

## **MRO and eProcurement: Opportunities and Challenges**

Abbas Foroughi

Department of Management, Management Information Systems, and Computer Science  
College of Business, University of Southern Indiana,  
8600 University Blvd., Evansville IN 47712  
Tel: 812-465-1667, email: aforough@usi.edu

### **Abstract**

A sum approaching \$400 billion is spent by U.S. companies each year on the procurement of MRO (maintenance, repair, and operating) supplies. Ranging from low-value, non-critical, high-volume items to highly expensive, specialized equipment, MRO supplies are used by many employees and must be maintained and/or stocked on an as-needed basis to prevent shut downs and ensure efficiency and capacity. The modern technologies of eBusiness—the Internet, intranets, extranets, and EDI-- now make it possible for firms to realize significant cost savings, enhanced communications at each step in the MRO acquisitions process, and improved efficiencies. This paper discusses the specific ways eProcurement can benefit MRO procurement and presents evidence of the current status of eProcurement use. Examples of companies who have implemented eProcurement for MRO purchases are detailed. Also included are serious challenges that prevent many companies from using eProcurement, and a discussion of possible future directions for MRO eProcurement.

### **Introduction**

One area of the supply chain in which potential lies for large cost savings and improved efficiencies is in the procurement of indirect materials, those that are not used directly in the production of goods, but are necessary for the maintenance, repair, and operation of the company. Such indirect materials are referred to as MRO (maintenance, repair, and operating supplies). MRO supplies include everything from office supplies, business services, and cleaning supplies, to trucks, warehouse, equipment, spare parts, and plant machines. They range from low-value, non-critical, high-volume items to highly expensive, specialized equipment. MRO supplies are used by many employees and must be maintained and/or stocked on an as-needed basis to prevent shut downs and to maintain efficiency and capacity. Spend on MRO by U.S. companies is significant and tends to follow the pace of general economic growth. Predictions for the end of 2006 were that spend on MRO supplies would reach \$400 billion (Falgione, Hartle, and Hess, 2006). This paper discusses the opportunities eBusiness offers to enhance MRO procurement. The following sections describe challenges encountered in using eProcurement, evidence of the status of eProcurement use, and examples of businesses who have implemented eProcurement. The paper finishes with a discussion of the possible future for eProcurement and key ingredients to the successful eProcurement implementation.

## eBusiness and eProcurement

Modern information technologies—the Internet, intranets, extranets, and Electronic Data Interchange -- provide support for supply chain management that can bring cost and time savings and improve communications at each of step in the MRO acquisitions process. The Internet links businesses to consumers and businesses to businesses with speed and ease of use that facilitates the flow of information from the retailer to the customer and vice versa. The sharing of data across different information systems via the Internet is facilitated by XML (extensible markup language). Within a company, intranets allow internal users to share information with each other and may span multiple locations throughout the world (Bartoo, Elliot, and Naik-lyer, 2000). Marketing and sales, accounting and finance, and customer service can be linked together through the company intranet. Extranets extend the company's intranet to other companies and organizations, such as suppliers, manufacturers, and distributors (Bartoo, Elliott, and Naik-lyer, 2000). EDI allows the computer-to-computer exchange of standard transaction documents, such as invoices, bills of lading, and purchase orders invoices (Laudon and Laudon, 2006; Leonard and Davis, 2006), reducing transaction costs, and yielding time and cost savings, faster communications with supply partners, and better control and reduction of inventories. Data from EDI can be integrated with accounts payable, inventory control, and production planning to further reduce costs (Leonard and Davis, 2006).

