An Overview of B2B and Purchasing Technology

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Sam Kinney
Executive Vice President & Co-Founder
FreeMarkets, Inc.
FreeMarkets Center
Pittsburgh, PA 15222
(412) 434-0500
www.freemarkets.com

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Table of Contents

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Introduction

Business-to-business electronic commerce (B2B) has experienced explosive growth in the marketplace, beginning in early 1999. This growth can be explained by the confluence of new technology with old needs. Businesses around the world purchase trillions of dollars of goods and services, but the traditional methods and technologies for business 'purchasing needs had serious deficiencies. Because of the early success of business-to-consumer (B2C) Internet companies that provided new ways for consumers to purchase goods, venture capital became plentiful, and entrepreneurs developed Internet solutions to long-standing business purchasing problems. The market for B2B has continued to expand in light of analysts 'predictions that the B2B commerce will far exceed B2C commerce in the future.

This White Paper provides background information on the evolution of Internet solutions for business purchasing. It first provides a brief historical context for the development of B2B in the wake of the earlier growth of B2C. It then details the complexities of industrial purchasing, particularly for the direct materials that are the raw materials and components of industrial end

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[1] Author Sam Kinney is a co-founder and executive vice president of FreeMarkets, Inc. (http://www.freemarkets.com), one of the most established of the B2B specialty companies. FreeMarkets was the first to commercialize the use of Internet auctions to negotiate large industrial and government purchases. The FreeMarkets auction marketplace is utilized by over 45 large industrial enterprises including United Technologies Corporation, Emerson Electric, Eaton Corporation, SmithKline Beecham, Quaker Oats, BP Amoco, Visteon Corporation, and by government agencies including the Commonwealth of Pennsylvania General Services Administration, the United States Postal Service, and the US Navy Supply Systems Command (NAVSUP). Mr Kinney helped to co-found FreeMarkets five years ago. Before that he worked five years as a management consultant, three with McKinsey & Company and two with Booz-Allen & Hamilton, and two years as a budget director of a division of Lucas Aerospace, now part of TRW. He holds an MBA with highest distinction and a BA in economics, cum laude, both from Darmoth College. He and his co-founder Glen Meakem are Ernst & Young Entrepreneur of the of the Year regional award winners. He is a frequent speaker and panelist at industry conferences and in management education programs.

products like cars or washing machines. Because the distinction between direct materials and indirect materials such as office furniture, paper clips or shop supplies is important in understanding the various B2B technologies in use today, the White Paper describes the historical inadequacies of traditional purchasing methodologies used in each of these categories.

The White Paper then goes on to describe the development of the two most important tools that have emerged to solve these historical purchasing problems: Internet-based buyer catalog tools for indirect purchasing, and dynamic pricing technology such as auctions for direct and indirect materials purchasing. These tools are then placed in the context of the three major business models that have emerged in B2B. Finally, the emergence of industry exchanges, in which direct competitors collaborate to form B2B purchasing entities, is described, along with some predictions about the future of B2B, based on analogies to U.S. capital markets.

A Short History of B2C and B2B

The Internet has spawned the creation of a massive industry collectively called "electronic commerce", which is a mere five years old. Some of the key milestone dates in the development of the Internet include the announcement of Java in June of 1995, a programming language allowing sophisticated user functionality to be deployed over the Internet. Netscape Corporation's IPO in August of 1995 heralded the commercial dawn of the Internet.

Within the overall electronic commerce industry, there are two major branches: Business-to-Consumer (B2C) and Business-to-Business (B2B). Independent research firms such as Forrester Research have predicted that B2B becomes by far the bigger branch with the total value of commerce conducted electronically in the U.S. B2B segment reaching $2.7 trillion by 2004[2]; and by that time

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[2] Kafka, Steven J., Bruce Tempkin, Mathew Sanders et al, *eMarketplaces Boost B2B Trade*, Forrester Research (http://www.forrester.com), February 2000.

$746 billion in commerce will be traded using dynamic pricing mechanisms[3]. The term "B2G" has been recently introduced to refer to "business-to-government" commerce[4].

The stakes are enormously high for businesses. McKinsey & Company has estimated that purchasing and supply management costs for automotive businesses equals 80% of total cost[5]. Thus, the impact of achieving savings in purchasing activities flows rapidly through total business performance and to the bottom line.

B2C was the first to develop, because the marketplace is comparatively simple. B2C commerce typically emulates catalog retailing, where consumers order standard products from producers or retailers. An Internet website substitutes for the traditional paper catalog. Because there was an existing catalog retail segment that was well developed, substituting the Internet for the catalog was readily understood by consumers. Advantages of B2C included the convenience of 24-hour shopping, and real-time availability of information such as promotional sale prices or stock outs. B2C pioneers such as Amazon.com and Priceline.com spent enormous sums in consumer advertising to establish their brand names, and in doing so, lifted the entire tide of retail commerce over the Internet.

B2B was slower to develop because of the vastly more complex market structures involved, but has attracted attention because of the comparatively larger value of potential commerce. B2B is so large because products often stop at many places along the supply chain, with companies adding their unique value at every step of the way. This creates a multiplier effect where products change

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3 Kafka, Steven J., Bruce Tempkin, and Lisa Wegner, *B2B Auctions Go Beyond Price*, Forrester Research, May 2000.

4 While B2G represents a different market segment, B2G shares much in common with B2B. To understand B2G, it is easiest first to understand B2B, and then contrast the few important differences.

5 Chapman, Timothy L, Jack Dempsey, Glenn Ramsdell, et al, *Purchasing: No time for lone rangers*, The McKinsey Quarterly (http://www.mckinseyquarterly.com), 1997 Number 2, pp 30-40.

hands many steps along the way. In addition, there are huge markets for products whose end users are businesses, such as machinery, trucks, aircraft, and ships.

The market for B2B solutions accelerated as the B2C companies began going public, and people started to extrapolate the potential success of B2C to the business marketplace.

The Complexities of Industrial Purchasing

Industrial purchasing is far more complex than consumer purchasing, which slowed the adoption of electronic commerce for business as compared to electronic commerce for consumers. Some of the complexities of industrial purchasing include:

- ***Professional purchasing discipline***. Whereas consumers typically act as their own purchasing agents, corporations employ professional purchasing agents. These agents often spend years learning about the product categories they purchase. They often specialize by product. It is, therefore, not unusual to find different buyers purchasing plastics, metals, and electronics within the same company. Their full time job is to make sure their company purchases the best products, on time, at the best prices. They are paid to analyze, compare, negotiate, and monitor results. Simple consumer-like marketing techniques and functionality offered by web sites fails to impress this group of disciplined and informed users.
- ***Derived demand***. Most consumers choose what to buy and when. They select brands and they shop for bargains. Industrial buyers are typically buying the products that they're required to buy, when they're required to buy them. Expensive software programs called Materials Requirements Planning (MRP) or Enterprise Resource Planning (ERP) programs keep track of the products the company must buy in order to meet

production schedules[6]. Understanding how MRP/ERP software systems work is enormously important to understand B2B technologies. MRP is introduced in the footnotes, and an example is included as Appendix A to this paper.

- ***Legacy systems***. Commercial purchasing is often accomplished by forwarding from buyer to supplier documents called "purchase orders." A purchase order ("PO") represents to the seller that the buyer has duly authorized a purchase and stands ready to take delivery and make payment. Buyers use their ERP/MRP systems to issue purchase orders. Web sites that expected industrial buyers to fill in order screens are doomed to fail, by failing to integrate with the legacy systems and the underlying purchasing process used by buyers[7].

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[6] Manufacturers use MRP computer systems to manage the production of products. More modern installations that include human resources modules and financial accounting modules are typically called ERP systems. ERP systems typically have an MRP module. MRP is essentially the cookbook that manufacturers use to manage production. Just like a recipe has a list of ingredients, MRP maintains lists of ingredients for every product a manufacturer makes. Please see the Appendix for an example of how MRP manages purchases. In MRP lingo, this list of ingredients is called the bill of materials ("BOM"). The BOM may be organized hierarchically, so some ingredients become intermediate products called sub-assemblies. Sub-assemblies are connected to form final products. In addition to maintaining ingredients lists, the bill of materials database also stores important information about lead times—how long it takes to get the ingredient once it's ordered—as well as information about the preferred suppliers from whom to order each ingredient.

