



**SAP White Paper  
SAP for Chemicals**

# **PERFECTING THE RECIPE FOR COMPETITIVE ADVANTAGE: THE CHEMICAL INDUSTRY AND ADAPTIVE BUSINESS NETWORKS**

**Don't Be Fooled by the Boom –**

**It Won't Solve Your Structural Problems**

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## EXECUTIVE SUMMARY

It's been an up-and-down (recently *way* up) last couple of years for the chemicals industry. Less than two years ago, sales of everything from petrochemicals to paint were sluggish, inventories practically overflowed their storage tanks, and pricing power was weak. Today, those tanks are almost empty, the plants can barely keep up with demand, and as a result, many companies are practically minting money, in some cases hitting historically high profit levels and cash flow. Which is why management's job has only gotten *harder*.

The boom has temporarily masked the fact that chemicals are a mature, slow-moving industry while exposing an entirely new set of challenges and complexity facing the entire industry. For the basic chemical giants like Dow Chemical or ExxonMobil, downstream specialty chemical makers like Sherwin-Williams or Rohm and Haas, or even a company in both segments, such as BASF, the recent recovery has been the best of times and the perhaps most challenging of times (although definitely not the worst of times).

Crude oil pricing above \$50 a barrel has been a boon for back integrated petrochemical makers, but natural gas and other raw material prices have soared as well, forcing manufacturers to consider building new plants in the Middle East and Asia to lower costs and move production closer to where new demand is located. Globalization and the rise of China in particular has opened new markets, but has also given rise to new, hungry competitors and extended already sprawling supply chains farther, from Texas to Toulouse, and now to Shanghai and beyond. Companies have responded by repositioning their portfolios – leading to a flurry of merger and acquisition activity, joint ventures, and a rush to both add new plant capacity *and* squeeze out a solid return on a mammoth capital investment before the cycle turns downward again.

It's a whole new world for chemical companies – and an increasingly complex one. As they've added new plants, new subsidiaries, new partners, and new products, they've also

added new divisions, new employees, new processes, and new systems – systems that aren't connected, or only connected tenuously, with separate interfaces for each function, running on separate platforms (and creating more headaches than they cure). All of this has combined to challenge an already complex industry – one in which some manufacturers are their own best customers, where companies commonly look outside to third parties for key process steps – with sudden, painful change.

What's worse is that none of these attempts at coping with the pain points of success and expansion have addressed the underlying problems facing what is ultimately a mature, slow-moving business with low asset turnover, limited production flexibility, and decreasing product innovation (especially for basic chemical manufacturers, as new chemistry is increasingly rare).

Finding lasting success – and dampening the shocks of the boom-and-bust cycle – is a matter of continual refinement and optimization, of creating and perfecting new processes as well as products. The industry-wide swing back to profitability and tight supply has highlighted the mounting importance of visibility, flexibility, responsiveness, and speed in forecasting demand, ramping up (and down) manufacturing output, managing customers' expectations (and, increasingly, their inventory), and smoothing out their far-flung supply chains.

What if they had known about the boom three months before it began to occur? What if customers' tank sensors, or RFID scanners in the paint aisle at home improvement stores, had noticed and signaled the first upticks in demand as it happened? What if their IT systems had been able to detect and synchronize that real-time data for sharing not only within the four walls of their plants, but with their suppliers all the way upstream, and end-use customers all the way downstream?

Chemical companies need to become more demand driven. They need to embrace and adapt new business processes and new information technology that generates actionable data – from customers, from suppliers, and from the plant floor – and sharing it both internally and with an emerging network of companies around them. Chemical manufacturers are tearing down internal walls and opening their processes to their partners, suppliers, and customers. They’re bringing everyone closer together and sharing information – about new product improvements, supply chain efficiencies, inventory levels, and lead times – and seeking to link up the underlying IT systems needed to enable this new era of sharing.

The most insightful firms hope to confront and start solving the challenges posed by both booms and busts, and to create a lasting strategy for meeting any demand via cooperation internally, visibility into each other’s businesses, and newfound abilities to collaborate and change.

### **Ride the Cycle Smoothly with the Adaptive Business Network**

Leading companies are moving, whether they know it or not, toward the ideal of the adaptive business network (ABN). When fully realized, the processes of manufacturing, planning, and execution are seamlessly integrated inside their network, making the participants newly responsive to sudden change – demand spikes, emerging global competitors, and customer requirements – smoothly and in real time.

The ABN is not a piece of software, nor is it a system to be installed. And it definitely can’t be fully implemented under the roof of just one company. It’s a business strategy – actually an entire suite of strategies – for the reorganization and synchronization of a business, its partners, and eventually its partners’ partners.

It’s an ideal, but the gains to be realized in getting even halfway there are tangible, and explains why the manufacturers exerting the most influence within these emerging networks – BASF, Dow Corning, Cognis, and others – are already asking their partners to freely share information about new products, supply constraints, and demand signals.

As their networks evolve, this information will be synchronized, cleansed, and stored as a single version of the truth accessible to network members for analysis, use, and reuse by enterprise applications, then fed back into business processes to inspire further optimization. Chemical manufacturers will cope with increasingly complex supply chains and volatile costs by seeing further – into their partners’ and their partners’ partners’ processes – and reacting faster to demand-driven signals arriving in real time from the source.

New streams of automated data – arriving from the plant floor, from global storage facilities, and from real-world-awareness technologies, such as tank- and machine-mounted sensors – will enable network members to more rapidly identify new market opportunities, reallocate inventory, reconcile customers’ needs with R & D efforts, strike a balance between long product runs and the flexibility needed to deal with demand spikes, and above all, create a unified view of their increasingly complex businesses.

One company that has thoroughly enmeshed itself in such a network is (the very fictional) Adaptochem, which, for the purposes of this paper, is a specialty chemical manufacturer that primarily produces paint sold directly to automotive manufacturers. Before Adaptochem began assembling its own adaptive business network, it struggled with many of the challenges facing all chemical companies today – monitoring its upstream supply chain, prioritizing customers, exploiting sudden opportunities and finding the best balance between its manufacturing capabilities and its customers’ demands. Adaptochem will appear throughout the paper as an example of a manufacturer reaping the benefits of participating within a network.

### **But There's Still So Much Work to Be Done**

Whether their best-selling product is benzene, soda ash, semiconductor polishing slurry, pigment, or paints, chemical manufacturers are up against a laundry list of obstacles and challenges facing their industry, and giants like BASF or niche local producers must cope with all of these to some degree.

Consider:

- **Before they can extend business processes beyond their four walls, they need to connect them internally first.**

Chemical companies are still struggling with the challenge of putting their houses in order by streamlining business processes and installing the underlying IT necessary to support them. Before manufacturers can extend the beginnings of an adaptive business network to their partners, suppliers, and customers, they'll first need to confront internal barriers and gaps inhibiting internal process automation and data integration.

