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WORLD WIDE WEB BUSINESS CATALOGS IN BUSINESS-TO-BUSINESS PROCUREMENT

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Abstract

The use of on-line Web catalog systems to support business-to-business procurement activities is a rapidly growing function in electronic commerce. These systems can be used to link suppliers to customers in different ways, with a variety of support functions and with several different information architectures: many-to-one, one-to-many, and many-to-many suppliers-to-customers respectively. In addition, approaches differ among the types of products and services (P/S) being exchanged: production P/S, maintenance, repair and operations (MRO), and capital, R&D, and ad hoc procurement. There will also be differences that depend upon whether the P/S are to be requisitioned or sourced. This paper explores the various issues that affect decisions among the different procurement architectures. We conclude that, although large supplier and customer companies may wish to support their own one-to-many and many-to-one procurement architectures respectively for reasons of flexibility and economies of scale, small to medium companies will probably find that the most cost-effective approach is a many-to-many architecture that is converted into a many-to-one-to-many architecture through a central multi-catalog intermediary.

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1. Introduction

Commercial use of the Internet and the systems it supports (e.g. e-mail, file transfer protocol, World Wide Web) has created significant opportunities for innovations in promoting trade in goods and services. We are now in a particular phase of innovation dynamics (Abernathy and Utterbach 1978), where a wave of product innovation has resulted in the development and improvement of high tech products (Internet, intranets, World Wide Web, search engines, e-mail, etc.). What is now occurring is the "transitional phase", where process innovation in electronic commerce is proceeding at an aggressive rate. The success of this transitional wave depends upon easy access to relevant information, the effective use of that information in making and implementing choices, and (Sirbu 1997) a secure electronic transaction and payments system to reduce the burden of completing the transaction. The focus of this paper is on business-to-business procurement, an e-commerce process area which relies on these factors for success. Thus far, firms that have adopted Internet procurement approaches have experienced significant cost reductions and service improvements. An industry study (Aberdeen Group 1999) showed a resulting 5% to 10% reduction in prices for goods and services through lower material and service costs, reduction of acquisition and order fulfillment cycle times of 50% to 70%, reduction of requisition processing costs of 70% per order, and improved inventory management practices. This makes the implementation of such systems very attractive to firms that are willing to deal with the changes in technology, organization, and operational practices that are needed to implement them successfully.

The rapid global growth in the number of World Wide Web business servers, due to low entry barriers and platform independence of the Web, has opened new avenues of contact between customers and suppliers. The runaway popularity of the Web and its massive and growing distributed database has caused an escalation in the volume of information available, and the proportion of irrelevant or marginal information that can be retrieved from the Web, through general search engines and browsing. This has led to information overload problems for users. One solution to this problem is the use of on-line Web business directories that index product and service information provided by companies, in databases for search and retrieval. A subset of business directories (Archer and Head 1997) is the supplier catalog procurement systems which provide not only indexes for searches, but also related descriptive and business

information similar to that found in hard copy catalogs and CDROMs. There are also a number of intermediary Web services available which include multiple vendor catalogs (MVCs), containing information on hundreds of thousands of products and services, from thousands of companies. In addition, a number of commercial systems are available that offer this functionality for business firm procurement support (see Appendix).

Web catalogs have advantages over traditional hard copy catalogs, directories, or CD-ROMs, for providing business P/S information, because they can be made widely available via the Web at low cost, are easily updated at their single source, and can support sophisticated on-line database searches. They can also include "hot" URL links to suppliers who maintain their own Web pages, but Keller (1997) points out the disadvantages to managing MVCs in this way, because of catalog heterogeneity and the lack of seamlessness in the associated procurement system. Business MVCs can be of great use to purchasing agents, design engineers, and other specifiers, during the information discovery process. However, information discovery is only a small part of procurement. Other related activities must be integrated with information discovery. Additional services include facilitating business interactions by serving as brokers, or by linking customers, suppliers, and banks through secure extranet links, and using standard EDI protocols for exchanging business transaction information such as invoices, purchase orders, and payment authorizations. Catalogs and MVCs are taking on an increasingly important role in the business procurement process, a role which is likely to become predominant as the volume of e-commerce continues to increase. The purpose of this paper is to examine the configuration and application of these services in business-to-business procurement, and their fit with current business approaches.

In the following sections, we will discuss the procurement life cycle and link it to the capabilities of catalogs and MVCs and related services. We then develop a classification of architectures for these systems in procurement, with some examples of each type currently in use, along with some commercial systems now on the market. We also indicate some of the decisions that must be made by firms considering the implementation of such systems, along with factors that affect these decisions. Finally, we discuss the current state of Web catalog procurement and suggest what the future trends indicate.

2. The Business-to-Business Procurement Life Cycle

The procurement function supports every primary functional area of the firm in some way (Porter 1985), from inbound logistics, through operations, outbound logistics, marketing and sales, and service functions. Information technology (I.T.) also affects every functional area and, especially with the growing use of the Web, is being used extensively to add value to procurement operations. I.T. in procurement may play a somewhat different role in each functional area. For example, I.T. in operations can assist in supporting procurement decisions and the transactions that relate to implementing these decisions. In inbound and outbound logistics, it can assist in contracting for transportation, monitoring progress in shipments, and completing related transactions. Marketing and sales functions interact with the procurement functions of other firms. The number of successful applications of networked communications and computing in procurement support roles continues to grow (The Economist 1997).

Products and services (P/S) used in business encompass a wide array of requirements, each with differing procurement support needs. It is useful to differentiate among such requirements, as in Table 1.

Table 1. Classification of Business Procurement Needs
(adapted from Gebauer, Beam, and Segev 1998).

1) Raw material and production goods and services (large quantities, high frequencies, unique specifications, often just-in-time delivery)

2) Maintenance, repair, and operating supplies and services – MRO (low unit cost, low volume, off-the-shelf, relatively high frequency), and

3) Capital goods, ad hoc procurement for functions such as R&D, and related services (high value, low frequency, and often outside the normal procurement process because of convenience, speed, and unique specifications).