The MRP system calculates that it needs to order parts based on analysis of the production orders for final products, entered by the company's sales department, indicating the date the product is due. MRP reads the recipe from the bill of materials and calculates what to order and when, based on the known lead-time for ingredients, in order to have all the right materials on hand at the right time.

Learn more about MRP at http://www.apics.org. APICS is The Educational Society for Resource Management (formerly the American Production and Inventory Control Society), and their publication at http://www.apics.org/magazine/.

[7] When ERP systems issue a purchase order, that document serves a variety of purposes. Notifying the seller to ship product is but one of these purposes. Another purpose is to notify the buyer's own receiving department to "expect to receive 100 widgets from supplier X next Friday." Another purpose is to notify the

- ***Custom products***. Many of the products purchased by industrial companies are custom-made, rather than standard products. When building an automobile, the side-view mirrors, instrument panel components, and trim pieces are all custom-manufactured to the buyer's specification. These products are not displayed in catalogs by suppliers, but are only made after a buyer and supplier agree to make them. For custom products, the typical consumer "shopping cart" metaphor for web shopping breaks down. Buyers cannot surf the web looking for the custom materials they need, but rather must open a relationship with a supplier first and subsequently have the parts made.

- ***Group decision-making***. Individuals acting alone make few industrial purchases. Often, an entire team of design engineers, buyers, production engineers, and quality assurance staff are involved in making a particular decision, especially for larger purchases. Group decision-making reduces the chances that industrial buyers could surf to web sites and simply order goods. Group decision-making also typically means that the *decision* to buy is made at a different time and in a different setting than the *transaction* itself. Contrast that with consumer purchasing, where people surf, find the item they seek, and complete the transaction immediately.

- ***Complex contracting format***. Many industrial products are purchased on long-term contracts that spell out pricing, terms, incentives, and penalties. Purchases are often made on different terms for different products. These contracts invariably require negotiation, rather than adoption of standard terms. This further reduces the likelihood that buyers could conduct commerce passively at web sites, as consumers are able to do.

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buyer's own accounts payable department to "expect to receive an invoice from supplier X after they deliver 100 widgets next Friday, and further note that we agreed to pay them $5.00 per unit, so if they invoice a different price, refer their invoice back to purchasing." Because these internal notifications are so important, a web site that merely accepted orders could not serve industrial buyers. The receiving dock would not have authority to receive the goods, nor would the accounts payable department have authority to pay the invoice.

- ***Trade credit***. Few industrial purchases are made using a simple payment tool like a credit card. Instead, they are purchased on trade credit. Sellers must do credit reviews, and elect to whom they'll extend credit. While companies such as American Express offer corporate purchasing cards ("P-cards"), these tools have achieved only partial penetration. So while merchant acceptance of MasterCard or Visa is nearly ubiquitous, penetration of P-cards is incomplete, resulting in a persistent friction around trade credit. Once again, the absence of simple payment infrastructure reduces the chance for passive web-based relationships in favor of more complex, negotiated relationships between parties.

- ***Product complexity***. Almost any manufacturing operation consumes a very wide variety of raw materials, components, and supplies. Few buyers have the luxury of buying a narrow range of materials. This complexity requires any given buying organization to adapt to the underlying structure of many different markets simultaneously, rather than optimizing on a few.

- ***Extensive private information***. Industrial buyers typically perform intensive analysis on suppliers, measuring price performance, delivery performance, product quality, warranty history, and service performance. This information, accumulated over many years, becomes part of the buyer's own decision-making criteria when selecting suppliers. Industrial buyers have few published sources of information such as *Consumer Reports* to rate the custom products they buy.

The complexities described above eliminate the possibility that simple B2C business models could be successfully applied to business purchases.

Further complicating B2B is that businesses purchase a wide variety of items to serve many different needs. Different types of purchases have different characteristics that determine the attributes of successful solutions.

Types of Industrial Purchases

Industrial buyers purchase a broad range of materials to support their operations. These purchases can be divided into two broad categories:

- ***"Direct materials"*** describe the raw materials and components that companies convert into end products. If the buyer is an assembly-oriented manufacturer, direct materials consist of the parts and sub assemblies that are incorporated into their own end product through their assembly operations. If the buyer is in a process industry like chemicals, direct materials are the feedstock, fuel, and additives they convert into finished products.
- ***"Indirect materials"*** describe all the other purchases that are necessary to run the business, but that do not become part of the manufacturer's end products. Indirect materials include categories such as office furniture, computers, lubricants, and shop supplies. While manufacturers have a high proportion of spending for direct materials, other types of companies such as financial service firms buy predominantly materials that would be classified as "indirect."

There are no hard-and-fast rules about whether a specific product type is "direct" or whether it is "indirect." Rather, it depends on the way an individual company elects to manage those purchases. As a general rule, if a company manages a product's purchase using its MRP/ERP systems, that product would be considered "direct." Products purchased without using MRP (i.e., not contained on a bill of materials) would be considered "indirect.[8]"

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[8] Because companies manage purchases differently, it is difficult to classify purchases as direct or indirect by product category. Some categories cross over. Fasteners are a classic example—some companies put fasteners on their product bills of material and treat fasteners as direct material, while other companies omit fasteners from the bills of material and maintain bins full of fasteners on the shop floor for consumption as needed.

The contrasts between direct and indirect are an important distinction for the design of B2B technologies. For an assembly-oriented manufacturer such as an automobile company, the dollar value of direct material is typically two to four times greater than the dollar value of indirect material.

Direct materials are often customized, and are purchased in large quantities. Direct material purchasing is typically relevant to a small group of people inside the company, and the purchasing function is quite specialized. Because direct material generates fewer transactions of larger value, successful approaches must attack the value of the transaction rather than the transaction costs.

By contrast, indirect material is typically standard, and is often purchased in small quantities. As a result, indirect material has less dollar value but more transactions. While a small employee group controls direct material purchases, every employee of a company is potentially a user and requestor of indirect material purchases. Transaction processing costs are typically a much higher proportion of total cost on the indirect material portion of purchases, thus transaction cost efficiency must be a primary objective of B2B technology aimed at indirect.

Finally, in order to understand B2B, it is helpful to understand other aspects of the professional buying environment. B2B has emerged while other trends have been at work, and these trends help explain why B2B has experienced such a rapid ramp-up.

Other Underlying Purchasing Trends

Pre-dating the rush to Internet commerce, industrial companies have been pursuing improvements in purchasing. The impact of improved purchasing can be huge, due to the high proportion of costs spent on outside purchases. After years of downsizing their own staffs, companies have sought less painful ways of making improvements. Major trends include:

- ***Supplier consolidation***. Large organizations often find they have tens of thousands of suppliers around the world. Businesses have been striving to consolidate to fewer suppliers to improve efficiencies. Efficiencies from consolidation can include the reduced

administrative burden in the order replenishment cycle, improved purchasing power as volume is concentrated on fewer winning suppliers, and better coordination when suppliers are asked to provide additional valuable services, such as engineering and design services.

- ***Cross-division buying***. As part of supplier consolidation, corporations are looking to coordinate purchases that had previously been made independently by their own different divisions or business units. Corporations that have grown through acquisition often find savings opportunities by coordinating and leveraging combined purchasing power. Purchasing is also a difficult corporate function to organize, because the choice between centralization and decentralization introduces difficult tradeoffs. Decentralized purchasing has some strong arguments in favor, including responsiveness to business needs, geographic focus, and coordination across product categories. Centralized purchasing has some equally strong arguments in favor, including product specialization by buying staff, volume concentration for better purchasing power, and global reach. These tradeoffs have been challenging for purchasing departments. Companies have sought to achieve the best of both using team approaches. They also see that Internet technology might possibly improve this situation.