- **The bullwhip effect is especially painful for basic chemical manufacturers.** Unlike many industries in which most manufacturers touch the end consumer in some manner, most basic chemical companies live far upstream from the final product, which could be anything from soap to cosmetics, to chewing gum flavors, to the dye used in next season's fashions, to toys – in fact, just about anything. Considering the long supply chains leading back to chemical manufacturers, demand spikes at the consumer level take a relatively long time to travel upstream, often leading to painful cases of the bullwhip effect (a small change at the end consumer level can lead to massive changes on short notice upstream with suppliers). How can chemical companies boost their visibility of end consumers and lessen these shocks?
- **The tension between the efficiencies of long product runs and the adaptive capabilities of shorter runs is more pronounced than in other industries.** Because chemicals manufacturing is a mature industry, especially on the basic chemicals side, efficiency is largely derived through

economies of scale, which translates to running plants 24/7, 365 days a year (except for short annual maintenance shutdowns) with infrequent grade changes. Whole plants or pieces of equipment are specialized for one or a few products. It is exactly that kind inflexibility that leaves manufacturers vulnerable to the bullwhip effect. How can they better manage grade changes to balance long, efficient runs with shorter ones, thus minimizing inventory and adapting to actual demand?

- **R & D is as much about customer service as it is about pure product and process innovation.** While specialty manufacturers are less affected by raw material costs and efficiency, their business depends on a continuous stream of new products driven by their own R & D as well as new demands from customers. This often results in unique products for preferred customers (Procter & Gamble, for example, would prefer no other detergent in the world smell quite like Ariel or Tide). This means that new product development is often more about a one-to-one relationship with customers and understanding their needs than it is about building a better molecule. The better the manufacturer understands that need, and the faster the new product request is delivered to the market, the better its chance of having materials on hand or quickly obtaining the materials for the next \$100 million product (and locking up profit on it for eternity).
- **Industry roles are utterly fluid.** The largest companies are both basic and specialty manufacturers. Others are critical middlemen, processing and adding value to basic commodities, and reselling the still-unfinished product for further processing. Some large manufacturers may sell the products of their basic division to their specialty subsidiary, in effect becoming their own largest customer. Or they may sell basic commodities to the intermediary and then buy back its finished product for further use by the specialty division. Some companies even partner, if only temporarily, with their competitors in order to cut costs. It's not uncommon for

ExxonMobil to swap ethylene in one location with Huntsman for ethylene in another, which in turns swaps it with Chevron, which swaps one of its own stocks back to ExxonMobil. How can manufacturers keep track of these complicated transactions, especially when the price of the commodities being passed around is rising and falling on a daily or even hourly basis?

- **Industry standards enable faster transactions and more repeatable business processes.** The Chemical Industry Data Exchange (CIDX) is a non-profit, industry-funded-standards body whose mission is to improve the ease, speed, and cost of conducting business electronically between chemical companies and their trading partners. Industry players, through the central coordination of the CIDX group, have created standards for 60 business transactions that unify how any chemical company would transmit data between buyer and seller. For example, in a transaction such as “purchase order create,” it might be dictated that field 32 is a 50 position alphanumeric field that will show line 1 of the vendor address. Everyone using CIDX standards to transmit data via XML technology will know where to place information, allowing everyone to speak the same language when exchanging data. For more information on CIDX standards, go to [www.cidx.org](http://www.cidx.org).

The use of CIDX standards has greatly enhanced the chemical industry’s ability to automate business processes and raise the level of business data visibility.

- **Customer service is increasingly the critical point of differentiation.** Beyond the trend toward vendor-managed inventory (VMI), customers are asking for services that go beyond mere delivery and replenishment. The sanitation chemical maker Ecolab, for example, sells, procures, manages, and ultimately disposes of its products on behalf its hospital customers.

Adaptochem performs a similar service, operating spray painting facilities within auto assembly plants. Overseeing the application of its products and immediately troubleshooting any problems is a condition for winning their business.

With examples such as these in mind, how should manufacturers best develop, offer, manage, and account for these services, and how can they integrate them with their overall supply chains?

- **Globalization is both an opportunity and a logistical challenge.** China in particular, with its insatiable demand for materials for consumer electronics and other goods, has seen an unprecedented construction boom of new chemical plants. Manufacturers are carefully considering which products and processes to place at these new factories. Building new plants in the Middle East, meanwhile, might shorten local supply chains but could carry other risks. These factors are balanced against the rapid growth seen in eastern Europe, Southeast Asia, and India.
- **Environmental regulations require strict monitoring and production restraints.** The manufacture and use of hazardous chemicals require adherence to strict regulations, especially in the United States and European Union. Implementing and ensuring compliance with employee safety guidelines, food contact rules, monitoring emissions (which are often delineated by regulatory permits), and even validating the origin and composition of products (such as pharmaceuticals for anticounterfeiting and safety reasons) are all mission-critical processes that contribute to the cost of doing business. How can companies guarantee 100% compliance while minimizing costs?

# WHAT THE ADAPTIVE BUSINESS NETWORK MEANS FOR THE CHEMICAL INDUSTRY

## The Architecture of Adaptive Business Networks

Successfully building an ABN ultimately depends upon a chemical manufacturer's understanding of architecture. Not necessarily IT architecture – an ABN is never just a software fix. It's architecture in a more fundamental sense: how people use and interact with space, whether that space is their house, their neighborhood, a downtown hub, or the virtual space of IT.

Architecture and urban planning may actually provide the best metaphors of how ABNs are built, and how they function and interact with the world outside a plant's doors. Building an ABN begins at home, inside a company's *house* – the metaphorical walls that contain the business processes, master data, and IT infrastructure that drive supply chains, product launches, promotions, and so on. The value of a real house and the potential for appreciation is understood only within the context of its community – is there power, plumbing, phone lines, and most of all, a neighborhood?

Our metaphorical house is no different. To confront the challenges facing their industry, chemical companies (the houses) are seeking closer connections to their *neighborhoods* of partners and suppliers. But connecting might require some extensive renovations; the walls currently dividing increasingly dependent processes – such as adaptive supply chains or new product development – are being torn down in favor of an open floor plan where business units connect and overlap. The open concept increases efficiency, speeds decision making, and boosts overall adaptiveness.

Participating in the world outside – the ABNs of your close partners, suppliers, and customers – requires having your house in order. Are your business processes consistent and integrated, ready to receive real-time data from customers' storage tanks as part of your vendor-managed inventory contracts? Will your IT configuration use this data to trigger automatic replenishment of those tanks? Have you already adopted the CIDX and other evolving standards that will deliver that data to your house? And, most fundamental (but often overlooked), is your master

data for customers, products, and suppliers consistent so that no manual intervention is needed to correct transactions that can't be processed automatically?