In procuring P/S of any type, there are certain activities a customer undertakes. These can be cast in the form of a procurement life cycle. A business-to-business procurement life cycle from the customer's perspective includes the activity phases shown in Table 2. These are a continuing process of interaction between potential suppliers and the customer, although not necessarily in the sequential order indicated. For example, there may be defections and returns to previous phases, if the process between customer and any specific supplier breaks down at any

time. This process can form an ongoing exchange relationship between supplier and customer, through coordinated arrangements between the parties, for the purpose of common business advantage. The marketing literature classifies the formation of business-to-business relationships of this nature as networking (Coviello, Brodie and Munro 1997).

Table 2. Business Procurement Life Cycle

1) Information Gathering: If the potential customer does not already have an established relationship with the sales/marketing function of suppliers of the needed products or services (P/S), it is necessary to search for information about suppliers who can satisfy the requirements.

2) Supplier Contact: When one or more suitable suppliers have been identified, Requests for Quotes (RFQ), Requests for Bids (RFB), Requests for Information (RFI), or Requests for Proposals (RFP) may be advertised, or direct contact may be made with selected suppliers.

3) Background Review: References for product/service quality are consulted, and any requirements for follow-up services including installation, maintenance, and warranty are investigated. Samples of the P/S being considered may be examined, or trials may be undertaken.

4) Negotiation: Negotiations are undertaken, and price, availability, and customization possibilities are established. Delivery schedules are negotiated, and a contract to acquire the P/S is completed.

5) Fulfillment: Supplier preparation, shipment, and delivery, and payment for the P/S, are completed, based on contract terms. Installation and training may also be included in the contract.

6) Consumption, Maintenance, and Disposal: During this phase the company evaluates the performance of the P/S and any accompanying service support, as they are consumed.

7) Renewal: When the P/S has been consumed and/or disposed of, the contract expires, or the product or service is to be re-ordered, company experience with the P/S is reviewed. If the P/S is to be re-ordered, the company determines whether to consider other suppliers or to continue with the same supplier. This may lead back to either phase 1) or 4) respectively.

This life cycle is a relatively detailed view, corresponding to other published life cycles, including (adapted from Gebauer, Beam, and Segev 1998; Nissen 1997) information gathering (phases 1-3), negotiation (phase 4), settlement (phase 5), and maintenance and disposal (phases 6 and 7).

How an MVC supports procurement during the life cycle depends upon whether it supports requisitioning or sourcing. Requisitioning implies pre-negotiated contracts between the customer and one or more suppliers, covering terms and conditions that apply under volume purchasing arrangements. This is a relatively standard procedure for MRO items, where contracts are often re-negotiated at regular intervals for the same P/S, over periods of years. Requisitioning applies in a different way in production environments, where contracts may be for specified lots of components or raw materials, designed and/or produced according to the customer's requirements. Contracts may be renewed many times in sequence, but often with customer-specified design updates at each renewal. Requisitioning normally applies to phases 4-7 of the procurement cycle.

Sourcing implies that the company has no contract for the required P/S, but the purchasing department or other specifiers such as design engineers are searching for suppliers of products or services that meet specific needs, as they arise. This ad hoc approach applies in typical R&D environments, where particular P/S have not been acquired previously, or in other situations where volumes are so small that contracts need not be negotiated. It also applies when the company is searching for new sources of a P/S it has used before, but perhaps is looking for a better contract (lower price, higher quality, faster delivery, different characteristics). Sourcing can be treated as a separate function, with links to the life cycle phases for requisitioning. Or it can be treated as a complete life cycle, covering all phases of the procurement cycle.

Sourcing situations require ad hoc decision making by the purchasing agent or other specifier and/or end user, and searching for information and checking background and P/S specifications are an important part of the activity (phases 1 through 3 of the life cycle). This requires access to a wide variety of suppliers and related P/S information, and it may involve unstructured activities such as advertising RFPs, RFIs, RFBs, or RFQs, and evaluating responses to these requests. In requisitioning situations, P/S choices are made in advance, limiting the need for access to P/S not covered by existing purchase contracts. Whether the MVC system will be used to support sourcing or requisitioning will affect the flexibility required when implementing related functions.

3. Multi-Vendor Catalogs

A Web business catalog, whether it is provided internally to company users on an intranet or externally via extranet or Internet connection, is an on-line source of information on suppliers and their products or services (P/S). It is accessed through a Web page front end, and includes its own internal index and search engine. Catalogs are usually organized and searchable by product category and/or SIC code, geographical region, and company. Company listings include at least company name, address, phone number, P/S offerings, and other contact information.

Information from limited business directories, such as on-line yellow pages, often correspond to their hard copy counterparts, and may be enough to begin the search for information in the purchasing cycle. However, the goal of the more sophisticated MVC procurement operations is to provide all the necessary information to the requisitioner to complete the order efficiently through a computer terminal. This should be possible without interacting personally with a supplier representative and without any paper forms being generated. MVCs include comprehensive information such as performance, schematics, graphics, and other descriptive P/S information. Price, delivery, and availability are not usually supplied on MVCs open to users in general, but are provided through accounts that operate under pre-arranged purchase contracts.

Recent years have seen a trend to encourage fewer and more permanent inter-company trading relationships once initial transactions have been carried out satisfactorily (Bakos & Brynjolfsson 1993). This type of relationship, available through many MVCs, includes inter-company agreements such as open purchase orders to facilitate requisitioner ordering, and delivery of P/S with lower costs and shorter delivery times. A further step towards supplier-customer integration may include electronic linking between companies so, for example, the supplier may have access to information on the customer's inventory levels, production requirement forecasts, and product designs. This assists in the automation of logistics functions such as Just-in-Time delivery authorizations, payments, and other record keeping operations, through extranet coupling of supplier and customer computer systems, using EDI protocols. Service support can also be offered through on-line communications, such as automated Web page displays, downloads of software updates, or helplines and user groups.