- ***Supply chain optimization***. Operations researchers have proven that when information flows infrequently between buyer and seller, buyers and sellers must make assumptions about each other's needs. Typically, sellers guess what buyers might buy, and they build inventory to ensure that if an order does come, they can deliver rapidly. When evaluated along the entire length of a supply chain, the amount of inventory being held for contingencies is quite large, and collectively adds much inventory carrying cost, obsolescence, spoilage, or overstocks. Sophisticated buyers install systems that attempt to better anticipate what customers might buy, and send better information to suppliers to reduce guesswork about needs. In the ideal, companies would like to achieve true

"build to order" capability through the supply chain, where inventory never sits for contingency.

- ***Outsourcing***. As corporations seek to specialize in the functions where they have unique core competencies, they are increasingly looking for suppliers to perform manufacturing tasks and services formerly performed in-house. This trend increases the proportion of revenues spent on outside goods and services, and raises the importance of excellent purchasing.

- ***Consortium purchasing***. Buyers have always sought ways of improving their purchasing power. One way is to band together with other buyers and agree to make coordinated purchases. Companies have done isolated consortium purchases for years. Typically, purchasing consortiums around specific product categories have evolved to include a web of non-competing companies who therefore do not object to information sharing. Consortium purchasing is particularly appealing to buyers after other avenues of improvement have been tapped out. Although appealing in concept, it is very difficult to make consortia work. Like cartels, consortia provide members a built-in incentive to "cheat" and break ranks with the consortia.[9] Further, the benefits of consortium purchasing are highly specific to the product category being purchased. For industries where suppliers can add capacity in small increments, such as plastic and metal fabricating, the benefits of additional volume beyond those purchased by a single buyer

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[9] In a seller's cartel, members can "cheat" by offering to sell more than their quota of product at the high prices established by the cartel. The company that attempts to cheat the cartel gets the best of both worlds—high volume and high prices. Of course, if everybody cheats, market volumes rise and prices decline to more competitive levels. In a purchasing consortium, members can cheat by comparison-shopping at non-approved suppliers using the price and terms negotiated by the consortium as a benchmark. A consortium might, for example, negotiate for office supplies at 40% off list. It's not hard for one member to approach another office supplies seller and negotiate a side deal at 45% off list. The original supplier offering the 40% off list deal thus fails to reap the full anticipated volume, and may pull out of the deal.

may be negligible. The suppliers merely add more units of the same capacity as volume increases. By contrast, when buying from industries where capacity is added in large increments, such as steel and paper, the combined volume of multiple buyers may be necessary to fill capacity, and discounts can result from consortiums in these basic commodity industries.

- ***Global sourcing***. In their attempts to lower costs, corporations have sought suppliers in low-cost countries in Eastern Europe, Latin America, and the Pacific Rim. Not only are they moving purchases from domestic to offshore suppliers, but also they seek low-cost countries when outsourcing some activities previously performed in-house.
- ***Renewed emphasis on competition***. In the early 80's, the purchasing profession's consensus swung far towards the concept of using deep supplier partnerships as a way of controlling costs. This swing resulted from a partial emulation of the supply chain practices of the Japanese automotive industry. Since that time, the consensus has swung back to include partnerships for some purchases, but relying on competition as the best practice for other purchases.
- ***Sophisticated data analysis***. One of the driving forces behind the explosive adoption of modern ERP systems, other than Y2K preparedness, is to provide managers with superior information. Buyers learn much by analyzing trends and past performance in their own purchasing. New tools such as data warehousing, data mining, and online analytical processing ("OLAP") tools have emerged to improve data analysis capabilities. Older technology typically was not adequate to support this important query and analysis function.

The landscape facing industrial buyers is a crucial consideration when evaluating which B2B approaches will work. Successful business models and technologies are those that adapt to the underlying needs of business buyers.

Historical Purchasing Technologies and Their Deficiencies

The structural challenges facing business buyers have generally always been present. They have always faced complexity, group decision-making, and custom products. Buyers have been applying technology to help the purchasing process for years. However, until the recent emergence of some B2B technologies, their historical technology has had major deficiencies in its support for both direct materials and indirect materials purchasing.

Historical Inadequacies for Indirect Materials Purchasing

There has historically been no automated purchasing system comparable to ERP systems for indirect purchasing. Organizations typically applied a mix of two strategies to manage indirect material purchases:

- ***Delegate it to end-users***. Under this strategy, shop supervisors, managers, or administrative assistants were allowed to select and contact vendors and place orders. Because a wide range of employees use indirect materials, delegation amounted to relinquishing control.
- ***Route paper requisitions to the purchasing department***. Under this strategy, end users would complete forms requesting materials and forward those forms to a purchasing clerk or buyer who would finish placing the order by selecting the vendor, negotiating prices, and sending a purchase order.

The lack of automated tools for indirect purchases raised costs for buyers in two ways. First, the internal processing costs of managing paper flow were often high, and in many cases, the processing cost for a purchase exceeded the value of the purchase for the small orders typical of indirect material. Second, when end users were free to buy from any supplier, they typically did an inadequate job of negotiating deals and buying from approved vendors. This phenomenon, called

"rogue buying," can be very costly, as end-users often failed to take advantage of important discounts from approved vendors.

The lack of an MRP-like tool for indirect materials also made it difficult for buyers to analyze past purchasing activities. Because MRP assigns a part number to every direct material item purchased, it can calculate the total quantity of an item purchased and certain statistics such as the average price paid. Lacking a system to track purchases by part number, indirect material purchases have historically been extremely difficult to track. This lack of data capture for indirect materials makes it hard for companies to measure their own performance. When a company's office supplies spending rises 10%, for example, it is extremely hard to determine whether that rise is due to a 10% increase in usage, a 10% increase in price (with the same usage), or some combination of changes.

Historical Inadequacies for Direct Material Purchasing

Despite the automation of order processing provided by MRP, these systems had other inadequacies that limited their usefulness. Essentially, while MRP automated the clerical tasks involved in processing routine replenishment orders, MRP did little to automate the knowledge worker's task of selecting suppliers and negotiating deals. So even the direct materials purchasing applications lacked critical functions.

A typical purchase has a long life cycle. The life cycle steps for a typical industrial purchase of direct material would look like:

- ***Need awareness***. This is the phase during which a company is designing a new product and must design that product's parts. To stay with the cooking analogy, the design phase is equivalent to developing a new recipe. At this stage, designers may have some hunches about what product they want, but they don't know exactly. They may know they need a housing, but they're not yet sure what material to use.

- ***Product specification***. As the design process proceeds, specifications become clearer. The housing may be more clearly specified as a plastic housing, made from ABS material, color off-white. Prototypes may be made at this stage.

- ***Vendor selection***. Once the designer knows the configuration of the housing, the purchasers must select a supplier to produce the part in production quantities. In many cases, these first steps happen concurrently or in a different sequence. In some cases, a supplier may be selected first and asked to finish the product design and specification.

- ***Price and terms negotiation***. As production launch nears, the company establishes the price and terms under which it will buy production quantities from the selected supplier. These terms are codified in a contract or a "blanket purchase order." The contract may extend for multiple years.

- ***Replenishment ordering***. Even after the terms of the contract are set, the manufacturer sends orders to suppliers based on the actual production schedule as it changes over time. Some companies send replenishment orders very frequently, even hourly if they are using a "just-in-time" inventory system. Each replenishment order is fulfilled under the terms of the contract previously negotiated.

- ***Receiving and payment***. As each order is shipped to the buyer, the supplier sends the parts and an invoice. The buyer's receiving dock verifies that the order was validly placed, inspects the parts, and legally receives title to them. The buyer's accounts payable department matches invoices with receipts and pays the supplier.