Once you have done this basic structural and remodeling work, your company is ready to join the neighborhood. The ability to effortlessly send and receive data between partners, and to peer inside their windows for a real-time glimpse of the state of business within, is key to the competitive advantage granted by an ABN. As neighbors themselves, chemical manufacturers play two simultaneous roles. They coordinate their own networks of suppliers, logistics partners, customers, and so on, but they're also participants in the networks of large channel partners – the Procter & Gamble, General Motors, and home improvement stores all over the world – along with suppliers of basic chemicals further upstream.

Adaptochem is already in that position. While it supplies products and services to auto manufacturers, it also manages an upstream supply chain that ends – literally, in some cases – at a mine. Its raw and semi-raw materials include carrier (the liquid that holds together all materials in a wet system, purchased from petrochemical giants), pigments, industrial coatings, flow additives, specialized chemicals for guaranteeing UV stability, and the list goes on and on. And attached to each ingredient is the name of a supplier, such as Rohm and Haas or DuPont, which is also a neighbor in Adaptochem's neighborhood.

In the name of being neighborly, companies like these – and Adaptochem itself – asked to take down the fences in their front and backyards in the name of boosting efficiency to houses down the street and around the corner. They're being asked for, and sometimes ordered, to make new investments and implement business process changes in order to streamline and automate operations up and down the supply chain.

A company needs to be able to say, “Yes,” when asked for help, and needs its own neighbors to do the same when asked. When the customer with the largest house in a neighborhood wants the latest information on your current supplies of chlorine or sulfuric acid, or a daily update on your inventory of that special flavor for Dentyne Ice gum, you’ll need to say, “Yes!” By being the neighbor that integrates its operations at the lowest cost, in the least time, with the tightest collaboration, and the most information, your company will rise to the top of your customers’ lists of preferred partners. And every time a competitor says, “I can’t,” or “Let us evaluate that request,” you’ll be in position to take their business and increase your market share.

All of this will happen within the grid of the city, the IT framework that makes the transfer of data and communication between neighbors and neighborhoods possible. Just as urban planners lay street grids, water and gas pipes, and run electrical wire through each neighborhood, CIDX industry standards and Web services will pave the streets to provide vehicles for data to flow between neighbors and large estates such as Dow Chemical or BASF.

Being a good neighbor means getting your house in order and thus having the power to support and enhance relationships with current partners, supporting and quickly accepting new ones, optimizing business processes using information already residing in their systems, thus making you ready to meet customers’ demands.

This demands a degree of intimacy and trust previously unknown. The first step will be choosing your partners according to a set of a business goals and practices shared by everyone within the network. Responsibilities, policies, procedures, and protocols must be in sync. These are written agreements flexible enough to be revised and fine-tuned over time. The network overall must remain pliant, able to add or replace participants without disruption, and able to change the duties or role of a given partner depending upon the challenges that arise.

### **Plan, Execute, Sense, and Respond**

These steps – plan, execute, sense, and respond – describe how companies become more demand driven as their business processes are transformed by their adaptive business network.

Traditionally, chemical manufacturers favor extremely long production runs coupled with an after-the-fact sales and marketing strategy. Rather than make what can be sold, they tended to sell what they’ve made – whatever the quality level or performance of those chemicals happen to be. But in recent years, they’ve adjusted by crafting plans based on historical data, executing those plans, and developing analytics to measure performance. Now, they ask, “Did we sell what we wanted to sell?” and even more importantly, “Are we selling the right products?”

There is a natural limit to planning accuracy. Inventing a better correlation of the past can only help so much. A new approach known as sense and respond offers improvements that go beyond the limits of the best possible planning and forecasting.

With the addition of sense and respond, the gap between plan and reality can be closed. Sensing signals from the real world (such as VMI updates, supply chain exceptions, downstream sales forecasts, and promotion plans) and then responding to them, allows a company to adapt its fulfillment and manufacturing capacity to real-time demands. Breaking the plan and execute mind set is the paradigm shift needed to get the chemical industry through the next down cycle.

**Planning** has historically taken place inside the four walls of the house, drawing upon data residing in the transactional enterprise applications like enterprise resource planning (ERP), customer relationship management (CRM), and supply chain management (SCM). These fundamental applications remain as the foundation of our metaphorical house, and will remain as an important part of your business. But as internal walls come down and new streams of data arrive from partners in the

neighborhood, new and composite applications will be in place to share that data and extend functionality throughout the house, out the open windows, and around the neighborhood.

A dye manufacturer might learn weeks ahead of the Milan fashion shows that red would be the dominant color of the fall collections, replacing spring's hot color indigo. This data might be stored in a Milanese clothing manufacturer's CRM application, while the sourcing of the red dye's raw materials might be handled through the SCM solution of another chemical company further up the supply chain. Correlating the demand for red dye in Milan with your American customers might be handled by your own company's ERP system.

**Execution** is a matter of refining your business process steps to maximize your neighborhood's potential. Best practices adopted within your house are amplified around the neighborhood as they're applied to and optimized for dynamic processes. That means reassessing – with newfound visibility – your forecast models, supply chain steps, and manufacturing runs as your and your partners' internal operations link up databases and inventory tracking. Automated systems receiving a constant stream of data from VMI sites or global chemical markets will **sense** your products' presence in customers' tanks, or constantly recalculate your margins in light of fluctuating basic chemical and energy costs. The same is true for the dye manufacturer mentioned earlier, in which case the ability to sense the latest trends will lead to a better and faster reaction from the neighborhood to meet those changing needs.

Key performance indicators (KPIs) previously difficult to measure in real time because of the massive amounts of data required – temperature and pressure readings from manufacturing processes or customers' inventory consumption rates – will be automatically collected and measured via real-time analytics.

Your newfound ability to **respond** to this stream of data is what ensures adaptiveness and a lasting competitive edge for you and your neighbors over the long run. Data harvested from the neighborhood or from elsewhere in the city will be used to further refine forecasts and processes, or give rise to new ones.

As the adaptive business network matures, houses in the neighborhood will begin to manage by exception. Automated systems will collect, parse, and sort data to transactional applications underneath, needing human intervention only when the unexpected happens. Management's time and energy will be freed to focus on new opportunities and boosting competitive edge rather than dealing with routine transactions. And by building on an IT foundation of standards-based, service-oriented, flexible, tightly coupled, and event-driven software – along with using an integration platform – ABN participants can extend and modify their current business models to cope with whatever competitive shocks they encounter in the future.

