into the variety of subassemblies and parts needed to produce an end-item. In an assemble- or configure-to-order environment, the system must also have the capability to plan sub-assemblies and parts based on some model stock (or MTS). As companies move to taking orders from consumers over the Web, product configuration systems must be incorporated into the order entry

process. Unlike older systems designed to support MTS only, next-generation systems are needed to support multiple operating models to meet the diverse needs of the electronics industry.

4. Capture and Manage Demand

In today's electronics industry, product life cycle compression has made new product introductions the norm. This trend has led to an increasing emphasis on capturing demand from sales, product management and customers, along with product life cycle assumptions. This is in contrast to using demand history as the primary driver for creating viable demand projections. In addition, feedback regarding commitments against demand plans (constrained forecasts) provides the basis for collaboration among customers and suppliers, as well as internally through the Sales and Operations Planning (S&OP) process. These requirements present several challenges including ensuring distributed access for sales and customers to the application and integrating the demand plan with the "back-office" supply plan to provide real-time accurate commitments for collaboration.

Next-generation demand planning solutions are designed to enable demand capture for intra- and inter-enterprise constituents through a distributed architecture with Web browser access. In this scenario, the demand planner is designed as an integral part of a single data model solution that provides tight integration between demand and supply planning. Once demand has been captured in the system, the demand planner can aggregate and match demand against supply constraints to determine the appropriate commitment for a customer's forecast.

5. Optimize the Extended Supply Chain

Managing multiple enterprises, plants, multi-staged hierarchies and hubs has become a reality for many companies in the electronics industry. Compared to a single-plant environment, multi-plant environments present significant challenges. For example, sourcing decisions for products produced in multiple locations should take into consideration material availability, cost, transportation, capacity and other variables. Additionally, multi-stage environments – where plants that produce components feed assembly plants – require tight integration between plans and schedules. As companies have grown from single-plant environments, many legacy planning systems cannot deal with the complexities of multi-plant environments.

Supplier and customer hubs have also emerged as a common part of the extended enterprise. Large assemblers are pushing inventory upstream by pressuring key component suppliers to locate, own and manage inventory in warehouses close to assembly plants. This practice, known as supplier hubs, has become a prerequisite in order to work with many large assemblers. In some instances, suppliers have partnered with third party logistics providers (3PL) to provide the physical warehouse and help manage the replenishment process.

However, there are challenges. Suppliers must meet inventory availability levels spelled out in contracts; assemblers must have appropriate visibility into hub inventory and committed replenishments for planning upsides and downsides in demand.

Global supply chain planning solutions provide a single solution for managing a multi-plant, inter-enterprise supply chain environment. Sourcing decisions can be optimized using a variety of user-defined business rules driven by cost, service and/or profitability. Synchronized inventory, distribution and production schedules are generated simultaneously in seconds for all locations in the supply chain. What-if scenarios can be generated and compared to evaluate trade-offs among different user-defined business rules.

With regard to hub management, supply chain planning systems are available to support both component suppliers and assemblers. Component suppliers can model hub distribution centers within an extended enterprise model. What's more, inventory management solutions can determine the optimal level of inventory to meet a desired customer service and plan future replenishments based on consumption and a time-phased demand plan. As an assembler, supplier hubs can be modeled as a stocking location within an extended enterprise with visibility of supply commits provided by suppliers.

6. Advanced Material Allocation

Several factors contribute to the allocation challenge in the electronics industry—material shortages, key components shared across multiple end-items, version control, and varying priorities for products and customers, to name a few. Establishing rules to determine allocation priorities can help, but they can impact several outcomes including profitability, service levels and handling of high-priority customers.

Next-generation planning systems provide rule-based allocation logic that enables users to evaluate and compare results of a variety of “what if” scenarios. These are useful for planning the enterprise, planning demand for a customer or providing commitments against a single order. These systems allow the user to define business rules for handling allocation of key materials in short supply. Examples of criteria available for rules include due dates, customer priority, product priority, profitability and service.

7. Respond Online to Customers

Providing online product commitments for product availability requires a tight link between “front-office” order processing and “back office” manufacturing systems. As electronic companies move to BTO/CTO environments, accurate commitments must be made against production schedules and finished goods. Online commitments may also be required for time-phased schedules for a single customer into the future, as well as single orders. In order to accurately commit to product availability online, product schedules must be feasible and the available-to-promise functionality must be scalable and distributed to support access for various constituents including customer service, sales and customer access over the Internet.