Several types of e-procurement models are used to reap the benefits of eBusiness—catalog systems, virtual marketplaces, online auctioning, and desktop purchasing systems (DPS) (Wening, 2001). Electronic catalogs give customers an alternative means of determining the products, services, and suppliers available, and provide comparative analysis of suppliers. The complexity of comparison shopping across vendors is alleviated by optimization technology, derived from applied mathematics and computer science, that enables buyers to solve a challenging multidimensional problem—how to determine the best trade-off between cost, quality, quantity, service, delivery horizon, shipping costs, product dimensions, and a multitude of other factors (Berger, 2000). E-Payment applications complete the e-purchasing cycle, by providing data to the buyer's back end financial systems. These systems provide buyers with comprehensive data on what was actually shipped and what was paid and digital signatures to prevent theft and misuse of data and information (Aberdeen Group, 2006).

Online catalogs can be used in seller-side, buy-side, application-service provider, or on Internet exchange models. Seller-side solutions are provided by suppliers who post their catalogs and specifications sheets on their web sites. Online supplier catalogs offer buyers many useful options such as controls for maverick buying, in which only authorized employees can access certain catalogs; approvals for inexpensive items; and display of previously negotiated prices (Cygnus Interactive, 2004).

Companies using the buyer-side model use software that accepts and standardizes vendors' catalogs, configures pre-negotiated prices, and maintains them on the buyer's intranet, through which purchase orders can be created, routed, approved, and sent to the seller. Software can either reside on an organization's intranet, or be hosted by an application service provider. The procurement department can use one user account and one interface to control item selection, pricing, and access to all of the ordering information inside the company's firewall (Wening, 2001). Drawbacks of the buyer-side model include the fact that firms must source content and aggregate it for the internal catalog, requiring a high level of effort for content management (Wening, 2001). The buyer-side model is most often recommended for larger companies, because they can be implemented quickly, are easily integrated with back-end systems, and result in a short, easily calculated payback period (Foster, 2000).

In virtual catalogs, information is dynamically retrieved from multiple catalogs and presented in a unified manner with its own look and feel (Rajkumar, 2001). Instead of product information on their own, virtual catalogs contain information pertaining to the contents of online supplier catalogs and linkages to the actual product information contained in them. User inquiries can be answered with information from separate online sources. An organization using a virtual catalog can configure the

system to allow individual employees within the company access only to approved products from established suppliers, or allow purchasing professionals to access any Internet-based catalog. The advantages of virtual catalogs are that legacy systems and workflow linkages only need to be established once, and the effort and expense associated with catalog aggregation are eliminated. In addition, virtual catalogs provide flexibility by allowing access to product information from a diverse array of sources and data formats, and providing current information directly from its source.

Online auctioning, both forward and reverse, is also possible with eProcurement. In a forward auction, sellers post the goods or services they want to sell, and buyers submit their bids for the services or goods. In a reverse auction, buyers post a request for quotes for items they want to buy, and multiple sellers submit bids. E-auction service providers offer a spectrum of support that can be tailored to a particular business' needs (BuyIt, 2001). For companies desiring full support, service providers will manage the entire auction process, including determining procurement areas with the most potential, searching for suppliers, structuring and conducting the most appropriate auction event type. In other cases, the customer decides which areas in its procurement should be auctioned and the type of auction strategy, and the service provider just prepares for and runs the auction. In this second scenario, companies focus on developing their own e-auction skills, with less expenditure on the e-auction, but still benefit from the objectivity provided by the service provider during the auction. In a third scenario, the service provider supplies only technical support, and the customer manages all other aspects of the auction. Companies who choose this option benefit from developing online auction expertise for the entire auction process, gain ownership of the process, and can develop their own supplier training packages and auction processes to suit their particular business needs.