### **Why SAP® Software Should Be the Foundation of Your Network**

As the leading supplier of enterprise applications and the integration platform that flexibly links them, SAP's offerings form a natural foundation for the gradual construction of an adaptive business network. This includes large manufacturers that delineate networks, as well as the smaller firms creating networks of their own – both are looking to SAP's preintegrated and standards-based products for an early advantage. The SAP NetWeaver™ platform integrates SAP and third-party systems, manufacturers, and other participants, making them able to live up to collaborative partnerships and enabling their own suppliers to meet their needs.

The foundation of an adaptive business network, as shown in Figure 1, includes the traditional ERP applications that span the entire organization in which nearly all chemical companies have implemented over the past decade. Building an ABN doesn't require ripping out and replacing these systems. On

the contrary, it's an incremental process – adding functionality only as needed by business processes. IT is an enabler, not the driver, of the ABN.

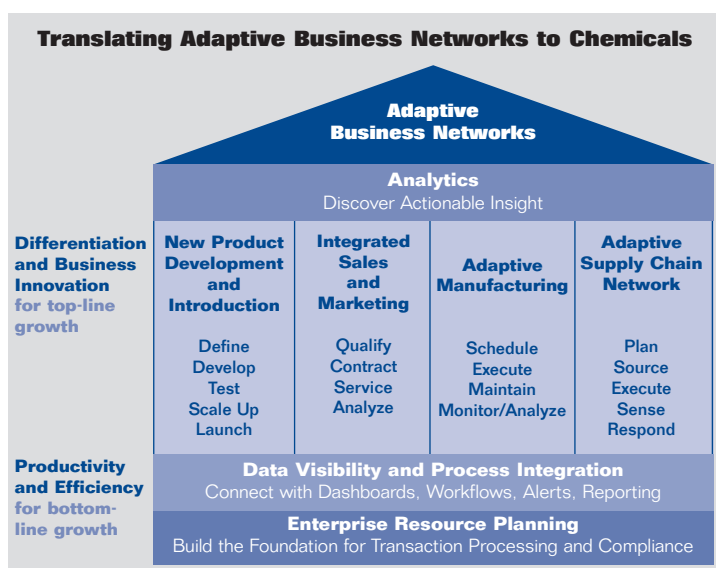


Figure 1: The Architecture of an Adaptive Business Network for Chemicals

Beginning with enterprise resource planning as the base, the implementation of analytics and industry standards and other visibility and data integration enablers provides the infrastructure for the complex exchange of data and information across business processes and corporate boundaries. Fundamental ERP systems provide the foundation, but not the differentiation.

Differentiation, the strategy that decides where and how you want to be better than your competition, is created by focusing on key business processes in the areas of innovation, demand management, manufacturing adaptiveness, and demand fulfillment. Creating an advantage in these areas amplifies a company's key strengths.

To build differentiating processes, the four critical pillars for chemical manufacturers are:

- New product development and introduction
- Integrated sales and marketing
- Adaptive manufacturing
- Adaptive supply chain networks

These are tailored to vertical industries, of course. Specific to the chemical manufacturing, chemical process development would play the same role as product development.

The task of integrating and enabling communication between this quartet of business activities belongs to analytical engines capable of storing, reconciling, and sharing the information generated by each. With a strong set of analytical capabilities in place, a network participant grants itself the ability to see further into its own and its partners' business processes and actively manage the performance of the network to make better-informed and smarter decisions.

(For a more detailed look at the workings of the adaptive business network, please look at SAP's white paper on the general concept: *Adaptive Business Networks: A Strategy for Mastering Change and Efficiency in Manufacturing.*)

## **SWITCHING FROM PUSH TO PULL: ADAPTIVE SUPPLY CHAINS AND ADAPTIVE MANUFACTURING**

### **Becoming More Demand Driven Won't Transform Your Business, but It Just Might Make You a Market Leader**

In an industry where products don't change much, a business is only as good as its supply chain. This is especially true for basic manufacturers selling pure commodities. Profits must be squeezed from an efficient and optimized supply chain, starting on the plant floor and ending at the customers' site – where the rise of VMI and other inventory management programs has created a massive data headache, but also an opportunity to see and predict demand more clearly than ever before.

Chemical manufacturers have historically tended to sell what they made – a continuous stream of prime products, plus whatever off-prime by-products that were not reprocessed, and any specialty chemicals they developed for customers. That strategy worked for a long time (and still does for most commodity manufacturers), but the gradually increasing complexity of the business – more customers, more products, broader geographical markets, and increasingly harsh occurrences of the bullwhip effect – have forced manufacturers to only make what they can sell. That deceptively simple paradigm shift has had massive implications for management of their supply chain.

Rather than run manufacturing plants 24/7 to fulfill long-standing regular orders, they find themselves juggling competing customer requests and struggling to reconcile the data needed to understand if and how they can fulfill those requests. Do they have the inventory on hand? If not, is it in a tank or railcar somewhere – and if so – can it be reallocated before those local customers are expected to need it? What's the best way to supply material from a collection of plants to the current mix of customers? Is it even possible (and profitable) to temporarily change a plant's product mix to fulfill a few orders while delaying others? (And then what would that do to my supply chain?) And then there's shipping, to consider. Is there sufficient railcar capacity? If not, can trucks get it there in time?

The growth of VMI has only exacerbated these challenges. While manufacturers are happy to have this recurring business, VMI's demands on data collection and analysis is a potential nightmare if internal work processes are not properly planned. Not only do manufacturers need crystal-clear visibility into their own operations, but also into their customers.

If you happen to be Adaptochem's titanium dioxide slurry supplier, ensuring regular replenishment is a matter of measuring the tank level regularly, back-calculating Adaptochem's recent consumption, figuring out how upcoming production is going to draw down the tank level and the resulting demand plan, then gauging the time and shipment size needed for an orderly replenishment so that Adaptochem doesn't run out, and finally reconciling that plan with the rest of your supply chain, operations planning, and long-term demand forecasting.

Within an adaptive business network, the torrents of data generated by VMI become a strength instead of a headache. Sensors mounted in the tanks feed a continuous stream of real-time measurement data to automated systems that check the service-level agreement kept by sales and marketing, the company's current stockpile of titanium dioxide, its near-term manufacturing schedule, and outstanding orders to determine if a different or better customer needs Adaptochem's replenishment shipment more urgently.

The tank sensors become a real-time window into the customer's demand, freeing the company from producing a certain grade of titanium dioxide blindly (and then hoping that what you make is what Adaptochem wants to buy). Instead, by peering into customers' operations, weighing the data, and then integrating that information with its own, a company is much better attuned to its customer needs.

Adaptochem does the same for its automotive customers, which have opened their production schedules to the paint supplier. Just as Adaptochem's suppliers are required to anticipate its raw material needs, Adaptochem itself will be ready to paint each car rolling down the assembly line, because it knows a week in advance the models that will be produced, and what colors they'll be painted.