ERP Systems and Procurement

Until recently, only smaller software companies such as Commerce One, Trade'ex, Agentics, Ariba Technologies and Intelisys Electronic Commerce have been involved in developing MVC procurement systems to support business-to-business commerce over the Internet. But many businesses have implemented off the shelf ERP (Enterprise Resource Planning) systems from vendors such as SAP, Peoplesoft, and Oracle, to integrate databases and transaction management for functions such as purchasing, material requirements planning, accounting, human resources, financial and marketing, to name a few. It is obvious that the record keeping facilities of ERP systems can support procurement activities, and some MVC developers have provided links to in-house ERP systems. For example, Ariba Technologies (see Appendix) has developed a multi-supplier internal catalog to simplify and streamline management of company internal resources, and its system can interface with SAP and Peoplesoft ERP systems. This allows end-users to select products and services from their catalog, check pricing, and submit requests which are automatically sent to approvers, based on business. This can take advantage of internal information in the ERP procurement module for standard shipping locations and accounting codes.

Some ERP vendors have begun developing online procurement applications that link buyers, sellers and other business partners. These capabilities are not necessarily associated with their ERP systems. For example, Oracle has introduced browser-based Internet procurement software and a Business Intelligence System for data analysis, connections with content management provider Requisite Technology Inc. for electronic search capabilities, and TPN Register for catalog hosting and electronic business delivery services. SAP has announced a Business-to-Business procurement application that will not require the installation of the SAP ERP suite. Other ERP vendors such as J.D. Edwards, Baan, and PeopleSoft, also plan to develop e-commerce procurement systems.

4. Business-to-Business Product/Service Procurement Infrastructures

I.T. infrastructure design depends on the type of task. If tasks are routine and occur regularly in similar form, even complex tasks can be structured fairly easily, and can be handled

efficiently within a standard automated framework. Innovative or exceptional tasks, such as those that occur in decision support, tend to be highly individual, occur infrequently, and cannot be structured easily. Handling these tasks requires a degree of flexibility, and normally requires human intervention. Some tasks may be a mixture of routine and innovative. Gebauer (1996) points out that there is a degree of integration – an optimum between complete automation in a standard structure, and maximum flexibility with no structure at all, for this range of tasks. A procurement system for requisitioning purposes can be largely automated since the data and business rules are known in advance due to the nature of the related supplier contract. Because of its structure, such a system may also be a good candidate for outsourcing to an MVC intermediary. But a procurement system that uses sourcing or which allows ad hoc purchasing cannot be totally structured because of related uncertainties. Decisions which are difficult to program in advance may have to be made during the process, requiring human intervention. One approach to handling ad hoc purchasing is to provide for human intervention when P/S are requested outside the range of the business rules and database (as for example in some commercially available systems).

Ginsburg, Gebauer, and Segev (1999) describe three classifications of MVC systems for MRO requisitioning, including: 1) Do-It-Yourself for the company that wishes to acquire, install, and manage supplier information on its own MVC system, 2) Third Party Integrator, where a third party intermediary is responsible for databases, catalog conversion, etc., and 3) Real-Time Knowledge Discovery, which can be used both for requisitioning and ad hoc purchases (sourcing). To extend the classification of MVC architectures beyond MRO requisitioning, and to support any of the three classes of P/S in table 1, requires identifying commonalities among approaches that can be used, to provide guidance to companies intending to adopt MVC procurement approaches. For this purpose, we need to identify the characteristics of architectures that can be adopted, and to examine which are most likely to work best in particular procurement environments.

We will organize architectures for e-commerce supplier-customer procurement into four main categories. For requisitioning, the supplier-to-customer architecture can be described as one-to-many, many-to-one, and many-to-many. Sourcing situations may operate in an ad hoc manner as an adjunct to requisitioning, or as a separate many-to-many architecture. Catalog and

MVC procurement systems operate differently in each such category. Each of these four architectures, along with examples being used in practice, is described below.

One-to-Many Requisitioning

This architecture (see Figure 1 – note that "E.U. y" means "End User y" within the customer firm) involves a single supplier catalog. This contains information on its products or services alone, for the purpose of maintaining ongoing relationships with many customers. Many of the currently most successful Web business sites are one-to-many. For example, in 1998 Cisco's Web site (Cisco manufactures, sells, and services networking equipment) handled over 70% of orders entered, of $8 billion in sales. The claimed savings due to the Cisco Web site, over equivalent telephone sales operations, are about $500 million per year (Morgridge 1999). Their system contains many advanced procurement functions that may eventually be used in MVCs. Relationships to customers of these sites may be in the form of contracts or open purchase orders, that give customer representatives the ability to access the supplier catalog, configure the desired systems, place orders, and track status and shipments. Secure links to customer purchasing and/or ERP systems may be used to handle transactions related to invoices, payments, and returns. Business rules concerning pricing, discounts, delivery, and payment terms are likely to be maintained on the supplier database, and they may be specific to the customer. The supplier catalog may offer considerable flexibility to customers, in terms of specifying product/service attributes in widely different systems such as specialized software or hardware configurations for products, airline flight specifications for flight reservations, or buy/sell stop orders for on-line stock brokerage.

The catalog and related procurement system is likely to be highly specialized and designed specifically for the supplier company. Examples of this type of system include Cisco Systems (networking systems), Boeing Aircraft (spare parts for aircraft), and two consumer e-commerce application examples, American Airlines (flight reservations), and Charles Schwab (stock and bond sales). For example, Boeing has a secure Web page through which their customers, with minimal training, can order spare parts for equipment purchased from Boeing. This system is described at http://www.boeing.com/assocproducts/bpart/partpage/ It provides

aircraft part inventories, prices, part interchangeability, and purchase order status to authorized Boeing customers. Price quotes can be requested, and contact can be made to sales staff at the spare parts operation. Claimed benefits include improved accuracy, faster order processing, and lower operating costs.

Many-to-One Requisitioning

This type of architecture (see Figure 2) is relevant for large customers which transact business with many supplier firms, especially for MRO and production goods and services, and is equivalent to the "Do-It-Yourself" classification (Ginsburg, Gebauer, and Segev 1999). The MVC may be developed and managed by the customer firm or outsourced, and contains information from all the suppliers with which the customer has ongoing relationships, including the associated business rules. Secure links may be used to handle transaction information between suppliers and customers. In some systems, the linkage between suppliers and customers is such that suppliers have the responsibility for monitoring product inventory levels and forecasts, and scheduling deliveries to meet demands, independently of the customer. Examples include Ford Motor Company and parts suppliers for its assembly plants, the Walmart retail firm and its suppliers, and the General Electric Trading Process Network, which handles parts procurement, including RFPs and RFQs, through its site. Outsourced implementations of these systems by smaller customer companies may utilize catalog information at supplier sites, with secure links to the customer for ordering, invoicing, and payments information. Commercial MVC systems that support this latter type of configuration include Intelisys and Elekom (see appendix).