Companies also use Internet marketplaces, also called independent trading exchanges (ITEs), where indirect materials can be purchased at set prices or sellers can bid for buyers' business. Third-Party application service providers link buyers and suppliers into networks of interoperable marketplaces, trading communities, and commerce portals (Swinton, 2002). Digital marketplaces help both buyers and sellers achieve efficiency in their procurement process. For buyers, this model offers access to below market bulk prices, and suppliers achieve access to potential buyers with minimal marketing. Digital marketplaces enable small buyers to have the same access to many sellers that large buyers usually do, as well as equal opportunities for obtaining short-term discounts and liquidations (Cygnus Interactive, 2004). Marketplaces manage buy-side and sell-side participants' information and business process, in addition to the transaction (Rajkumar, 2001). Therefore, they must support security, liquidity, transparency, efficiency, and anonymity. Exchanges can both horizontal, such as Works.com and Intelysis.com; and vertical, industry-specific, like Ventro.com and TPN Register. Vertical markets focus on alleviating inefficiencies in the supply chain within a specific industry sector, such as geographically dispersed buyers and sellers, lack of information regarding pricing, and under-utilized capacity (Wening, 2001). Vertical marketplaces provide industry information that can improve market and price transparency, and advice on how and where products can best be sourced (Korper and Ellis, 2001). Horizontal marketplaces, instead of serving the needs of a specific industry, focus on information, functions and processes that span across multiple industries. They provide knowledge and workflow expertise that facilitates customizing companies' business processes to respond to industry-specific differences (Wening, 2001).

Desktop Purchasing Systems (DPS) extend the support for the actual purchasing process which was provided by catalog systems and virtual marketplaces to other internal processes—licensing, goods receiving, or accounting control (Wening, 2001). Such employee-facing suites enable employees to use the same interface used for purchasing for expense and forecasting reports, time and attendance sheets, personnel and benefit forms, and other administrative tasks. Employees can order directly from suppliers in the company's internal catalog, and payments are made automatically. The company's business rules can be used to determine the unique procurement work flow for each MRO product, and the purchasing department can limit the type and amount of goods particular employees may order, negotiate agreements with suppliers, and list them in the company's buy-side catalog (Berger, 2000). Adjustments to the purchasing path for a commodity and/or employee access/limits

can be updated easily. The purchasing department is relieved from spending time on operational tasks and has more time for strategic decision making (Dolmetsch, 2000).

A recent study by Forrester Research shed light on the eProcurement software marketplace. eProcurement software is available from four types of solution providers (Bartel, 2007). Companies like Ariba, BasWare, ePlus, Oracle, and SAP provide licensed eprocurement software as part of spend management/supplier relationship management suites. EProcurement solutions are available as software-as-a-service from Ketera Technologies, Perfect Commerce, and SciQuest. A third category of vendors, led by Fieldglass and IQ Navigator, offers services procurement software that covers purchasing, temp workers, consulting, outsourcing, marketing, and legal services. Fourth, eMarkets are available with supplier networks and eProcurement solutions—cc-hubwoo, IBX, Perfect Commerce, and Quadrem, as well as Ariba, ePlus, Ketera Technologies, Oracle, and SciQuest. The Forrester study evaluated the top 14 eProcurement software providers on the basis of three types of criteria: overall procurement solutions, service procurement solutions, and supplier networks and enablement solutions. The study identified the leaders—including the top vendor, Ariba, followed by BasWare, Oracle, PeopleSoft, and SAP—all of whom provide goods buying, services buying, and supplier enablement.

### **Benefits of EProcurement for MRO Procurement**

Many firms are still missing opportunities for cost and efficiency savings in their MRO supply chains because MRO materials are often purchased outside the formal purchasing organization, and user-friendly tools are not available to support this process (Kilpatrick, 2001). Enterprise Resource Planning Systems (ERP), used during the 1980s and 1990s, have helped to streamline the purchase of items needed for production, but the 30% of the purchase budget that includes non-production items, such as MRO, are often not managed by ERP (Alberg Software, 2000). And, procuring and maintaining needed MRO supplies is a complex undertaking, often involving thousands of parts, suppliers, and inventory stockpiles, and multiple decision makers spread all over a company who have different agendas and little communication with each other (Genesis Solutions, 2002).