The integration of a company's external supply chain with its internal sales and operations processes – creating a unified set of business goals and KPIs for measuring them – promotes greater visibility into its own operations, which in turn leads to faster and more efficient strategy formation and decision making – ultimately creating a competitive edge over its rivals, and enabling it to stay that critical half-step ahead.

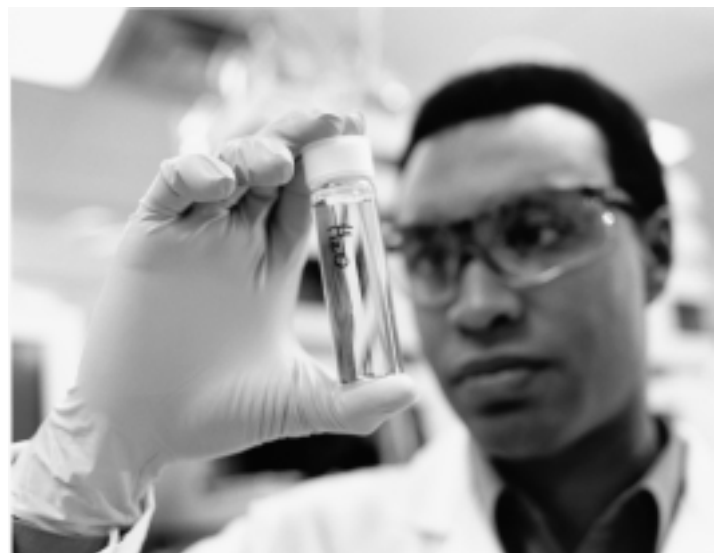
Building an ABN and becoming more demand driven won't transform a business by itself – there will always be structural constraints – but there is already evidence that the advantage it confers is real and meaningful.

The multibillion-dollar European polyethylene producer Borealis has streamlined its planning processes, slashed excess inventory, and successfully integrated its long-term capacity plan, midterm master production schedule, and short-term grade mix with its central sales and operations processes. Using the SAP® Advanced Planning & Optimization (SAP APO) component of the mySAP™ Supply Chain Management (mySAP SCM) solution and integrating with its existing SAP R/3® system and data warehouses, Borealis was able to create a synchronized single version of the truth for use across its entire supply chain, which now includes the sales and marketing division, plant supply planners, and demand managers. (The functionality of SAP R/3 is now available in the mySAP ERP solution.)

Millennium Chemicals, the world's second-largest producer of titanium dioxide, was able to automate its VMI services, improve demand planning, and integrate that data into its core ERP systems using the e-VMI functionality of SAP APO, which it also integrated with its CRM solution, data warehouses, and even its e-commerce Web site. Instead of calculating customer requirements and entering sales orders manually, today it manages those functions by exception, automatically scheduling replenishment orders.

#### **Extending Visibility to the Plant Floor: Adaptive Manufacturing**

The manufacturing process is often the weak link in the supply chain. Some call it the black box. Component products and semifinished raw materials require lead times that undercut attempts to be demand driven. A jeans maker's order for 10 tons of indigo dye demands preparation of numerous chemical components, which must actually exist for the order to be filled on time, but are excess if the order never materializes. The manufacturer can't accelerate the subassembly process (the laws of chemistry are more or less intractable), so the challenge for manufacturers is to integrate their demand forecasting, their sales teams, and the managers on the plant floor.



Perhaps the manufacturer has already spent millions of dollars upgrading distributed control systems, generating a new flood of data on the plant floor. The challenge here is to integrate that data back into the supply chain and sales and operations process. This data can be useful for quality control, can support an available-to-promise (ATP) inquiry, or can be used to estimate raw material needs. But add another variable, such as a reliability issue with a key piece of machinery – how will the downtime affect new orders, disrupt the fulfillment of core customers' service-level agreements, and impact the overall supply chain? Where should the company start looking to cover the shortfall? Are there overseas sources? Are short-term swaps with competitors possible?

Adaptochem relies on a pair of petrochemical refineries for the carrier material present in all of its paints. When a hurricane in the Gulf of Mexico slams the Texas coast, its primary supplier there is forced to shut down its facilities for three days and nights, and its rail yards are blocked, causing further delays. In the past, this situation inevitably would have led to shortages at Adaptochem's plant, crimping production. But within a network, the news from Texas is flashed to supply chain managers who immediately begin searching for carrier stocks to make up for the shortfall. Adaptochem's secondary supplier in New Jersey is notified that an unusually large emergency order of carrier is needed, and because that message is sent and received almost in real time, that refinery now has enough warning to add an extra railcar full of carrier to its next replenishment shipment, which will keep Adaptochem's plant running smoothly and without interruptions.

Plant data can be quickly integrated with core planning, sales, and supply chain processes inside an ABN. When disruptions occur, the effects cascade across the linked systems, automatically updating projections, firing off alerts to managers, and putting the scope of the problem in context at every level – from the plant floor on up to the CEO's office.

To monitor day-to-day operations, companies building an ABN might implement digital dashboards for plant managers that boil down the data stemming from process control systems into a handful of relevant KPIs. Dow Corning is seeking to do just that – its plant personnel receive role-based dashboards through an internal portal that trigger internal alerts along with KPI reporting for localized decision making.



## MANAGING THE CUSTOMER MIX: INTEGRATED SALES AND MARKETING

### It's Less About Cutthroat Competition Than It Is About Ruthlessly Managing Your Customer and Product Mix

In the chemical industry, brands matter much less than they do in the consumer product sector. It is unlikely you will see *Dow Chemicals Inside* on a drum of cleaning solvent or can of paint. And while Huntsman Chemicals is one of the world's leading producers of titanium dioxide, that doesn't make the company, or titanium dioxide, household names. Brand loyalty isn't the reason chemical customers keep coming back.

The chemical industry's customers care about price, about their close relationships (VMI and the like), and – particularly specialty manufacturers – about service and the ability to develop proprietary ingredients. Integrated sales and marketing (ISM) in this context is really about customer management. The actual channels include everything from manufacturers' field reps to local and national distributors, overseas agents, and e-commerce – but there are only so many buyers and sellers of propylene (or soda ash or indigo) in the world. Twenty-seven percent of the chemical industry's sales are to other chemical companies. ISM ultimately boils down to successfully managing service and price expectations, containing costs from customers' ever-increasing demands, and scoring design wins by selling the value of new and improved products. More advanced companies are developing a menu of services to offer customers, so they can choose only those they want and are willing to pay for.