Many-to-Many Requisitioning

A many-to-many requisitioning architecture, with direct links between all suppliers and all customers, may be inefficient because of the duplication and variety of MVCs and procurement systems that would be required to link all suppliers to their many customer sites. Some centralization of information and support systems through an intermediary may be used to improve efficiency in such situations. This changes the architecture from many-to-many to many-to-one-to-many. One such approach is through distributors (see Figure 3), which develop and maintain an MVC procurement system, along with business rules at their site that relate to

both customers and suppliers. Customers and suppliers may have their own procurement/supply systems linking to the central system, they may use the intermediary's services directly, or they may have their own invoicing and payments system that works outside the on-line system. These systems would be highly appropriate for small- to medium-sized supplier and customer companies, and should result in more efficient and effective operations, due to outsourcing of their more sophisticated systems that are managed by technically knowledgeable people. An example of such a system is Aspect Online, an electronic and electro-mechanical components distributor, where customers can access detailed product ordering information and drawings on-line, along with pricing and other business rules relating to their own company contracts.

The second centralization solution is through an MVC intermediary (Ginsburg, Gebauer, and Segev's "Third Party Integrator") to manage the catalogs and procurement systems for suppliers with whom they have contracts, and for customers with whom the intermediary has contracts (see Figure 4). This is very similar to the distributor arrangement discussed above. The main differences are: 1) contracts are supplier - customer rather than supplier - distributor and distributor - customer, and 2) the fulfillment of requisitions can bypass the intermediary unless the intermediary has a role in supporting order processing and shipping. Outsourcing the MVC and other procurement functions in this manner can reduce the costs of managing the catalog and ordering function, since the intermediary can share the costs of developing and managing the catalog among its suppliers and outsourcing customers. TPN Register (see appendix), for example, hosts supplier content and purchasing contract information for its customers. Their suppliers benefit since their catalog data are converted to standard electronic form, and can be used for multiple customers. Commerce One (see appendix) is another intermediary which uses a similar approach, except that supplier catalog information is downloaded to customer MVCs.

If a centralized index and distributed catalog is used for supplier companies, the index can link potential customers to the appropriate catalog P/S at the supplier site. This has an advantage over centralized catalog systems, in that the supplier can manage its own catalog and ordering systems, and links between catalog and ordering can be built into its own system. Note that there is very little similarity between this approach and a Web search engine, which can only identify possible supplier sites and cannot provide the detailed product information that the

customer needs for ordering. An MVC is tailored to the specific suppliers with whom the customer has contracts, and information overload is not a problem. The ordering system is accessed directly through the catalog, with the potential of secure links to the customer's procurement system. Some MVC vendors rely on links to catalogs at supplier sites (e.g. Agentics, Intelisys, and Trade'ex – see Appendix), rather than constructing and maintaining the entire catalog centrally. The disadvantage of this approach is that most suppliers do not use standard methods for storage and display of catalog data. This may cause difficulties for customers due to the need to access a variety of data formats, and it may also create problems when generating and managing requisitions.

Many-to-Many Sourcing

This type of architecture requires centralization of the MVC in order to achieve efficiencies, as in the equivalent MVC intermediary for requisitioning. The main difference between sourcing and requisitioning solutions is that sourcing does not involve contracts, but it includes search functionality which can eventually lead to a one-of delivery or a continuing contract. But centralization provides substantial efficiencies in a situation such as this, especially when sourcing is combined with requisitioning. Some existing MVCs (e.g. Elekom) provide the means to bypass requisitioning, so human intervention is possible when filling special orders that can arise from sourcing activities. There is a continuum of MVC sourcing services currently available, ranging from a basic duplication of equivalent hard copy catalogs (e.g. Thomas Directory Online, WIZnet), to MVCs with built-in facilities for order fulfillment support (e.g. Amazon.com, which may also be regarded as a retailer, although some of its customer orders are directed to suppliers). Sourcing can be an ad hoc add-on to an MVC that supports requisitioning (Figure 4), or it can be handled through a separate system. When there is one central MVC, the intermediary can use standard templates for its suppliers, so customers should not be faced with difficulties in interpreting displays and generating purchase orders. However, no matter how well the search and display functions work in such systems, if they do not provide seamless ordering interaction between customer and supplier they are not likely to succeed in the marketplace.

Table 3 provides a summary of the characteristics of some existing multi-vendor catalogs on the Internet (including Cisco for comparison purposes, although it is a single vendor site). Data were obtained from catalog vendor Web sites, unless otherwise indicated. The selection starts with Buyer's Index, which is really a directory to a large number of company Web sites and catalogs, some of which are consumer-oriented. The range continues across Web sourcing catalog vendors, to some which can handle both sourcing and requisitioning, to several that handle only requisitioning at the present time.

Supplier cost for obtaining listings in the MVCs indicated in Table 3 is relatively low for sourcing systems, but can be substantial for requisitioning systems (e.g. an initial fee for listing and/or a fee for extranet transactions of 25 cents and up when handled by the intermediary, depending on volume). The cost to customer companies installing such systems varies widely. Sourcing systems range from free to relatively low usage fees or hourly rates. Requisitioning system installations at customer sites are in the range of $250,000 and up for licensing fees, with annual maintenance fees of 15% to 20%. Other services (transaction management, etc.) are extra.

5. Success Factors for Multi-Vendor Catalog Systems

For a firm considering the implementation of a multi-vendor catalog system to aid in its procurement operations, there are major decisions to be made, with the most important being whether to go ahead with modernizing the procurement system. Once this decision is made, then other major decisions include the system architecture choice, the choice and distribution of functionality among customer, supplier, and/or intermediary, and whether to acquire or build the system. Other decisions include how much flexibility the system should have (e.g., should users be allowed to source P/S not available under supplier contract and if so, how should this be handled?), and whether design, development and/or operations should be contracted out to a firm that specializes in MVC procurement systems. Many firms opt for contracting out, if their staff does not have the expertise to implement such systems. Basic decisions are listed in Table 4.