Providing online commitments for orders and schedules is key to enhancing customer service and gaining a competitive advantage. Although few executions have succeeded, many companies envision this capability as part of the supply chain management strategy. Systems that provide real-time available to promise in a distributed Internet-based module are required to make online commitments to orders and schedules. Both sales and key customers can have access to the system through the Internet.

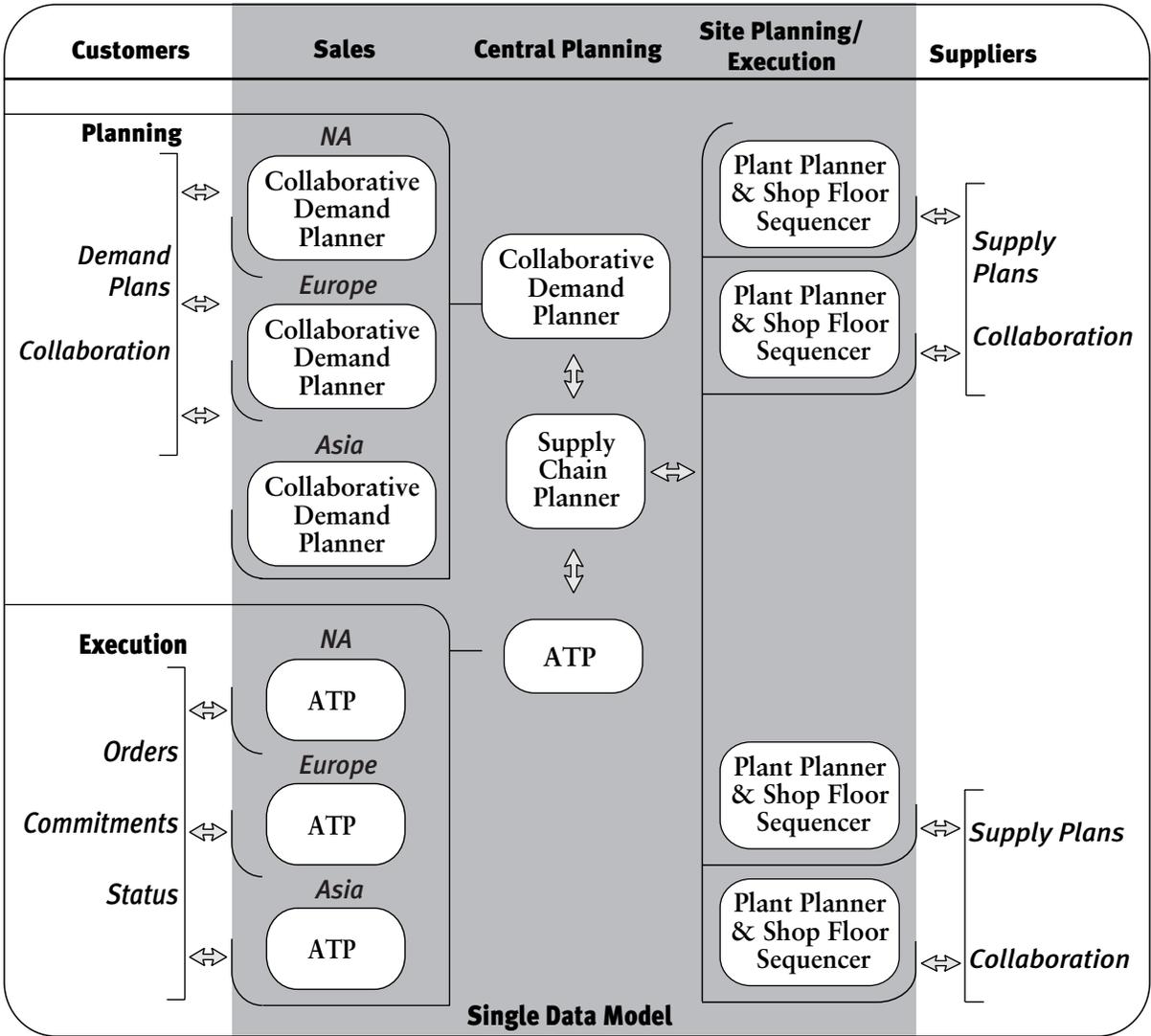
All of these winning supply chain strategies require a next generation supply chain solution. Having worked closely with electronics industry leaders, Adexa has developed a vision of supply chain excellence and a proven next generation solution that can be implemented today – the Adexa iCollaboration suite.