But managing customer expectations is a complex process that isn't helped by an endemic lack of internal communication. The CFO's office, the sales team, and the manufacturing division tend to operate almost independently of each other, working from their respective islands of information and sometimes toward opposing goals. The CFO has a financial target, the sales teams have revenue quotas, and the managers on the plant floor aim to maximize production. When goals and information aren't shared across these different departments, the

company can be at cross-purposes with itself. Manufacturing will maximize sales of its fastest-running products, while sales will sell the products customers want.

The chemical industry lags behind other manufacturing industries in data integration and reconciliation to create comprehensive and accurate customer profiles. As a result, it has lacked the ability to prioritize customer sales by channel, plant capacity, or supply chain fulfillments. In short, it has struggled to answer the question, at any given moment, "Is this customer even worth it?"

Armed with the right information, the answer can easily be, "No." Crompton Chemical recently admitted it was losing money on 30% of its customers. If Crompton had real-time access to profit and price, they might have more effectively segmented customers – granting high-touch attention on its most profitable customers, while dropping or raising prices on the unprofitable ones. High-cost, low-profit customers might be pushed to an e-commerce Web site or be charged a freight surcharge to their remote locations. What's the point of squeezing costs out of your manufacturing or supply chain operations if your company can't manage transaction margins?



The problem has only gotten worse in the era of globalization, when raw materials and customers are located at opposite ends of the earth, and when soaring crude oil and natural gas prices require hour-by-hour pricing recalculations. Under these conditions, forecasting prices and margins, then charting the best sales channels, is difficult and getting worse. Manufacturers have been equally at a loss when constrained supply situations in the market force them to rapidly rethink pricing, customer priority, supply chain efficiencies, and a cascading set of contingency plans.

Besides automotive paints, Adaptochem is also a manufacturer of industrial coatings for heavy machinery made by producers such as John Deere and Caterpillar. Booming overseas demand for those vehicles has led to a booming demand for coatings, leaving Adaptochem with a constrained supply of materials and a consistent lack of capacity to serve both its industrial and automotive customers. Adaptochem's new plant, designed to handle both, is still a year away from completion, forcing Adaptochem executives to take a long, hard look at their customer orders and begin paring away the least profitable 5% to 10%. What is the cost to serve each order? What is the mix of paints and coatings being ordered? If I drop the customer this year, can I get back in next year with a slightly lower price? How can we evaluate the real value of small orders of new, highly profitable paints versus large orders of industrial coatings from Caterpillar's plants in China? And speaking of China, how should price, supply chain costs, and currency fluctuations be taken into account when calculating the value of each customer?

This is where the benefits of an adaptive business network – even one that barely extends beyond a company's walls – become obvious. Within the ABN, the walls between finances, sales and marketing, and the manufacturing arm are torn down, data and processes are integrated, and – for the first time in many cases – a complete picture of the company's customers comes into view. Now, when a new customer comes aboard, sales executives are able to understand where and how that customer fits into the larger landscape, and how its needs (and the resulting margins) can be reconciled with existing orders for prior, higher-margin customers – and whether their latest and greatest product should be pushed down this channel.

As the ABN gradually extends beyond the company's four walls into the processes and systems of its partners and suppliers, it can sense, respond, and adapt to changing market conditions in real time. Specialty manufacturer Rohm and Haas has developed complex offline simulations exploring how raw-materials pricing affects the scope of its business. They use the results to supplement demand forecasting and calculate the pocket pricing (net prices) for their products. Those simulations are part of a larger overhaul of their ISM-related systems, the centerpiece of which is a 1,500-user customer relationship management solution that links sales and marketing, customer service, technical service, and business management teams. All groups now have shared access to reports, segmented sales prospects, and all other sales activity through a central portal.

## **ALSO CRITICAL: NEW PRODUCT DEVELOPMENT AND ASSET MANAGEMENT**

### **Specialty Manufacturers Live or Die Based on a New Products Pipeline**

While basic manufacturers are wholesalers competing on a low-cost business model, specialty chemical businesses depend instead on new product innovations. Specialty producers tend to live upstream from the end consumer because other manufacturers purchase and reuse their products in their own offerings. If Procter & Gamble wants no other laundry detergent to smell quite like theirs (or toothpaste to taste the same), the makers of these flavoring agents often have a one-to-one relationship between products and customers.

Supplying the aroma agent in detergent is a nice business to have, but what if the engineers happen to develop a new formulation that knocks out half of the manufacturing cost? Substituting it for the old formulation isn't as easy as simply slapping "New and Improved!" on its own shipping containers. Procter & Gamble might decide it likes the smell of Tide or Ariel just fine, rendering the specialty maker's breakthrough moot. It could even open the business to competitors, risking the complete loss of sales.

For that reason, new product development and introduction (NPDI) in the chemicals business has as much to do with customer relationships as it does with R & D. NPDI processes are usually aligned with both commercial and manufacturing as all groups depend on each other to develop and introduce a new product. NPDI wins more flow from recognizing and exploiting customers' needs for new adhesives, flavoring agents, polymers, and so on than from trailblazing a new market with a purely technological innovation. The faster the time to market and time to volume, the greater advantage they have over their competitors, and the greater their chance to gain market share.

All of this requires effective recipe management, which means developing, perfecting, and protecting franchise products, their potential successors, and the failed prototypes that came before them. Many specialty chemical makers are still struggling to compare development and production costs versus the potential value of a new product. They also must consider the rest of their intellectual property portfolios: how can they know that a new idea is a feasible and profitable idea, especially when they lack the means to factor in the impact on manufacturing capacity and supply chains?

Adaptochem is hard at work on prototypes for a new metallic finish the company intends to introduce next year. The company's last round of market research discovered that young car buyers were craving a bright finish that shined regardless of sunny or cloudy conditions. Now Adaptochem is rushing to have a demo ready for its traditional launch platform at the Detroit Auto Show, with production beginning in earnest a few months later. It's the fastest product launch the manufacturer has ever attempted, in large part because General Motors promised to make the new finish its metallic paint of choice if Adaptochem could cut its usual six-month development cycle in half. But how is the company supposed to do that?



A more complete internal integration with ISM processes (in order to evaluate new ideas against customer needs) and the supply chain (to ensure smoother time to volume) is a start. Extending an adaptive business network into NPDI processes of their best customers is even better – they can begin developing a new product the moment the customer first identifies the need.

Degussa integrated its in-house R & D teams with its ERP system and central planning processes using the mySAP Product Lifecycle Management (mySAP PLM) solution, which includes the recipe management and environmental health and safety functionality. After creating a centralized R & D project management system, formulas, production processes, and central records were integrated with ERP master data, making automatic data sharing with plant managers possible for the first time.

### **Save Time, Money, and Sleep Using Predictive Maintenance and Other Forms of Asset Management**

If you need another example of a supply chain disrupter that can snarl a manufacturer's supply chain, there's no need to look beyond the plant floor, where critical equipment could fail without warning, disrupting the flow of business in every direction. Companies don't have backups on hand for every piece of equipment (in that case, they might as well build a second plant next door), but they can predict when components or linings might come close to failure, and thus plan repair or replacement ahead of that failure.