Table 3. Some Multi-Vendor Catalogs Currently In Use

Catalog Name	URL	Suppliers	Records in Catalogs	Sourcing/ Req'ng	Comments
Buyer's Index (directory)	www.buyersindex.com	11,000 company sites/catalogs	96,000,000 through linked sites	S	Directory of Web catalogs, shopping sites (consumer-oriented)
WIZNet	www.wiznet.net	86,000, 100,000 catalogs	10,000,000	S	1.1 million queries/ month, can post RFBs
Software and Information Industry Assoc.	w2.spa.org/member/dir.htm	1200+	36 categories of info. services, products	S	Co. & prod. descrp'n + contact info. only
Thomas Register	www2.thomasregister.com	155,000, 5500 catalogs	124,000 brand names, 60,000 P/S headings	S	Extension of Thomas Register paper/ CDROM directories
Government Electronic Mall	www.gsa.gov/gem.htm	600 Co's available to supply U.S. gov't	600 (brief co. & P/S descriptions)	S	Used by U.S. gov't employees
Aspect Online (distributor)	www.aspectonline.com	600, includes datasheets for components supplied	4,000,000 electrical, electro-mech'l components	R & S	Can be searched on many key selection parameters
GE Trading Process Network	www.tpn.geis.com	25,000	Unknown	R & S	Distributes RFQs automatically
TPN Register (commercial external catalog)	www.tpnregister.com	Unknown	500,000*	R & S	Secure access via extranet, trans. mgt (EDI-EDI, EDI-FAX, Web forms), sourcing catalog, negotiation tool
Ariba.com Network (external catalog)	www.ariba.com	84,700	10,100,000	R	Extranet links, security, multi-protocol support, ERP links, trans. mgt.
Commerce One (commercial internal catalog)	www.commerceone.com	5000 catalogs	500,000	R	Internal catalog, selected from Mktsite suppliers; receiving, extranet links for catalog content mgt, pricing, availability, EDI trans. mgt.
GSA Advantage (internal catalog)	www.fss.gsa.gov	Unknown	Unknown	R	Limited to U.S. gov't employees
Cisco Networking Products Marketplace (single supplier)	www.cisco.com	1	100s, with many possible configurations	R	On-line product configuration, order, track shipments, view invoice, maint., warranty info.

* Source: Internet World.com ("Intranet World", Feb. 15, 1999)

Table 4. Major Decisions in Implementing MVC Systems

- choice of whether to modernize the procurement system
- choice of off-the-shelf system or to build in-house
- choice of outsourcing for the design, development, and/or operation of the system
- choice of architecture, and whether it is to be a requisitioning and/or sourcing system
- whether to link the proposed system to existing corporate operational systems
- distribution of functionality among supplier, customer and (if used) intermediary
- level of flexibility to include in the system

There are a number of factors to be considered that will affect successful system implementation. These can be derived partially from existing studies. A detailed perspective on planning and managing Internet-based techologies is given by Ware et al (1998 – see chapter 8). Issues relevant to successful e-commerce implementation are also similar to those indicated by Kappelman et al (1995) for EDI implementation. Other factors of importance, and facilitators in the success of IT projects of this type, have been studied (Cannon 1994; King and Teo 1996). The more important factors that should be taken into account when making choices relevant to implementing MVC systems are listed in Table 5, classified as strategic, technical, and organizational.

Table 5. Factors That May Affect Successful Implementation

Strategic
- competitive position of the firm
- long term strategic direction of the firm
- core business functions of the firm
- cooperation of trading partners and financial institutions
- innovative needs of the firm
- economies of scale/savings available from the proposed system
- effects on current procurement and distribution channels/customers
- well-planned and executable implementation plan
- top management guidance

Technical
- current systems in place for managing procurement, accounting, record keeping, transaction processing (e.g. ERP, MRP, etc.)
- sophistication of supplier/customer systems
- cost of acquiring, installing, and operating the proposed system
- technical sophistication of staff available to install, support, and manage the system
- availability of internal network (intranet)
- availability of extranet links to suppliers and/or intermediary

Technical Factors (continued)
- interoperability of proposed system with existing systems
- availability of off-the-shelf software to support the requirements
- amount of customization required if an off-the-shelf system is acquired
- standards used by trading partners and possible intermediaries
- amount of data conversion necessary to implement system
- ease of learning, ease of use of the proposed system
- amount of training necessary
- risk assessment level

Organizational
- re-engineering required to support the technology and operating procedures change
- end-user interest in the solution
- top management support for the change
- availability of a strong champion
- improvements in ordering flexibility
- resulting changes to interactions among functional areas

6. Discussion

The main advantages of Web catalog procurement systems are that they provide greater control over spending, improve and streamline the purchasing process, and in many cases have proven to introduce efficiencies into procurement operations. A number of companies now provide commercial packages to support these operations; several are listed in the appendix. There are several general considerations of importance to companies wishing to use the Web to achieve efficiencies and enhance effectiveness of procurement requisitioning and sourcing operations.

1) One of the most important considerations is the choice of architecture, which in turn depends on a number of the factors listed above, including organizational re-engineering issues, cooperation of trading partners and financial institutions, and sophistication of supplier/customer systems, to name a few. In general, if the customer is a large company with many contracted suppliers, or if the supplier is a large company with many contracted customers, there are economies of scale that may be achieved with the one-to-many or many-to-one architecture respectively. These companies also gain flexibility in managing their own catalog and associated ordering and fulfillment facilities.