EProcurement can enhance the MRO procurement process in many ways. EProcurement systems can be easily and economically implemented, and compared to ERPs, offer significant, immediate return on investment. “The return on investment for e-procurement is amazing,” according to Kut Ritcey, partner with Deloitte Consulting. “We’ve seen studies that show it can be as high as 300 percent over the lifetime of a system. Other studies show that companies can expect to reduce their external spend by 9 percent after implementing one of these systems.” (Cygnus Interactive, 2004, 2). While the average cost of processing a purchase order manually ranges from \$75 to \$200, automating procurement reduces the cost to between \$10 and \$40 (Aisbett, Lasch and Pires, 2005).

With eProcurement, the risk factor for buying many indirect items online is very low. “If you buy office supplies electronically and something goes wrong, you are not going to sink the company. On the upside, you can cut 20 percent of the cost,” says Bob Parker, service director of e-commerce strategies for AMR Research, in Boston (Foster, 2000, 2).

eProcurement can reduce material and service costs for MRO goods and services 5%-10% by reducing maverick purchasing, defining the use of preferred suppliers, and providing better leverage for contract negotiations (Aisbett, Lasch, and Pires, 2005). Buying practices that do not conform to the corporate policy can be avoided. Time to process a purchase requisition can be reduced by 50%-70%, and requisition processing costs by 70% per order. Shorter fulfillment cycles and improved purchase control enable some organizations to implement just-in-time MRO procurement strategies.

eProcurement enables companies to make better decisions related to rationalizing their supplier base by providing a broad overview of the market (Reese, 2003). eProcurement provides new levels of visibility to CFOs and finance directors about what the company is buying and from whom (Bedell, 2002). CFOs can have confidence that employees are adhering to corporate contracts made with suppliers, trace company spending trends, and negotiate better prices on future contracts (Bedell,

2002). By aggregating the spend of different groups within an organization, eProcurement enables companies to have better control of enterprise spending (Moore, 2007).

The web-based environment of eProcurement eliminates the need for IT support of traditional software, supports maintenance of all data in a central database, and makes the purchase to pay cycle “almost instantaneous...from as much as two weeks to under an hour,” according to Chea Simm, business development manager at Compusearch (Bedell, 2002, 2).

EProcurement systems provide a variety of new options for procuring materials. “Different products may call for different solutions,” said Ritcey, of Deloitte Consulting. “So, one company could conceivably use electronic data exchange to source capital inputs or raw materials, a supplier’s self-service catalog for office suppliers, a buying network for, say, paper stock or certain chemicals, an online auction site to book cheap cargo rates with a carrier that has extra space and perhaps a multi-supplier mall just to browse for even better deals” (Cygnus Interactive, 2004, 3).

eProcurement enables companies to maintain lean inventory levels, since inventory databases can be linked to suppliers’ ordering systems, and minimum threshold levels set, at which suppliers will automatically replenish inventory levels (Moore, 2007).

### **EProcurement Implementation Challenges**

“Paper-based purchasing is still the norm in the maintenance world,” according to Tom Singer, of Tompkins Associates, in Oak Brook, Illinois (Singer, 2003, 1). In fact, 86% of MRO orders are not transacted online, and 84% of MRO payments are processed by paper (Aberdeen Group, 2006).

Problems with integration to backend systems, which may have incompatible platforms, are a stumbling block to many eProcurement efforts. Some companies use multiple ERPs, which may not be compatible. Suppliers need to be able to handle different eProcurement systems customers are using. Ariba, i2, Commerce One, for instance, each have specific formats (Bedell, 2002).

Most manufacturing plants are still using decades-old equipment and parts whose documentation is paper-based and lacks the digital format necessary for eProcurement systems (Moore, 2003). The original suppliers of this equipment often prefer to sell manufacturers new equipment rather than to make the necessary upgrades to digital format. Manufacturers who cannot afford to replace their aging equipment must forego opportunities to implement eProcurement.

Although advances have been made in search technology to address nomenclature issues, inconsistencies in nomenclature for parts, between companies and even within different departments or sites of the same enterprise, often lead to costly delays and errors (Moore, 2003).