Reliability-centered maintenance is the standard among manufacturers. The connected nature of the adaptive business network promises to take asset management abilities to a higher, more visible level.

By attaching sensors that monitor the equipment itself, real-time data can be used to more accurately predict inefficient operation or failure, reducing chances of downtime and lost production. As ABNs evolve, the combination of sensors, management by exception, alerts, and integrations with third-party partners leads to possibilities where a company like GE – which increasingly provides equipment management services – might receive an automated alert from a manufacturer's plant informing technicians of a motor's imminent failure.

Before Adaptochem enters its annual busy season, the company usually stops production at its main plant for several days for maintenance purposes. Considering this happens once a year, and considering that a single piece of equipment failure can cause disastrous delays during the busy season, it's critical that Adaptochem ensures its pumps, impellers, and packaging facilities are ready for another manufacturing drive. But what equipment needs special attention this time around? What needs to happen in this three-day window of opportunity, and how can it be done with maximum efficiency? Thanks to its adaptive business network, Adaptochem has data detailing the wear and tear on each piece of equipment, systems analyzing that data and recommending a course of action, and integration with contract maintenance service partners who will carry out that plan during the plant's precious downtime.

The commodity resin producer Nova Chemicals has already slashed its maintenance costs by implementing an asset lifecycle management solution via mySAP PLM. It standardized and integrated a dozen separate maintenance processes with its core operations, leading to lower costs going forward, minimal unplanned equipment outages, lower inventories of backup components, and cumulative savings of \$22 million.

## SINCE WHEN HAS IT BEEN ADAPTIVE?

A truly adaptive enterprise requires collaborative business processes and integrated IT to support them. But creating an adaptive enterprise from a set of disparate systems means a protracted struggle against a legion of internal and external obstacles. SAP's solution is simple: avoid the struggle altogether and go straight to greater efficiency and more market share.

Integrated and adaptive systems are the next big step for IT. Consider a typical challenge: Someone in manufacturing needs timelier product inventory information. Naturally, it's distributed among several different systems on the shop floor and also with suppliers all over the world. Needless to say, IT can't easily assemble the data or provide portal views for the business end to make good decisions. Frequently, what starts out as a simple request for some information morphs into an expensive and frustrating project that drags on for months.

This doesn't have to be the case. Enterprise software has made huge strides in automating transaction processing. Still, when it comes to turning on a dime, IT often gets stuck in the mud. The problem is the amount of integration required to cobble different systems together – which is why SAP created SAP NetWeaver and the Enterprise Services Architecture blueprint to make integration easier, so companies no longer need to rip and replace existing systems.

The goal is to perform two distinct types of integration as quickly as possible. Most businesses are at the stage where many processes are automated by standard enterprise applications for ERP, CRM, SCM, and so on. The first challenge is to create end-to-end business processes, such as order to cash, which begin in one application, CRM in this case, and end in another, say ERP. The next step is to extend this application-to-application integration across the boundaries of the enterprise. Business-to-business integration requires connecting partner, supplier, and

customer applications through transaction formats and gateways that all sides understand. For example, a business-to-business integration of the order-to-cash process might include receiving an order through an agreed-upon Electronic Data Interchange (EDI) or RosettaNet XML protocol, that gets converted into an SAP IDoc, then processed; the results of which are sent in an e-mail and also pushed to an Internet sales site.

Once the applications (both internal and external) are connected for a specific end-to-end business process, the second challenge is to integrate technology components with the applications and with each other. Integration technology provides visibility into business processes and delivers information to the people who need it. Reports must be constructed, and analytical frameworks and metrics designed. Events and thresholds must be monitored to allow automatic alerts to sound the alarm for problems. To support decision making and quick response execution, portal views must provide a comprehensive picture of the situation. Integrating otherwise incompatible technology tools and applications requires a lot of maintenance and many complex tasks, including cleaning, synchronizing, and harmonizing the master data.



## WHY SAP SOFTWARE

SAP meets these challenges with its tailored industry products and innovative solutions for adapting business processes to adaptive business networks. By turning to SAP for solutions and infrastructure, your company can create the network effect during the formation of your own ABN. Even if your network isn't completely built on SAP's products, SAP software provides the tools to put an integrated system in place. Turning to SAP for process and integration solutions – especially the integration capabilities of SAP NetWeaver, the platform for creating next-generation business process steps and composite applications – creates an early, momentum-building advantage to any company seeking to aggressively participate in an emerging network.

Based on years of design, research, and customer feedback, SAP has produced a version of SAP NetWeaver that dramatically reduces integration's time to value. Unlike other software companies, SAP creates its applications to mesh perfectly with its integration technology, using the mySAP Business Suite family of business solutions and SAP NetWeaver.

End-to-end process integration is simplified and expedited by mySAP Business Suite solutions, including the mySAP Customer Relationship Management and mySAP ERP solutions, which are powered by SAP NetWeaver. Using a third-party integration tool creates an expensive, hard-to-maintain custom project. And this is the advantage of using an integrated suite of products rather than cherry-picking a mismatched bundle of applications, and then trying to weave them together to interact as if they were made that way – like SAP's products. That's a big IT job by anyone's measure.

The integration of technology components with applications to provide visibility is also part of the solution. SAP NetWeaver comes with preconfigured business content such as iView portlets, reports, dashboards, and process templates for chemical business processes. Further, with a mySAP ERP implementation, a best-practices template is available to speed it up. Eighteen business processes can be implemented in 15 to 20 weeks using packaged solutions available from SAP Consulting and its partners.

For companies with SAP applications as part of a heterogeneous landscape, using SAP NetWeaver means that most of the work to meet the core challenges mentioned earlier is done. All that's left is the integration between SAP NetWeaver and non-SAP applications, which, given the alternative, is far better.

In addition to packaging integration, SAP NetWeaver also enhances a system's adaptability through its deep commitment to standards. SAP NetWeaver is based on open standards, such as Java, Web services, and many others. It interfaces to chemical industry standards (such as CIDX) and other industry protocols (such as RosettaNet for high tech), supported through the SAP NetWeaver Exchange Infrastructure (SAP NetWeaver XI) component, which provides maps and gateways to better interoperability.

## ENTERPRISE SERVICES ARCHITECTURE

In addition, SAP has created a new blueprint for IT called Enterprise Services Architecture, a service-oriented architecture that enhances the reusability and flexibility of both mySAP Business Suite solutions and SAP NetWeaver across the business – for example, integrating mySAP ERP Human Capital Management with mySAP ERP and all the other components in the SAP NetWeaver platform. Enterprise Services Architecture simplifies business processes and enterprise applications into usable, IT-scalable, and non-IT-comprehensible *enterprise services*.