MRP systems provide for automated processing of the replenishment ordering, receiving, and payment steps. While a company might set an annual contract with a supplier once per year, the order replenishment cycle might run many times over the course of the year. Because the

replenishment cycle is distinct from the early phases, different people within a company often perform these activities.[10]

MRP systems do little to help designers through the design phase. They have little functionality to help in product specification, vendor selection, and price negotiations. These steps typically involve the coordination of many personnel inside the buyer's company, and even include coordination with outside suppliers and consultants. These functions are typically the high-value, intellectual functions of knowledge workers, where professional buyers prepare requests-for-quotations ("RFQ") documents, set negotiating strategy, and actually conduct negotiations face-to-face with suppliers. The absence of these higher value functions in MRP was a second major inadequacy in the functionality of purchasing software tools.

Supply chain optimization technology improves upon the performance of MRP. Electronic Data Interchange ("EDI") technology can be used to electronically link buyer and supplier computer systems. Both technologies have their own limitations. For a discussion of supply chain optimization and electronic data interchange deficiencies, see Appendix B.

The Internet has brought two primary types of innovation to industrial buyers: technology tool innovations and business model innovations. It is possible to separate the technology tools from the business model, and a solution can fail either due to an unworkable technology or an unworkable business model. Success typically requires both the tools and the business model to be aligned with the market's needs. This paper will next examine the business models and Internet tools of B2B.

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[10] The early life cycle phases—product specification, vendor selection, and price/terms setting are referred to as "sourcing"—establishing what supplier will be the source of the product. Sourcing is typically performed by "buyers" or "commodity managers" in coordination with design engineers, production engineers, and quality assurance personnel. Consultants are sometimes used to help the sourcing process. "Material planners"—the staff members who respond to the shopping list generated by MRP as new orders are received, typically perform replenishment ordering.

B2B Business Models

The first question about a B2B business model is the question of directionality. Which direction does the application face? The following describes the three basic options – seller-push; buyer-pull; and neutral:

- ***Seller-push applications*** are intended to help sellers sell goods and services to industrial, commercial, and institutional buyers. The simplest seller-push applications were company websites to distribute product information, and later, websites that could accept orders online. An application can be considered "seller-push" if one or a small subset of suppliers is featured on the site. The objective of the site is for that group of sponsoring suppliers to achieve higher prices or volumes as a result of the site. These applications typically derive revenue in two ways— from advertising or sponsorship and from commissions earned on successful transactions. A typical seller-push application has one or a small group of suppliers, and a large group of potential buyers.
- ***Buyer-pull applications*** are intended to help buyers purchase products on more favorable terms than might be found from traditional sales channels. The most direct example of buyer-pull solutions are reverse auction purchasing solutions, where many suppliers submit bids in a declining price auction format in order to win a buyer's purchase order[11]. An application can be considered "buyer-pull" if many suppliers are allowed to compete, and the application creates a competitive level playing field among those suppliers. Buyer-pull web applications seldom take advertising revenue from suppliers, which would present a conflict of interest favoring that supplier over others. A typical buyer-pull application has one or a small group of buyers, and a large group of potential suppliers.

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[11] The author's company, FreeMarkets, Inc. is the original example of a reverse auction purchasing solution provider.

- ***Neutral applications*** are those seeking to emulate the structure of stock or commodity exchanges, where the website becomes the meeting point for many buyers and many sellers. In the financial markets prices move rapidly down and up to equalize differences in supply and demand, typically in a bid-ask format.

Entrepreneurs sought to pursue B2B market opportunities with all three types of business models. It wasn t unusual to see all three models proposed for any given industry or product category.

The Winning Model is Determined By Market Structure

The underlying structure of the market being addressed should determine the winning Internet business model. This view is consistent with a traditional Structure-Conduct-Performance analysis favored by industrial organization economists. The design of appropriate application functionality depends on structure and determines performance.

In trying to fit one of these models to a given market, the fundamental market structure question is "which party has the power to set product specifications, prices, or terms?" The locus of power in the purchase transaction is independent of whether an Internet business model is being tried, but rather, is endemic to the particular purchase situation. On the Internet, the winning model will be the one that favors the party in power. In markets where sellers have the power, seller-push markets work. In markets where buyers have the power, buyer-pull markets work. In markets that are evenly balanced, or where power shifts back and forth due to market conditions, a neutral model can work.

Power is partially a function of buyer size, but also depends on the customization of the product being purchased. Buyers of customized products, even small buyers, are often in a position to require suppliers to perform to specification and to compete on price. When buyers face

standardized product offerings, they lose the ability to control specification, resulting in less buyer power, regardless of size.

Neutral marketplaces are often promoted as being superior to seller-push or buyer-pull marketplaces that involve auction pricing. These claims often fail to analyze the underlying microeconomic structure of the market in question. The microeconomic analysis will typically show that the choice of market technology must follow from the market structure, independent of any normative or emotional issues of "fairness." Three basic market structures are found for any given purchase:

- ***One-sided buyer markets.*** When a buyer purchases a unique custom product, by definition there is only one buyer and many potential sellers of that product. The correct market technology for such a situation is an auction where prices decline through competition among suppliers. This is the same economic situation the sellers find themselves in, regardless of whether the auction takes place over the Internet or through a series of negotiations with a buyer.
- ***One-sided seller markets***. When a seller possesses a unique asset, for example a particular used machine, by definition that seller is the only seller of that asset, facing many potential buyers. The correct market technology for this situation is an auction with buyers bidding competitively as prices rise. Again, the economic situation is the same, regardless of the amount of technology applied.
- ***Many-buyer, many-seller markets***. When the exact same product is supplied by many sellers and is bought by many buyers, prices would be expected to rise and fall to match supply and demand. The correct market technology for this situation is a bid-ask market (technically, a continuous double-auction). In these markets, it is typical to see speculators, and to find that a company can be a buyer or a seller depending on how they view the outlook for prices.

Analysts that simplistically describe neutral markets as "fair" and auction markets as "biased" are confusing emotional issues with simple economic structure reality. A one-sided buyer market is what it is, regardless of whether the negotiation is an Internet auction or a buyer conducting traditional negotiations. That structure should carry no negative connotation as being biased. It is a different issue whether the marketplace operator enforces a strong set of ethical rules to prevent abuses.

Application Focus—Horizontal or Vertical

While the first question to ask about a B2B business model is its fundamental direction, the second question is its product focus. Sites that aggregate the sellers of particular product categories are known as "vertical" web communities, reflecting their orientation along many steps in the supply chain of one product category. Most vertical marketplaces were typically built on the "seller-push" model, where the value proposition to buyers consisted of better product information, supplier advertising, and reduced information search cost. Vertical marketplaces typically sought revenues in the form of advertising fees from sponsors (sellers) and transaction fees for completed sales, also typically seller-paid.

Marketplaces that sought to help a buyer purchase a wide variety of products have been referred to as "horizontal" marketplaces. These marketplaces feature product breadth, not necessarily specialized depth in any one category. The contrast is important because a typical manufacturer buys a wide range of product categories, or in the lingo of B2B, buys from a wide range of verticals.

Choosing which model is preferred requires resolving a trade-off. To believe that vertical solutions prevail, you have to believe that purchasing success is more a function of deep product information and knowledge, and that coordination and consistency within buyers is less relevant. To believe that horizontal solutions prevail, you have to believe that buyers value consistency of

approach across the wide range of markets from which they buy more than they value additional depth of product information or knowledge.

The wide range of products purchased has led buyers to prefer horizontal solutions rather than vertical solutions. Horizontal solutions allow them to create a degree of consistency across purchases that has historically been difficult to achieve, and which a proliferation of vertical supplier marketplaces would tend to exacerbate. Buyers, for example, would prefer to standardize terms and conditions, rather than being subject to different terms from many vertical marketplaces. Further, buyers have found that horizontal marketplaces provide consistency while in many cases also approach the same degree of vertical information and product knowledge of a purely vertical solution. So horizontal solutions allow buyers to have the best of both worlds.