As with any new technology introduced into the workplace, an eProcurement system’s effectiveness depends, ultimately, on its being adopted and regularly used by employees. Since eProcurement systems are a self-service tool, end users sometimes resist using it (Bedell, 2002). Employees are said to comply with the purchase of contracted items only 65% of the time, causing companies to miss out on the 22% in cost reductions possible through compliance with contract terms (Aberdeen, 2006).

Maintenance requires a wider supplier base than other business functions, and an eProcurement system needs to provide access to a broad supplier base. Many suppliers, especially smaller ones, do not have the technological capability to integrate with eProcurement platforms. They may lack the IT infrastructure and capital necessary to provide eProcurement and fear that eProcurement will enable buyers to leverage price concessions (Singer, 2003).

Procuring MRO supplies over the Internet is not a strategic priority with many companies, who think it wiser to buy uniform direct materials parts from a few suppliers rather than putting money into spot buying of MRO supplies from a wider supplier pool. They are overlooking problems of traditional MRO procurement like excess safety stocks and the impact of delays on work order planning and scheduling. (Singer, 2003).

MRO eProcurement is still a fragmented market, with many different solutions offered, so some companies are hesitant to rely on it. Many companies have Enterprise Asset management systems or ERP packages for maintenance support that cannot be easily integrated to an electronic marketplace (Singer, 2003).

The potential for legal problems also exists in the way digital exchanges are operating. Exchanges that mark up inventory for revenue, control the receivables as a virtual distributor, and have control over the receivables, but the title to the inventory remains with the supplier (Cygnus Interactive, 2004).

eProcurement creates a whole new set of responsibilities for purchasing departments (Foster, 2000). Content management involves maintaining product and price data in the supplier catalogs that are placed on company enterprise systems and making updated information available to the employees who need them. Workflow management must be done to provide smooth, timely expenditure approval at various levels that assures compliance with budgets and procedures and eliminates maverick buying. Systems integration is also an issue. In order to obtain savings from the elimination of paperwork, eProcurement systems must integrate with enterprise resource planning (ERP) systems for accounting, payment, and inventory management. Supplier integration is also essential, with real-time links to suppliers' systems that can confirm purchases and make quick updates of their catalogs on a company's enterprise system. Information analysis from procurement systems' data can be used in negotiating better pricing with vendors, allocating costs to various departments, and auditing and planning.

## **Examples of eProcurement Implementations**

### *GE Transportation Systems*

GE Transportation Systems, in Erie, Pennsylvania, is a leading supplier of freight and passenger locomotives, motorized drive systems for mining trucks and drills, and railway signaling and communications systems (GE Global eXchange Services, 2002). Each year, GE processes 100,000 invoices for indirect purchase, most manually. The processing of each paper-based order and payment of each invoice was very costly, and contracting agents were spending up to 40% of their time reconciling invoices. GE Transportation Systems now uses GXS's EC Service Center's ePcard XML system, which automatically extracts the PO number from the buyer's eProcurement systems, records it to the MasterCard transaction record, and transfers it to the customer's accounting system for automatic reconciliation. The ePcard also increases security and control, since the system reviews supplier authorization to pay requests and declines authorization to suppliers who attempt to charge more than the agreed upon PO amount. GXS's EX Service Center gives buyers and suppliers the flexibility to interface with the ePcard XML service in any data format—XML, EDI, proprietary formats, or fax. In nine months, GE Transportation Systems saw a 75% decrease in time spent reconciling incorrect invoices, and the firm projected an annual savings of \$900,000.

### *Lufthansa CityLine*

Lufthansa CityLine has a fleet of 80 jet aircraft that provide feeder services to hubs in Frankfurt and Munich (Electronic Data Systems Corporation, 2005). To reduce costs and increase competitive advantage, CityLine decided to replace its mainframe-based systems used for MRO operations. MRO consultants from EDS configured hierarchical task lists for maintenance functions; and automated workflow capabilities that tailored to CityLine's particular resources, such as employees, material, hangar space, and tools; as well as material management functions such as subcontracting, pooling, loan and exchange, and warranty management. Management and engineering processes were

translated into SAP transactions. CityLine found that the SAP-based solution reduced operational costs, increased productivity, and improved the company's competitive position in the industry.