Enterprise services allow for the quick assembly and reassembly to create new business processes. The most popular way to implement these services is by the Web, because of its interoperability across every computer platform. These are powerful concepts, but SAP has made them even more powerful by adapting them to the needs of enterprise computing.

To achieve adaptability while maintaining efficiency – the key challenge of the ABN – SAP has rethought how it builds the applications in mySAP Business Suite, based on the concept of Enterprise Services Architecture using SAP NetWeaver as its foundational technology.

For the ABN, Enterprise Services Architecture closes the gap between business and IT, providing the ability for rapid change while reducing cost and maintaining efficiency. SAP NetWeaver is the key agent of this transformation and for companies with SAP applications as part of their infrastructure, the transformation will be delivered automatically in each new product release.

The beauty of Enterprise Services Architecture is that this evolution takes place while leaving in place the efficiency and automation of traditional business processes for which SAP is famous and well-respected. User interfaces remain stable, while enterprise services allow the company to support new business processes faster than ever before, and with the lowest possible total cost of ownership.

### **Making Choices, Taking Action**

The ABN is an ideal that will never be fully implemented to perfection. But huge rewards await those who get even partway there. The path forward is not a complete retooling of IT, but rather a coordinated series of incremental improvements to existing enterprise applications, achieving the coordination, collaboration, and flexibility that an ABN can offer. With SAP as a partner providing solutions in every business process area required by the ABN, companies can accelerate their progress toward sustainable profitable growth.

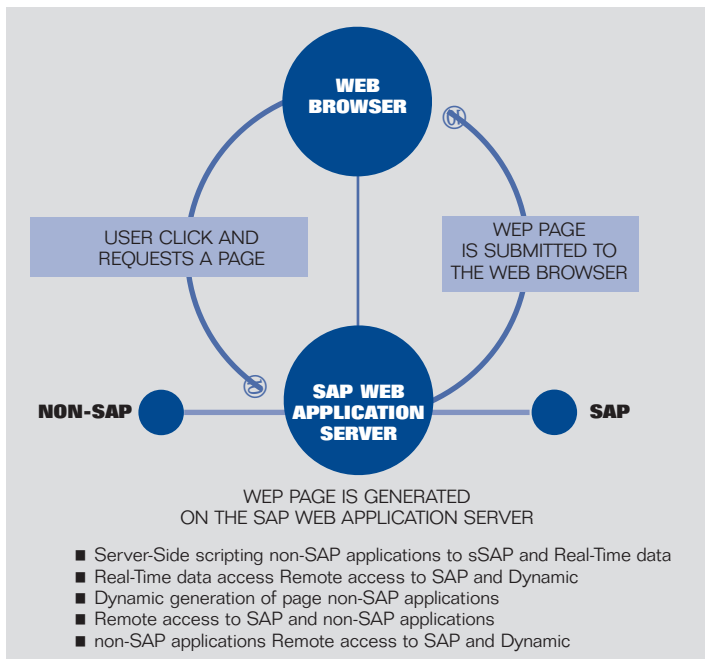




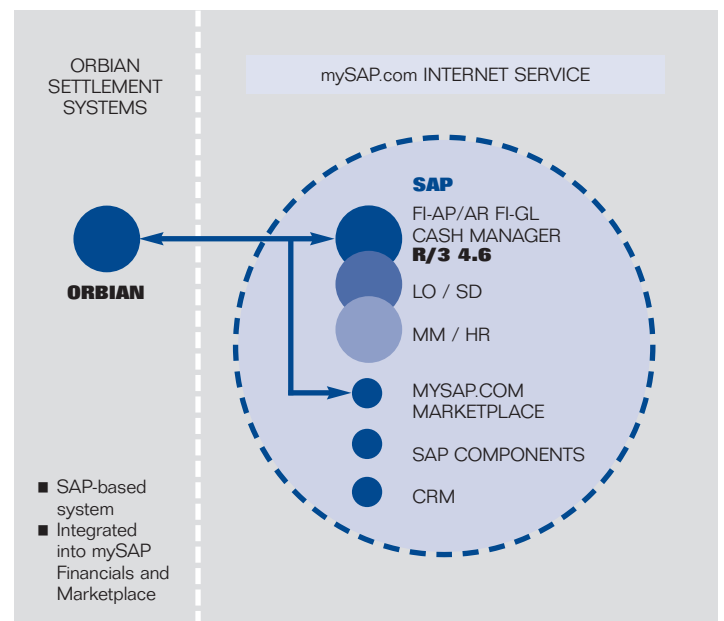
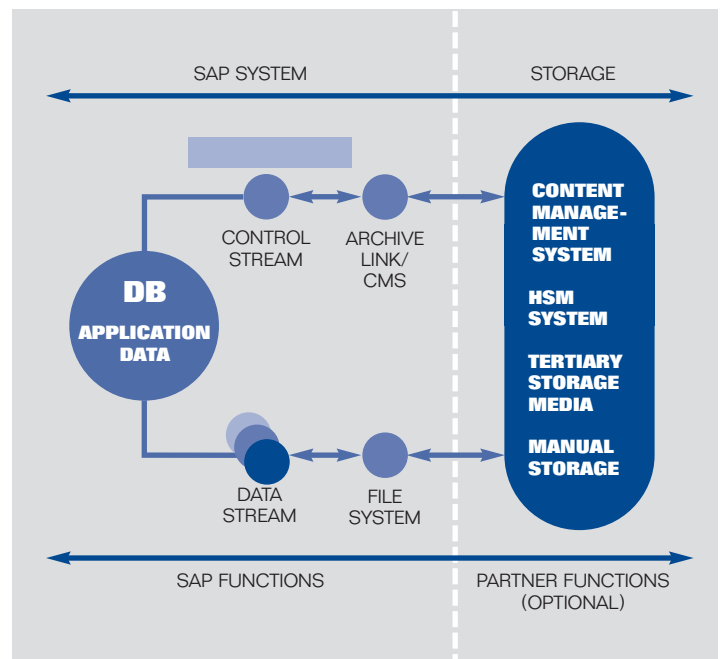
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# GRAPHIC AND TABEL EXAMPLES:

Availability (Release to Customer)	End of Extended Maintenance	Target Releases for Upgrade
to engage new customers farther reaching, more valuable and scalable	to engage new customers valuable and scalable	to engage new customers farther reaching, more valuable and scalable
farther reaching, more valuable and scalable	to engage new customers	to engage new customers farther reaching, more
to engage new customers	to engage new customers farther reaching, more	to engage new customers farther reaching, more valuable and scalable to engage new customers farther reaching, more valuable and scalable



Web application paradigm



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