The Limitations of Seller-Push Solutions

Given the range of complexity in industrial purchasing, it's no surprise that a simple e-commerce application that looked like a retail catalog failed to work. Seller-push solutions specifically fail in the following situations:

- ***Custom products.*** Seller push solutions typically rely on catalogs with search features. Catalogs apply to "made to stock" products, and cannot assist a buyer in need of a custom product.
- ***ERP integration.*** For direct materials that are typically ordered using MRP/ERP systems, the lack of integration features between a web site and a buyer's underlying systems limits the seller-push approach.
- ***Complex contracting and trade credit.*** Business purchases require a significant relationship between buyer and seller. These relationships, including the trade credit relationship, have proven hard to build at arms length over the web.

- ***Information asymmetry.*** Buyers rely heavily on their own information sources when selecting suppliers. This information includes past performance of the supplier, even if that information is unfavorable to a particular supplier. Seller-push solutions typically present buyers with that information the seller deems most advantageous to his or her cause, and typically resists publishing negative information. Knowing this, buyers discount the value of information they receive from such seller-push sites.

Seller-push solutions do appear to have a role in the overall industrial commerce market. While they fail to address some of the issues enumerated above, there are still buying situations where seller-push solutions make sense. These situations include:

- ***Small and medium sized purchasers***. Whereas big buyers typically invest heavily in establishing sophisticated purchasing technology, staff, and operations, smaller businesses are not always able to do so. A buyer in a smaller company would not typically be specialized by product category, and in fact, purchasing might be only a part of that person's role. In these cases, the product information offered by seller websites can be beneficial.
- ***Infrequent purchases***. For one-off purchases of unique items, it doesn't make sense for even the biggest buyers to develop specialty knowledge. Information search is an important part of such purchases. Examples of the kinds of products purchased infrequently include maintenance equipment, test equipment, or facilities-related capital equipment like overhead cranes.
- ***Small dollar purchase categories***. Certain purchase categories have relatively trivial financial impact, and buyers often choose convenient solutions to these categories. For categories like these, a buyer may elect not to invest in a specialized, buyer-pull solution and just adopt a seller's proposed solution.

The Limitations of Neutral Solutions

Neutral applications, or bid-ask marketplaces, are frequently promoted as being the "right" model for all markets because they contain an emotional promise of "fairness." They appeal conceptually because of their similarity to better known capital markets like the New York Stock Exchange.

While neutral bid-ask marketplaces have conceptual appeal, there are few industrial markets structured to work well in a bid-ask manner. As a result, there have been few successful examples of bid-ask industrial markets. The structural barriers to truly neutral trading markets include:

- ***Custom products***. An automaker buying nameplates for its own models is the only buyer in the world for that part. So the market for nameplates is not structured as a many-to-many market where bid-ask pricing would work.
- ***Little tolerance for speculators***. In financial markets, a trader might be a buyer at one price and a seller at a different price. Speculators can jump in and buy or sell in hopes of profiting on the offsetting transaction. In industrial markets for custom products, there is little tolerance for speculators. Financial markets require speculators to provide liquidity. Because speculators are rarely tolerated in industrial markets, the liquidity of trading can be limited.
- ***Difficulty creating derivatives***. Much of the liquidity in financial markets results from the market's ability to create derivative securities such as options, futures, and collateralized lending instruments. These derivatives help investors hedge or find arbitrage opportunities, and in doing so, help force pricing into competitive equilibrium. Derivative trading typically requires short selling, which implies short sellers can borrow the underlying good. Most industrial markets cannot support such borrowing and short selling. As a result, the important arbitrage function of derivative trading cannot develop, further limiting liquidity and attractiveness to traders.

- ***Unique contract terms***. The financial terms of a transaction are as important as the technical specifications. Unique terms cannot be easily accommodated in a many-to-many market format. Differences in terms introduce significant transaction costs, limiting the ability of the market to declare one uniform clearing price.

- ***Counter party preference***. Industrial buyers care from whom they buy, because a supplier's quality, reliability, engineering support, and financial strength are important. On a stock exchange, it doesn't matter from whom you buy. Any shares will do. By contrast, financial markets can go so far as to tolerate trader anonymity, an unlikely scenario in most industrial purchases. Because sellers typically extend trade credit, sellers also exhibit counter party preference, seeking well-qualified and financially sound buyers. They cannot accept blind orders when trade credit is necessary. When this is the case, markets structures tend to be private. This is true in certain sectors of the financial economy as well, for despite the advanced evolution of equity capital markets like the NYSE, there is still enormous activity in private placement equity transactions like venture capital investments.

- ***High transaction costs for transportation and logistics***. Because stock exchanges typically use depository institutions to keep custody of securities, trading amounts to making bookkeeping entries reflecting changes in ownership. Industrial trade typically requires physical delivery of a product from one place to another, often at great cost and with risk of damage, spoilage, or obsolescence. As an example, the cost of low-sulfur western United Stated coal can be as high as 75% transportation when delivered to midwestern cities. These transaction costs imply that clearing prices, even in equilibrium, can differ for different trading partner pairs. These apparent price differences limit the liquidity that can be achieved in an exchange environment.

- ***Trade-specific risks***. One of the mechanisms that helps stock exchanges work is the ability of market makers and brokers to guarantee trades and payments. On an

exchange, if a seller fails to deliver shares to settle a trade, a broker can typically purchase or borrow replacement shares for delivery to the customer, preventing the trade from failing. In industrial markets with unique products, long lead times, and high transaction costs, it can be difficult to obtain such replacement product to prevent a failed trade. As a result, it is extremely risky for a guarantor to step into the middle of such trade and agree to guarantee performance and liquidity. While certain industries use surety bonds to provide sellers with an incentive to perform (or suffer penalties for non-performance), the buyer often has to scramble to find replacement product.

- ***Lack of information transparency***. Equity capital markets impose stringent information disclosure rules upon the companies supplying shares of stock. The SEC examines investor communication, and can require companies to change those communication documents to be more clear, accurate, and objective. Executives and directors are prohibited from sharing inside information, and must make complete public disclosures of material negative information. Those same companies, however, are free to misrepresent the capabilities of their products when they sell to customers. They can misrepresent the status of their facilities, their backlog, their capacity, or their employee turnover. There are no oversight bodies in industrial markets to act in the role of the SEC. The result is that information is reasonably transparent in capital markets, enforced by criminal statutes, but it is comparatively opaque in industrial markets. In response, buyers conduct commerce in private relationships where they can do their own due diligence, more like private equity investing than like equity trading on an exchange. True neutral trading marketplaces cannot exist without an infrastructure to guarantee information transparency.

All of these structural friction sources limit the potential for true bid-ask marketplaces. In true commodities like natural gas and basic metals like copper, some successful markets emerged[12]. Other categories that show promise are commodities like fuels, certain standard plastics, certain standard metals, standard chemicals, and electricity.

Even in those commodity categories, there can be significant customization and additional value-added services. Steel, for example, is often delivered in buyer-specified dimensions, quantities, delivery schedule, and often has special treatment such as coating or special packaging. So while certain product categories may support neutral exchanges, there will also be significant product volume in those same categories that trade in private customized transactions, off the exchange.

The Advantage of Buyer-Pull Solutions

The industry structure of traditional B2B markets has led to the adoption of buyer-pull solutions as the preferred, winning model. The effect of the structural complexities in industrial purchasing is that it is typically the buyer that has the power in industrial markets. Buyers of custom products set specifications, control timing, and negotiate price and terms.

As a result of the specifications, unique terms, special services, the market structure for a typical large industrial purchase matches the "one-sided buyer market" model, with a unique product specification, a group of potential suppliers, and a negotiation process designed to elicit the most competitive price for the buyer.

Buyer-pull applications such as reverse auction marketplaces and buyer catalog tools have succeeded where seller-push applications have failed. Buyer-pull applications are adapted to the complexities of industrial buying. They can integrate with internal systems, accommodate the purchase of custom products, and permit global sourcing and the use of trade credit.

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[12] See Enron (http://www.enron.com) and Altra Energy Technologies (http://www.altra.com) for successful

Internet Tools for Purchasing

The explosion of B2B applications for purchasing can be attributed to a confluence of need and opportunity. The need existed in the inadequacies of traditional purchasing automation tools. The opportunity arises because the Internet forms a natural medium to address some of these inadequacies. Some of the basic limitations of traditional purchasing can be naturally overcome with new Internet technologies.