2) The many-to-many architecture, when converted to many-to-one-to-many by an intermediary, is an appropriate way to minimize the number of separate links between supplier and customer. Intermediary requisitioning and/or sourcing may be the most efficient way for smaller- to medium-sized companies to operate, depending on the cost savings from eliminating additional operations required by the extra links that are eliminated. For M

suppliers and N customers, there are M x N links. When there is a centralized intermediary that maintains links, catalog information, and business rules, this number is reduced to M + N links, to say nothing of the potential reduction in cost required to manage customer or supplier-end procurement systems for each such combination. Obviously, there may be a corresponding reduction in flexibility, since the supplier or customer must accept what the intermediary has to offer in terms of support for ordering, transaction management, and sourcing. But especially for requisitioning, which should be handled by end-users for both improved efficiency and effectiveness, it is critical that the ordering and delivery process be seamless. This is difficult to standardize unless it is managed by an intermediary rather than handled by suppliers, each of whom may have different formats and procedures.

3) According to a June 5/98 survey by *Purchasing Online* (http://www.manufacturing.net/magazine/purchasing/pointpgs/buynews.html), MRO buyers are gravitating to smaller numbers of preferred suppliers, and towards integrating them into the company's business. The use of MVCs is suited to this trend, indicating a continuing growth in the further development and use of MVCs for procurement support.

4) As MVCs evolve, additional functions will be added to support ad hoc purchasing and sourcing activities, as well as to improve transaction management and provide seamless integration with the internal systems of their customer and supplier companies. In addition, more support will be provided for non-MRO procurement, to broaden the scope of MVC services.

5) At the present time, the commercial offerings of requisitioning MVCs (see appendix) are too costly for small businesses to consider. However, sourcing MVCs tend to be relatively inexpensive and easily accessible. As commercial offerings of requisitioning MVCs improve and as competition increases, it is likely that versions of requisitioning systems will become available at costs that are affordable by smaller companies.

There is a great deal of technological development in procurement support systems. In particular, the development and application of open standard formats such as XML (Extensible Markup Language) and EDI (Electronic Data Interchange) standards for catalog information management, display, security, and transaction management, is critical to the success of MVCs used in requisitioning environments. For example, XML-based applications could parse XML-encoded data and business rules from an internet procurement system and retag or reorder it for presentation in formats required by a back-office legacy application or ERP system. Such interoperability between frontline operational transaction systems and back-office budgeting and planning systems would enable inter-application support. A similar use of XML technologies to support system-to-system inter-operation across organizational boundaries could significantly improve the use of supply chain operations at higher management levels (Aberdeen Group 1999).

Consortia such as CommerceNet, OBI (Open Buying on the Internet) and U.S. federal government agencies are working together towards implementing such standards (Gannon 1999). Provided that these standards do not become too complex and expensive to implement, and that interfaces to non-standard systems can be developed, they will contribute to the rapid growth of the industry.

Current research on agent-based technologies may be useful in extending search and selection capability, and allow less structured approaches to procurement (Keller 1997). It is too early to tell whether these technologies will work well enough to overcome the general Web information overload problem and return information of value cost-effectively to the user. For example, a proactive catalog management environment could be established through the use of automated, intelligent agents that would scour the Web sites of contracted suppliers to identify and parse key information such as product listings, pricing, and availability, using technologies based on XML. The associated applications would initiate the appropriate response or business transaction. This would enable requisitioners to use a single user interface to search multiple catalogs hosted remotely at supplier sites, and use XML-encoded data for more detailed purchase and supplier analysis (Aberdeen Group 1999).

Other technologies which may impact procurement support include groupware and negotiation support systems (e.g. Yuan et al 1998), for negotiation and group decisions when evaluating RFPs and RFQs, for example. These will probably take their place as add-ons to basic procurement and MVC systems, as they continue to develop.

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Appendix

Some Commercially Available Multi-Vendor Catalog Support Systems

Descriptions of the following commercial packages were gleaned from vendor Web sites and corporate announcements. It is not intended to be complete, but to give some of the claimed characteristics of these systems. Due to the speed at which developments are occurring, more up-to-date information should be gathered directly from the vendors or their Web sites.

The Agentics SupplyChannel (www.agentics.com) system is an application installed at the customer's site that links supplier catalogs into a central repository via a set of automatically updated hyperlinks. Orders for goods from approved vendors are placed directly from employee desktops via the company's Intranet. Price and product information is managed by the supplier, eliminating the buyers' need to maintain supplier product data. It enables users to simultaneously access multiple on-line catalogs, residing at supplier sites, as though they were one, unified catalog. Suppliers do not need to provide any special or dedicated interface. The intention is to deliver accurate, relevant, and uniformly displayed product, without paper records, and at lower labour costs.

Ariba Technologies (www.ariba.com) recently implemented their Ariba.com Network, which provides a common Web site for supplier catalogs and access by customers. The site includes a large number of supplier catalogs. Ariba provides catalog and content management, order transaction routing, and multi-protocol support to link customers with suppliers. Catalog content is made available through XML open architecture, with system customization possible. Several large U.S. firms have established contracts with Ariba to use their system for procurement.

Commerce One BuySite (www.commerceone.com) and its associated network allow purchasing managers and authorized end users in an organization can check the pricing, availability, and other important attributes of comparable goods and services being offered by multiple suppliers through their Web browsers, and then complete their transactions online. The system utilizes prices or other procurement terms and conditions negotiated beforehand between the buying and selling organizations. Business rule workflows are incorporated into the system. BuySite also has a desktop receiving capability, so buyers can complete the purchase cycle, indicate that the goods are received, and initiate a payment request. It also includes requisition and purchase order capabilities for such items as services, contracted labor, and capital goods, each of which may require specific kinds of information and unique organizational review and approval processes. It has the capability of being programmed to automatically exchange information with a buying organization's ERP system.

Commerce One MarketSite (www.commerceone.com) works in conjunction with their BuySite product. Commerce One MarketSite claims to have large numbers of supplier catalogs in their database. Customers can select which suppliers they want to have listed, so they can be downloaded into their local catalog. The catalogs apparently include negotiated prices for the company products in the catalog database, and access to a search index over all the items listed. Business processes enabled by Marketsite include: transaction content management, price & availability checks, purchase order submission, processing & reconciliation, purchase order tracking, taxation, freight & shipping, and invoicing & payment. CommerceOne has formed a strategic alliance with a large consulting firm, and has installations at several large customer sites.