### *Sunway Group*

The Sunway Group, a prominent Malaysian conglomerate, implemented the Ariba Buyer eProcurement system across its entire company (Ariba, 2005). The company initially focused on decentralizing procurement for purchasing and administration departments' online purchases of desktop computers, paper supplies, and printing. Since then, expanded implementation of Ariba Buyer has streamlined and standardized key commodity procurement. The company has realized millions of dollars of saving, reduced the supplier base from 6,000 to 2,000, put into place paperless transactions that can be processed more accurately, and increased corporate spend transparency and accountability.

### *Boston Globe*

New England's largest newspaper, *The Boston Globe*, has a circulation of 472,500 on weekdays and 704,000 on Sunday (MRO Software, 2006). The Globe's presses, which are several stories tall and print, collate, fold, and trim pages, are difficult to maintain. With seven-day production, a breakdown in the printing presses can spell disaster for the newspaper. For this reason, *The Globe* decided to seek a strategic asset management solution that could maintain its assets, from printing production to facility assets, in its four locations. The system chosen by *The Globe* was Maximo, MRO Software's Strategic Asset Management solution, which can be accessed from any computer with a web browser. Maximo tracks the history of failures of the various pieces of equipment and helps *The Globe* decide if it is more cost effective to repair or replace it. With the electronic maintenance and repair histories of printing presses Maximo maintains, *The Globe* is able to predict when the machines will breakdown and perform proactive maintenance to limit downtime. In addition, upgrades are done from one central site, instead of separately, at each facility.

### *University of Pennsylvania*

Over the past decade, the University of Pennsylvania has realized \$88.7 million in savings from its eProcurement system, BEN Financials, an Oracle financial management applications that has a purchasing model and Pen Marketplace, an online marketplace with 170 suppliers through which the university does 72% of its purchasing (Moore, 2007). The consolidation of suppliers encourages them to offer discounts, and supplies that used to require a turn-around of 18 days are delivered in less than one day. Maverick buying has been greatly reduced, with 80-85% of purchasing going through the purchasing department, compared to 38% before e-Procurement. Purchasing has now become a top strategic administrative departments that annually contributes to return on investment.

## **MRO eProcurement: Now and Toward the Future**

The Aberdeen Research study, *The Maintenance, Repair and Operations Supplies Benchmark Report* (2006) found that MRO costs have been reduced by 19% by best-in-class companies, who take a broad look at MRO costs that goes beyond the cost of individual MRO items to focus on total MRO costs, including freight, loading, unloading, packaging, warehousing and inventory management. Online ordering and payment, strategic sourcing systems, and spend analysis and intelligence systems are essential for reducing high MRO administrative costs. The source-to-pay process has been automated by 51% of best-in class companies, compared to 30% by the average company.

The Aberdeen survey also examined asset utilization trends, finding that more and more companies are scheduling planned downtimes to repair or replace equipment. The result is, of course, increased spend on MRO supplies. However, as the report points out, when equipment is maintained at peak-performance levels, higher levels of quality, less waste and higher yields can be realized. In other words, better equipment maintenance may require increased MRO expenditure, but in the long run, has very positive ramifications on total manufacturing cost-savings.

Other interesting results of the study include the fact that the only 16% of MRO transactions are automated, representing missed opportunities to reduce costs; and that 18% of all MRO purchases are unplanned, spot-buys.