We have already explored that structurally, buyer-side solutions promise a better fit for B2B commerce. Two tools have emerged as the dominant B2B purchasing technologies:

- Buyer catalogs
- Dynamic pricing tools such as auctions.

Both have rapidly gained acceptance, and both are the cornerstones of promised functionality in recent B2B marketplace announcements. Both are described more completely later in this section.

Three additional Internet technologies are emerging with promise. These tools are described briefly below and in Appendix C:

- ***Collaboration tools***. These Internet tools help to automate the process of working together across organization boundaries. Internet collaboration tools manage the sharing of documents such as business plans and blueprints, and can provide the means for other virtual interactions. They can help define a project workflow and manage achievement of these steps. Because human interaction during the intellectual phases of product design can be complex and non-standardized, Internet collaboration tools must support a wide range of interaction styles, including document sharing, Internet discussion groups, real-time chat functionality, and even real-time voice and video. Importantly, these tools can

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neutral trading marketplaces for energy commodities like natural gas

be beneficial within an organization, helping different functional groups collaborate in cross-functional projects, as well as in assisting buyer-supplier collaboration.

- ***XML-based EDI using the Internet***[13]. Buyers have sought to replace EDI with a more functional system using a more open architecture. XML-based standard documents are likely to be the tool that can replace EDI. XML itself cannot replace EDI, but can be used as the underlying technology to do so. An XML-based replacement to EDI would benefit users by allowing easier implementations, providing a human-readable version of documents previously meant to be exchanged only by computers, and would allow the development of much more rich functional documents such as RFQ documents that are used in the early, high-value phases of purchasing and design.
- ***Internet-based supply chain optimization***. Because optimization techniques require a near-constant level of analysis and refinement of production plans as conditions change, the volume of interaction that might occur between a buyer and a supplier attempting to jointly optimize production is huge. The Internet can help solve the integration challenge by providing a low-cost conduit for requests and acknowledgements, as well as by defining standards for how requests and acknowledgements are formatted and shared.

The two most significant tools to have emerged to date are buyer catalog tools, which address many of the deficiencies of traditional indirect purchasing, and dynamic pricing technology such as auctions, which address many of the deficiencies of historic purchasing systems for both direct and indirect material purchasing.

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[13] EDI, or Electronic Data Interchange, is currently used to transmit electronic forms such as purchase orders between buyers and suppliers. See Appendix B for more information about EDI.

Buyer catalog tools.

Buyer catalog tools have become the indirect material equivalent of MRP. They allow purchasing organizations to display to end users catalogs of approved products, rather than forcing users to complete requisition forms or go directly to suppliers themselves. These tools improve control over purchasing by reducing "rogue buying" (the use of non-approved vendors) and by capturing detailed part number data about product purchasing history.

Buyer catalog tools represent one of the revolutionary innovations being introduced through the emergence of B2B. The inadequacy of historic solutions for indirect material created massive inefficiencies. While such catalog tools could have been created and introduced before the Internet's emergence, the Internet is an ideal platform for such systems, because:

- ***These systems must face many users***. MRP tools are typically used by the small subset of staff in the purchasing and material planning function. The buyer catalog, by contrast, may be displayed to nearly 100% of the employees in a company, due to the universal nature of requesting basic supplies. The Internet has proven to be an inexpensive mechanism to reach many users without paying expensive license fees on a user-by-user basis.
- ***Platform independence***. A buyer catalog should ideally cover all of a company's divisions and business units. While these business units may currently use different MRP systems and computer hardware, often the result of growth through acquisition, the Internet browser is universal and may be accessed without complicated installations.
- ***Rich content***. The Internet allows catalogs to contain multimedia content that can be helpful to users. So buyer catalogs can easily contain product photos, videos, and other product information that was difficult to present in legacy mainframe and PC environments.

While important for managing indirect materials, buyer catalog tools cannot be readily applied to direct materials because:

- ***MRP already manages replenishment of direct material***. Manufacturers must use MRP and the bill of materials to ensure that the necessary ingredients are on hand to make the products they intend to ship.
- ***There is no supervisory approval process for direct material***. MRP contains built-in controls to allow material planners to order whatever is necessary. Orders from MRP do not typically need supervisory approval. The approval routing function so important in catalogs does not apply to direct materials.
- ***Direct material is often custom***. Catalogs are great for managing standard products such as toner cartridges, but not appropriate for managing custom products that a buyer has contract-manufactured by one supplier.
- ***Direct material is not end-user controlled***. Professional buyers, commodity managers, and material planners control the flow of direct material. By contrast, almost every employee in an organization might be an end use consumer of office supplies. The catalog's ability to deploy a simple user interface to all users is of no use for direct materials, where professional buyers need sophisticated interfaces for repetitive processes.

Buyer catalog tools are one of the most significant innovations the Internet has brought to B2B. They answer a clearly felt need for virtually any business to control the purchase flow of indirect materials in a business environment. The benefits to buyers include the ability to reduce administrative headcount, and to regain control over approved vendor usage, maximizing the value of corporate discounts. For more information on these tools, see Appendix D.

Dynamic Price-Setting Technology.

The other major Internet innovation for B2B is dynamic pricing technology such as Internet auctions, which address MRP's deficiencies in the high-value, early stages of the purchasing life cycle—the product specification, vendor selection, and price and terms negotiation. An auction can be used to help manage the coordination and flow of work between the many parties involved in a major industrial procurement. It can provide the information and price transparency characteristic of a stock market, but tailored to the unique structure of custom products and infrequent decisions. In addition to providing automation, the rapid interaction of suppliers in an auction format can typically create a more competitive outcome than a buyer might obtain using traditional negotiating techniques.

Dynamic pricing is useful for both direct and indirect materials. Direct and indirect materials both go through a sourcing phase, where the buying organization is specifying the product (or service) to be purchased, selecting a vendor, and negotiating price and terms. During this phase, marketplaces using auction technology can deliver far more competitive outcomes for buyers.

The Internet was a powerful enabler of such technology because it can provide a rich user experience across many platforms and through many enterprises. At FreeMarkets for example, our Java-based auction technology can display sophisticated user interface elements while launching from a browser-based link.

An auction marketplace can be used any time a negotiation occurs. Very often, the negotiation is for a major contract covering twelve or more months of subsequent replenishment ordering. However, it is possible for buyers to purchase without long term contracts—shopping for new prices and terms upon each replenishment order. In practice, using the auction to set terms for annual contracts, as opposed to doing repeat auctions for each order, is preferable because:

- ***Larger contracts mean more buying power***. A buyer will typically get a better deal on a big commitment than on a lot of small contracts. Suppliers value the predictability and lower selling costs of bigger orders, and translate those savings into discounts.
- ***Auction theory supports fewer, bigger auctions.*** Auction theory suggests that auction sponsors do better when they have a fewer number of auctions with higher stakes outcomes than when they have repetitive auctions each with reasonably low stakes. When there are many auctions, bidders learn behavior that allows them to signal one another, and tacitly to submit bids higher than they otherwise might. When the stakes are small, the business is divisible, allowing more than one competitor the chance for a comfortable outcome.
- ***The auction can add transaction costs***. Preparing and running an auction can often create more transaction cost than a manual procurement. But the effectiveness of the auction in reducing price typically more than outweighs the added transaction cost. As a result, it is typically more cost effective to run fewer big auctions than more small auctions, because a portion of the auction transaction cost is fixed and can be amortized over bigger purchases.

An Internet auction for purchasing mirrors the traditional purchasing activity in most respects. A typical auction progresses through the following stages:

- ***Request for Quotation preparation***. Remember that many industrial procurements are for custom products, and even when procuring standard products, buyers often like to spell out terms and service requirements. They typically solicit quotes from suppliers by describing their needs in a request for quotation ("RFQ") document. These documents often contain blueprints, material specifications, quality expectations, commercial terms, and quantity and timing expectations. They sometimes indicate target prices, particularly when purchase may be contingent upon achieving a certain price level. Buyers have always used RFQs to obtain bids. When conducting an Internet

negotiation rather than a manual negotiation, buyers must conduct the extra preparation step of ensuring that suppliers are put on a competitive level playing field. For example, if suppliers would have differences in freight cost and would ordinarily submit bids sans freight, for an auction they must be instructed to include a freight estimate.