Elekom Procurement (www.elekom.com) was recently taken over by Clarus Corp. Their system uses a combination of local databases and supplier Web sites to provide requisitioners with information on contracted P/S. The local database includes only essential information like part numbers, short product descriptions, contracted pricing and links to specific Web pages matching a given item. Control over the purchasing process is maintained through customer-defined business rules based on things like spending limits, job function, cost center, and so on. The system also allows for direct links to supplier web pages in the event that employees need to access additional information like technical specifications or detailed descriptions. Users can search for items on the local index using any combination of part number, product description, supplier and manufacturer. Dun & Bradstreet Standard Product and Service Codes provide a uniform method to classify products across a broad range of commodities and suppliers, allowing users to "drill down" to specific item classifications. The system automatically creates requisitions, routes them for approval based on customer-defined business rules, and submits them electronically to contracted suppliers. Employees can request Non-Catalogued items by entering part numbers (if available), quantity, and any pertinent comments as freeform text. Non-catalogued requests are forwarded to a purchasing agent for sourcing and pricing.

Intelisys Electronic Commerce (www.intelisys.com) uses XML technology from webMethods to provide access to supplier product information and to search across distributed supplier catalogs, and to create requisitions based on these searches. Suppliers are not required to install additional software. Authorized employees within an organization can securely browse

contracted supplier catalog information, hosted either at the buyer or supplier site, and select items for purchase. The purchase order is submitted via the company intranet, routed for approval, and securely transmitted over the Internet using open industry standards. An electronic invoice is received back from the supplier, which can be used for settlement of the transaction. The system includes controls for managing users, monitoring spending limits, accounting, payment information, etc. Intelisys allows the buying organization to either maintain internal product catalogs or link directly to the product information and back office systems of their suppliers.

TPN Register (www.tpnregister.com) is a 50/50 joint venture between GE Information Services and Thomas Publishing Company (publishers of the Thomas Registry). It is an MRO oriented MVC intermediary, which converts specific supplier catalogs to standard form for a central MVC, for extranet use by specific customers who have contracts with the suppliers. The company offers catalog hosting and content management services. Supplier catalogs are the best source of data for the MVC, but must be converted to on-line format. Data are indexed and searchable by the requisitioning user through secure links, with contracted prices and other business rules included in the database. Suppliers may update their information at any time. The advantage of this approach is that the customer does not have to be concerned with data conversion or MVC support. The MVC is also available to other potential customers with little further work involved in data conversion. The system does not appear to handle order management, but sourcing and negotiation are supported.

TRADE'ex Electronic Commerce Systems (www.tradeex.com) offers a multi-tier, component-based architecture, written in Java and using CORBA (Common Object Request Broker Architecture). In addition, it supports workflow and rules management capabilities and XML document exchange technology. It uses a regional catalog management system to control product and supply sources accessible by each user, based on delivery location. The user is assisted in mapping out the steps to complete particular tasks. Catalog controls determine what products or catalogs each user can access. Users can review requisitions of their employees. XML allows exchange of product, pricing, and order information with various suppliers. TRADE'ex Procurement is built on a multi-tier, component-based network application architecture, utilizing Java and JavaBeans.