As one of the last links in the supply chain to be automated, online procurement is still in its infancy. However, demand is growing, for instance, for digital marketplaces to offer value-added services, such as demand planning, inventory management, as well as a means of factoring in costs of transportation, customs clearing, regulatory/tax, insurance, and warehousing in the bidding process. Distributors have predicted that revenue received from online orders for MRO will grow from the 18% of total revenue received in 2006 to 38% by 2012; and that customer orders via EDI will account for 11% of their sales revenue by 2012, which is 4% more than in 2006 (Avery, 2007).

Success with eProcurement will continue to depend on suppliers' willingness to provide update to date, easily accessible electronic catalogs in appropriate formats and to use XML open standard to send and receive purchase orders and receipts electronically. E-Procurement systems must be integrated with existing financial, human resource, and ERP systems to enable automated approval and accounting. Process re-engineering and organizational change must accompany e-Procurement efforts, to make sure employees are on board. Each company should consider the level of eProcurement that is most appropriate and strategically beneficial for its needs, since eProcurement can range from information search to full automation, and from non-core to core supplies (Aisbett, Lasch and Pires, 2005). Companies who do successfully implement eProcurement will find that online procurement is an integral part of successful B2B exchanges and an essential part of supply chain strategies aimed at reducing cycle times and lowering costs (IBM Global Services).

## References

1. Aberdeen Group (September, 2006). *The Maintenance, Repair and Operating Supplies Benchmark Report: Strategies for Improved MRO Spend Management*.
2. Aisbett, J., Lasch, R, and Pires, G. (2005). "A Decision-Making Framework for Adoption of e-Procurement." *International Journal of Integrated Supply Management* (1) 3, 278-293.
3. Alberg Software (2000). White Paper, "Procurement Process Improvement Using Internet," [comdotos.com/whitepapers/procProcess.html](http://comdotos.com/whitepapers/procProcess.html)
4. Ariba (2005). "Sunway Group Expands Ariba Implementation for Corporate-Wide Adoption of Spend Management." [www.ariba.com/company/news.cfm?pressid=2500](http://www.ariba.com/company/news.cfm?pressid=2500)
5. Avery, S. (March 1, 2007). "MRO Purchasing Pros Demand More Personal Buying Experience." *Purchasing* (136) 3, p. 33.
6. Bartel, A. (April 26, 2007). "The Forrester Wave: eProcurement Solutions, Q2, 2007." Forrester Research.
7. Bartoo, J, Elliot, T, and Naik-Iyer, V. (2000). *Increased Competitive Advantage: The Combination of eBusiness and Business Intelligence Tools*. San Jose, CA: Business Objects.
8. Bedell, D. (May, 2002). "Solving the Headaches of eProcurement." *Corporate Finance*. [www..../pqdweb?TS=1045444536&RQT=309&CC=2&Dtp=1&Did=000000121053487&Mtd=1&Fmt](http://www..../pqdweb?TS=1045444536&RQT=309&CC=2&Dtp=1&Did=000000121053487&Mtd=1&Fmt)
9. Berger, I. (January, 2000). "At the Cutting Edge of eProcurement." *Plant Services*.
10. BuyIt Best Practice Network (October , 2001). "Online Auctions: A BuyIt eProcurement Guideline. Online: [www.buyitnet.org](http://www.buyitnet.org)