- ***Supplier selection***. Typical industrial procurements are conducted by soliciting a select few potential bidders. Buyers have always conducted closed negotiations, for a variety of important reasons. First, they must ensure quality, and absent standardized quality rating systems in industry, they rely on prior experience and their own due diligence to select a list of trusted suppliers. Most industrial procurements are the beginning of a long relationship, not a single transaction, so long-term trust and performance are imperative. Second, buyers are often distributing highly sensitive information, and wish to limit the exposure of that information. Third, buyers often seek to avoid using suppliers who also serve their competitors, to minimize the chance of information sharing of trade secrets. Fourth, buyers must often address social and policy issues when buying, such as the inclusion of minority or woman-owned businesses, or the exclusion of suppliers with poor child labor or environmental records. Internet auctions typically open up the competitive playing field to a wider group of suppliers, but in nearly all cases, the buyer will retain control over exactly who is allowed to participate.

- ***Bidder preparation***. For engineered custom components, bidders must analyze the RFQ, clarify assumptions, and prepare cost estimates. During this phase, there can be significant interaction between buyer and the potential bidders, to clarify information. This interaction can occur by phone, fax, e-mail, or through Internet collaboration tools.

An auction marketplace operator like FreeMarkets may conduct much of this interaction as an added service to buyers and suppliers[14].

- ***Negotiation***. Before the Internet, the negotiation phase of a competitive procurement would have involved one or more rounds of quote submission by bidders. Typically quotes from suppliers would spell out a long list of terms and conditions that made prices less directly comparable. Indeed, it has been traditional during quoting for suppliers to submit quotations not based on exactly what the buyer sought, but on an alternative basis that favored the supplier. It has always been the job of salespeople to raise prices and obscure the buyer's ability to compare prices by tying in additional terms. Internet auctions spell out terms and conditions in the RFQ, and reduce the final negotiating element to price. The economic structure of the auction situation mirrors what has always been the case—buyers negotiate with one or more suppliers, and suppliers drop price quotes through the negotiation. Unlike a traditional negotiation, though, an Internet auction can achieve a high level of interactivity in a short period of time. It is not unusual to see more than 50 bids and counter-bids within the span of an hour. This is far more interaction than a face-to-face negotiation could obtain.

- ***Implementation***. After the negotiation, there are often follow-up questions to be answered. Buyers may wish to examine in detail the bidders' assumptions, such as their cost estimates for specific items like raw material or transportation. In doing so, buyers often discover that they are able to provide the supplier better freight rates or raw material prices through the buyer's larger purchasing power. For custom engineered goods, there is typically a long conversion process, requiring the supplier to build or install new tooling, produce sample parts, and have those samples tested by the buyer's

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[14] FreeMarkets uses its proprietary FreeMarkets Desktop™ Internet tool to coordinate and automate many of the preparation steps, including RFQ presentation, bidder list preparation, supplier question and answer, and project timeline management. The auction itself is but one step in a multi-step purchasing process.

engineering staff. Only after all these steps have been conducted can routine orders flow.

While the preparation steps for an Internet auction are basically the same as for a typical procurement, a buyer can implement a wide range of strategies in an auction. Many of the general complexities of industrial purchasing were spelled out earlier in this paper. However, each purchase decision has its own particular complicating factors, objectives, and strategies. So no two auctions are ever exactly the same. Industrial purchasing is itself complex, and introducing a new electronic tool adds to the complexity.

One outgrowth of this complexity is that for most purchases, different buying organizations would have different objectives and would therefore tend to use separate customized auctions rather than one common auction. It is difficult to get many buyers to agree in advance on a particular set of objectives.

When people hear about auction purchasing, they often wrongly assume that auction purchasing means the end of long-term relationships between buyers and sellers. This is far from the case. In some true commodity product categories, the frequency of re-purchase may tend to increase, or the duration of contracts shortened, when auctions are introduced, because the auction reduces the cost of incremental renegotiations. However, for custom product categories that have high switching costs, buyers typically use the auction to determine with whom to establish the relationship, based on excellent market price discovery. But once the auction is over, production parts are approved, and tooling is installed, the working relationship can run for years.

Because of the complexity, running a successful purchasing auction requires significant preparation, analysis, strategy setting, and setup. In many ways, auction technology is useful to purchasers in the same way spreadsheets are useful to pension portfolio managers. While spreadsheets are powerful tools, they are only as good as the data and models built by the analyst. Auctions too can be powerful, but they are only as effective as their user.

When we prepare an auction at FreeMarkets, we work to help the buyer balance multiple objectives, including:

- ***Product quality***. Because buyers care about product quality, the preparation process for an auction consists of significant supplier due diligence and data gathering. It is not unusual for buyers to make their specifications more stringent than in past purchases, in an effort to upgrade the product or service being purchased.
- ***Supplier consolidation***. Because it is often the buyer's objective to reduce the total number of suppliers to consolidate administrative tasks like bill payment, we often employ strategies to help buyers end up with fewer suppliers than before.
- ***Global sourcing***. Buyers are often targeting international supply sources. When this is the case, the preparation requires extra due diligence and supplier research.
- ***Year-over-year price reductions***. Buyers often like to build-in savings from year-to-year. When year-over-year price reductions are important, the RFQ package must specify such strategies and targets.
- ***Price risk hedging***. Buyers like to avoid price fluctuations in commodity products. They can establish auction-purchasing programs to allow them to buy some portion of requirements on long-term contracts and other portions on repetitive short-term contracts, allowing them to naturally hedge against underlying price risk.
- ***Sub-tier sourcing***. Because big buyers often have greater buying power than their smaller suppliers, it is common practice for big buyers to help suppliers obtain better prices for material and subcontract work. Our auction preparation often involves sub-tier suppliers as a result.
- ***Minority and woman-owned supplier development***. Many buying organizations, particularly government contractors, run supplier inclusion programs for minority or

woman-owned businesses. Such programs can affect how suppliers are recruited and how the purchase is broken up into different parcels or lots.

- ***Cross-division coordination***. Buying organizations that historically purchase independently at different locations often wish to coordinate their purchases. The degree of coordination can vary depending upon the product being purchased and the buying organization's wishes.
- ***Value-added services***. Buyers often wish to obtain special services along with products. Examples can include engineering and design support, consigned inventory, and just-in-time replenishment. These desires must be spelled out in the RFQ, and must be selection criteria for suppliers.
- ***Savings***. Auction purchasing often results in savings below the last price the buyer had paid, especially for custom engineered products. Even in commodity markets where prices fluctuate, buyers use auctions to purchase at more favorable prices than their competitors, gaining advantage as a result.

While the range of different buyer objectives for any given purchase can complicate auction setup, setup is complicated further by market conditions in the supply market. Among the considerations that must be factored into the auction setup include:

- ***Competitiveness of the supply industry***. In industries where there is ample competitiveness in the supply industry, buyers may be more selective in supplier recruitment. In fragmented industries, the auction can be set up with little fear of outright supplier collusion or tacit collusion through signaling.
- ***Attractive increment of business***. In industries where the basic unit of productive capacity is small, business can be broken into a number of smaller lots and remain attractive to suppliers. In capital-intensive industries like steel, it is more attractive to suppliers to aggregate more business into fewer, bigger lots.

- ***Transportation and logistics***. Some product categories are inherently more shippable than others, and can be sourced from a wider radius. Others must be purchased from reasonably local markets.

- ***Distribution versus direct***. Buyers can choose to buy product directly from manufacturers or use distributors. Each industry has different distribution characteristics, and different geographic regions can have different viable options. Buyers that would desire to have national contracts often find they must use regional distributors to supplement a national distributor strategy.