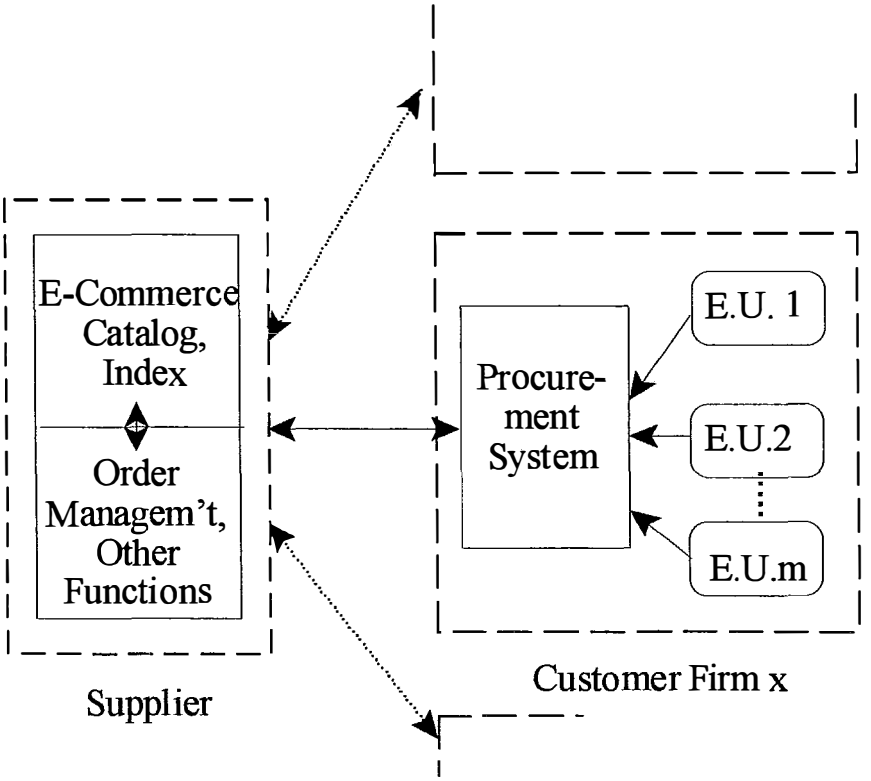

Figure 1. One-to-Many Supply System

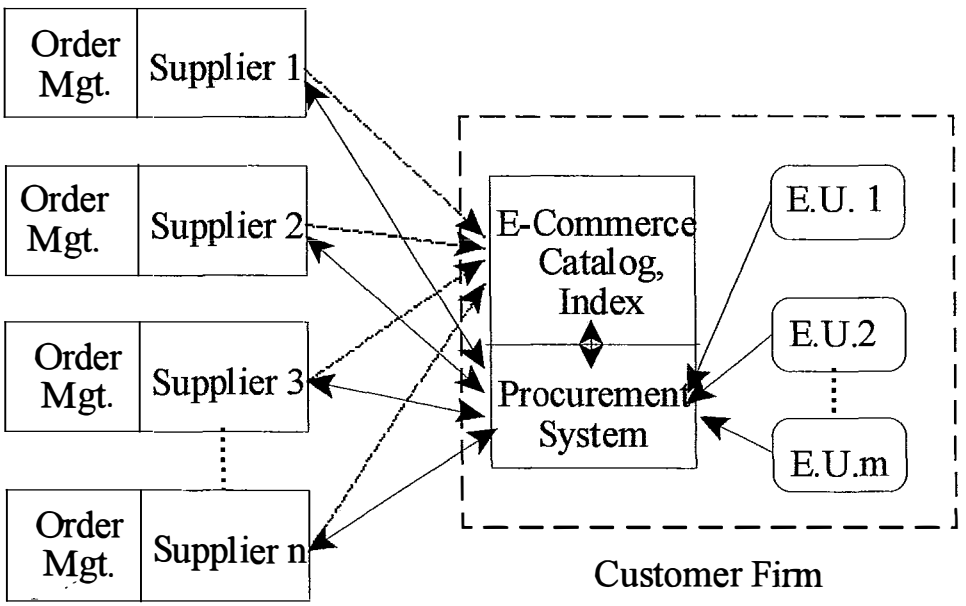

Figure 2. Many-to-One Multi-Vendor Catalog

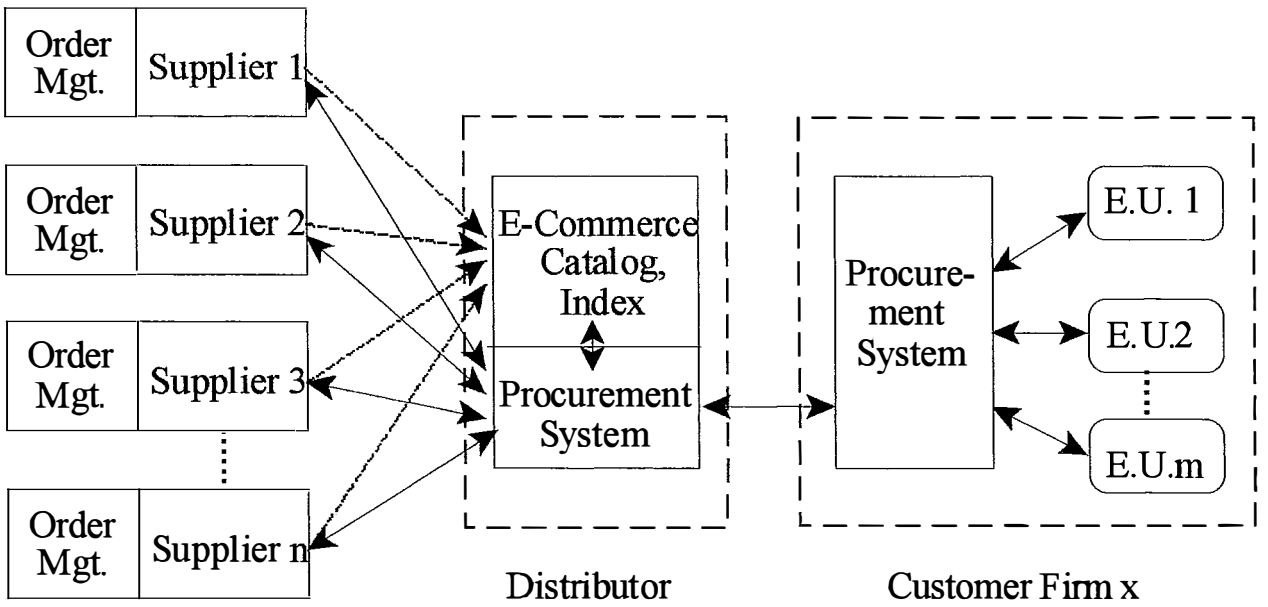

Figure 3. Many-to-Many (Distributor)

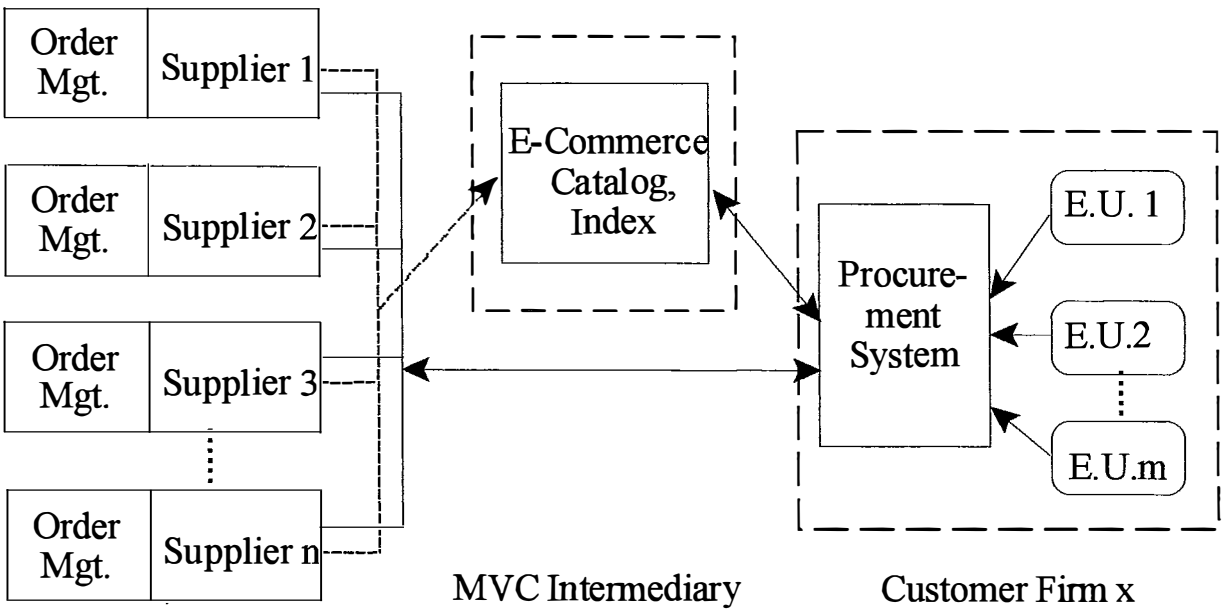

Figure 4. Many-to-Many MVC Intermediary

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