11. Cygnus Interactive (2004). "Is eProcurement Transforming Business?"  
[www.isourceonline.com/isourceprintpage.asp?article\\_id=165](http://www.isourceonline.com/isourceprintpage.asp?article_id=165)
12. Dolmetsch, R. (2000). *eProcurement: Sparpotential im Einkauf*. Munchen, Addison-Wesley.
13. Electronic Data Systems (2005). "EDS axsMaintenance flies Lufthansa CityLine to Success." Case Study. [www.eds.com/services/casestudies/downloads/lufthansa.pdf](http://www.eds.com/services/casestudies/downloads/lufthansa.pdf)
14. Falgione, J., Hartle, L. and Hess, G. Core (2006). "Category Detail: Services and MRO." *Ariba Supply Watch, Q4, 2006*. [www.ariba.com/monitor/SupplyWatch\\_Q406/services\\_mro.htm](http://www.ariba.com/monitor/SupplyWatch_Q406/services_mro.htm)
15. Foster, T.A. (August 31, 2000). "Online Shopping for Big-Buck Basics." *SupplyChainBrain.com*.  
[www.supplychainbrain.com/archives/8.31.00.Shopping.htm?adcode=15](http://www.supplychainbrain.com/archives/8.31.00.Shopping.htm?adcode=15)
16. GE Global eXchange Services (2002). "GE Transportation Systems Steams Ahead to Purchasing Efficiency." Case Study [www.gebusinessmarketplace.com/cs\\_GETS\\_ePcard.pdf](http://www.gebusinessmarketplace.com/cs_GETS_ePcard.pdf)
17. GenesisSolutions.com. (2002). "Integrated MRO Supply Management: A Three Dimensional View." WhitePaper, [www.GenesisSolutions.com](http://www.GenesisSolutions.com)
18. IBM Global Services Feature Story. "Companies are Placing Procurement Systems on the Web to Cut Costs and to Avoid Order Errors."  
[www.1.ibm.com/services/feature/procurement\\_systems.html](http://www.1.ibm.com/services/feature/procurement_systems.html)
19. Kilpatrick, J. (June, 2001). "The Supply Chain e-Business Top 100 Buy: Moving from Indirect to Direct Procurement," *SupplyChainBrain.com*.  
[www.supplychainbrain.com/archives/6.01Buy100.htm?adcode=15](http://www.supplychainbrain.com/archives/6.01Buy100.htm?adcode=15)
20. Korper, s. and Ellis, J. (2001). *The E-Commerce Book: Building the E-Empire* (2<sup>nd</sup> ed.) San Diego, CA: Academic Press.
21. Laudon, K. and Laudon, J. (2006). *Management Information Systems: Managing the Digital Firm* (9<sup>th</sup> ed.). New Jersey: Prentice-Hall.
22. Leonard, L. N.K. and Davis, C.C. (2006). Supply Chain Replenishment: Before-and-After EDI Implementation. *Supply Chain Management* (11) 3, 225-232.
23. MRO Software, Inc. (2006). "The Boston Globe Manages Its Production and Facilities Assets Using MRO Software's Strategic Asset Management Solution." "  
[www.mro.com/corporate/pdf/TheBostonGlobe.pdf](http://www.mro.com/corporate/pdf/TheBostonGlobe.pdf)
24. Moore, J. (April 1, 2007). "E-Procurement Pays Its Own Way: Strategic Sourcing and eProcurement Transform Purchasing in DeKalb County, GA." *FCW.COM*  
<http://www.fcw.com/article98118-04-02-07-Print>
25. Rajkumar, T.M. (Fall, 2001). "E-Procurement: Business and Technical Issues." *Information Systems Management* (18) 4, 52-60.
26. Reese, A. (February 23, 2003). "eProcurement Takes on the Untamed Supply Chain." *ISourceonline*,. [www.isourceonline.com/article.asp?article\\_id=46](http://www.isourceonline.com/article.asp?article_id=46)
27. Singer, T. (January, 2003). "MRO eProcurement: Where Is It Now?" *Plant Engineering*.  
[www...pqdweb?TS=1045443175&RQT=309&CC=2&Dtp=1&Did=000000278488351&Mtd=1&Fmt](http://www...pqdweb?TS=1045443175&RQT=309&CC=2&Dtp=1&Did=000000278488351&Mtd=1&Fmt)
28. Swinton, A. (2002). "Avoiding the Pain Chain." *BT Ignite*.  
[www.btignitesolutions.com/consulting/now/articles/article11.htm](http://www.btignitesolutions.com/consulting/now/articles/article11.htm)
29. Wening, A. (2001). *Electronic Procurement: Concepts, Instruments and Benefits*. Georg-Simon-Ohm Fachhochschule, Nurnberg, Germany, June 14.