Adexa's iCollaboration Suite – Meeting the Challenge

Adexa's iCollaboration suite was specifically designed for the needs of the electronics industry. Built around Adexa's Single Data Model (SDM), iCollaboration provides a unified planning environment for strategic, tactical, and operational planning. In concert with Adexa's Customer Agent, Supplier Agent, ATP Agent, and Business Alert Agent Java Client technology, the iCollaboration suite enables dynamic and synchronized planning among all supply chain stakeholders.

By compressing information lead times with customers and suppliers and synchronizing planning among demand planners, master planners and plant schedulers, the iCollaboration suite provides electronics companies with the highest levels of flexibility and responsiveness. With real-time visibility of supply chain constraints, total demand and work-in-process, the software also dramatically reduces the time it takes to plan and re-plan, as well as run "what if" analyses.

Our Distributed Single Planning Environment Provides Highly Responsive Customer Service



The distributed planning capabilities of Adexa's iCollaboration suite dramatically improve responsiveness, reliability, and customer service through (1) collaboration among customers, suppliers, and planners; (2) visibility of current constraints; and (3) fast rule-based solving capabilities.

User views into Adexa's iCollaboration suite include Collaborative Demand Planner, Strategic Planner, Supply Chain Planner, Plant Planner, ATP, and Shop Floor Sequencer. These tools provide a native Web architecture, exceptional scalability, and rapid problem solving to enable a globally distributed, one-touch planning system.

Adexa's intuitive object modeling tools enable users to quickly represent their supply chain and facility environments with user-defined attributes and plug-in business rules. Adexa is able to model 100% of all resources with very compact models through dynamic routing and common BOM concepts. Importantly, Adexa's superior heuristic solving algorithms provide the fastest solving times available. Benchmarked against rival systems, Adexa's software solves problems orders-of-magnitude faster.

Adexa's applications provide one-touch rapid integration to ERP and other legacy applications. Our integration tool set enables bi-directional communication with any relational or object database. Moreover, Adexa provides standard interfaces to the leading enterprise applications used by the electronics industry, including those from SAP, Oracle and QAD.

Conclusion

Supply chain excellence can decrease inventory and cycle times while significantly increasing on-time deliveries and inventory turns. Taken together, these results can provide companies with greater profits, improved customer service and that ever-elusive competitive advantage. But it takes the right vision, the right strategy and above all, the right software tools for theory to become reality. Building on the business solutions partnerships and successful implementations Adexa has developed with industry leaders such as Xerox, Philips, Viasystems, Mitac, Synnex, D-Link, Lucent and Nortel Networks, the Adexa iCollaboration suite represents the next generation of supply chain software tools. Available now, iCollaboration enables companies to achieve supply chain excellence and overcome the myriad challenges facing today's ultra-competitive electronics industry.

Getting Started – The Path to Supply Chain Excellence

The most important first step in achieving supply chain excellence is to understand the value that can be created for your customers and your shareholders. Adexa can establish the value of supply chain excellence through the Adexa Supply Chain Assessment (SCA). The Adexa SCA enables companies to rapidly develop a supply chain performance scorecard, identify baseline performance, assess business process drivers on performance, and establish an attainable target performance level based on the Adexa business solution.

Adexa provides support for all phases of implementation, from establishing the value proposition through a Adexa SCA to creating your vision, developing your business solution, training, implementation, and post-implementation support. Adexa's rapid implementation methodology typically enables the first benefits of implementation to be realized in less than four months.

For more information about Adexa or arrange to meet with one of our Adexa Solution Representatives, please call (310) 338-8444.

Adexa, Inc.

5933 West Century Blvd

Los Angeles, CA 90045

Phone: 310•338•8444

Fax: 310•338•9878

adexa.com