- ***Timing***. Buyers ideally like to buy on long-term contracts when capacity utilization and prices are low, and desire to buy on short-term contracts when prices are high. Further, different markets experience different seasonality peaks and valleys. Auctions must be set up to accommodate timing as a consideration.

At FreeMarkets, we have built a wide variety of auction formats that are appropriate given different market conditions. Within any of these auction formats, we can further configure the exact details of how the auction will run. The number of combinations of auction formats and configurations we can run exceed 150 million. Significant setup decisions include:

- ***Lot setting***. Most auctions are run for more than one part. Independent auctions for each part can be ineffective if the buyer's goals include supplier consolidation. Smaller orders can be less attractive to suppliers. In concentrated markets, buyers can elicit more competition by making fewer, larger lots. The way in which parts are grouped into lots has enormous impact on the outcome.

- ***Format***. Auction prices can run down in the case of a purchase or up in the case of a sale of used or surplus assets. Bids can be for just price or can include multiple non-price parameters that are handicapped by formula in determining the best bid. Bids can be for one period of time, or different bids can be solicited for different periods of time.

Suppliers may be allowed to view the auction in the currency of their choice. The buyer's objectives, market conditions, and our collective experience control selection of format.

- ***Feedback***. When suppliers are bidding, they obtain market feedback. In a traditional live auction, feedback comes instantly as all participants listen to the auctioneer. In an Internet auction, the auction server program returns feedback. When buying from a fragmented global market with little chance of supplier collusion, the auction server can be programmed to show bidders the current market price and indicate the number of active bidders, while disguising the bidder identity. In more concentrated markets, where collusion is possible, the amount of feedback can be reduced. For example, instead of showing bidders the current market price, they may be shown what rank their own bid earns.
- ***Timing and operating parameters.*** The competitive dynamic expected in the market determines how long suppliers should be given to bid, and under what conditions bidding should be extended. The number and location of international suppliers, and to what extent multiple languages would be expected to slow down the speed at which suppliers may be expected to participate may determine the schedule.

As a result of the complexities, at FreeMarkets we have organized our company to provide buyers with assistance in the setup and conduct of auction purchasing. We have done so because we have discovered that purchasing via Internet auctions is a complete discipline, not just a technology, and buyers benefit from guidance in how to adapt auctions to different markets, different market conditions, and in pursuit of different strategies. To make an analogy to the equity capital markets, auction purchasing is closer in complexity and intellectual content to portfolio management than it is to stock brokerage.

While Internet auctions don t change the fundamental fact that many suppliers typically bid prices down for a buyer s purchase order, Internet auctions can be a far more effective way of purchasing. Buyers receive numerous benefits through the use of Internet auctions:

- ***More competitive pricing***. It is not unusual for a traditional negotiation to end not based upon reaching a competitive equilibrium, but based on running out of time and energy for additional iterations. When every supplier is given the chance to respond to market prices, they typically do so until a competitive equilibrium is reached. At FreeMarkets, our experience over five years is that our average savings has stayed reasonably constant between 15 and 17% below previous purchase prices.
- ***Faster conclusion***. An Internet auction can be over in just a few hours, rather than the days and even weeks it can take to conduct an iterative face-to-face or phone-and-fax negotiation. This allows buyers to process more work in less time.
- ***Compressed spreads***. Low bidders do not automatically win industrial purchasing auctions, just like low bidders don t necessarily win in traditional procurements. When buyers conduct more traditional negotiations, it is not unusual for there to be 5-15% price differences between first and second place bidders. Because industrial buyers don t always buy based on lowest price, but evaluate the quality, service, engineering support, synergies, and other intangibles when selecting suppliers, they can face a tough tradeoff when they prefer the second place bidder but have to accept a 15% price premium. Because Internet auctions are interactive, and prices decline slowly near the end, it is often the case that the best two or three bidders are within only a couple percentage points. If a buyer prefers the second place bidder, it is easier to select that bidder when the price premium has been reduced to a small increment.
- ***Tighter process discipline***. Because an Internet auction must be conducted with suppliers on a level playing field in terms of non-price factors such as freight and terms, buyers must be more diligent in preparation of RFQs. More rigorous preparation is a

discipline that pays off in improved communication, better supplier selection, and better negotiations, regardless of whether the negotiation technology is manual or automated.

Price transparency clearly provides benefits to buyers. Price transparency can uncover market inefficiencies that had previously benefited suppliers. In general, the transparency provided by dynamic pricing creates a more competitive world for suppliers. However, the liquidity and transparency of auction markets provides its own benefit to suppliers. Among the benefits include:

- ***Competitive benchmarking***. The openness of Internet auctions demonstrates vividly the competitive landscape suppliers face. In traditional negotiations, it is often the case that losing bidders have no idea of the price level of winning bidders. In such an environment, it is easy to disbelieve a buyer's feedback as mere negotiating tactics. In the open environment of Internet auction pricing, where bidders are known to be pre-screened peers, competitors take feedback much more seriously.
- ***Buyer accountability***. With the proliferation of Internet auction purchasing, buyers cannot protect favored incumbent suppliers from competition as easily as they could when negotiations are private. Purchase decisions are easy for senior purchasing management to audit, often ensuring that these decisions are clearly based on the merits of the suppliers' quotations.
- ***Volume liquidity***. Internet auctions running through a market operator like FreeMarkets can provide an enormous pool of potential sales opportunities for suppliers to evaluate and pursue selectively. The liquidity of a marketplace allows suppliers to pick and choose that business best suited to the supplier's strategy and facilities. When markets lack liquidity, suppliers are forced to quote on business that might be less than optimal, just because it's the only business to quote.
- ***Low cost of sales***. The cost of selling to buyers can be a large part of total costs. Internet auction marketplaces dramatically lower the cost of selling, through the liquidity

they generate, through the information transparency in detailed RFQ documents, and because sales commissions in these marketplaces is low or absent.

The Emergence of Industry Exchanges to Sponsor B2B

Technology entrepreneurs and technology companies began creating the innovations of B2B in 1995, and have been rapidly commercializing them. These technology companies operated by offering their technology and services individually to major enterprise buyers. Beginning in 1999 and early 2000, large companies that are horizontal competitors in a variety of markets began to organize industry-specific B2B marketplaces or exchanges that would enable competitors to pool their resources and purchasing power and to benefit from the financial markets' perceived appetite for the IPOs of B2B companies.

The announcements of these exchanges have promoted the concept that industries have unique, industry-specific needs that need to be embedded into B2B applications, thus the need for collaboration among horizontal competitors.

Industry exchanges have only recently begun to announce definitive product/service offerings. Those announcements typically include the basic B2B building blocks described above and in the Appendix[15]:

- Buyer catalog tools
- Dynamic pricing tools such as auctions
- Collaboration tools
- Internet-based supply chain optimization

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[15] This paper has concentrated on purchasing and purchasing-related exchanges. There have also been sell-side exchanges announced, following the seller-push business model. Metal Spectrum has been characterized as one such sell-side model in its early press releases. This paper does not attempt to analyze sell-side solutions.

– XML-based EDI replacement

Exchange operators are buying the basic B2B building block tools from the same software companies that sell these tools to individual enterprises. Beyond the basic tools, each industry marketplace plans to configure the tools to match specific industry needs. Buyer catalogs, for example, would focus on the generic product categories applicable to all businesses, like office supplies, as well as industry specific product categories. In addition to using the basic B2B tools, the exchanges may create additional purchasing power through the combined purchase volumes of the exchange sponsors and members.

However, the dangers of collusive purchasing and information sharing or leakage among direct competitors, as well as the possibility that technology innovation could be slowed if B2B were to be dominated by industry exchanges, have led to questions about their impact. In many of the announced exchanges, there have typically been one or more high profile competitors who have abstained from joining, or who have started competing exchanges, largely due to fear they would lose control of proprietary information or would dilute their own perceived competitive advantage by sharing know-how with competitors.

One of the potential benefits of exchanges is to become the standards-setting body for a particular industry, much in the way ANSI has been the standard setting body for EDI technology. Open standards for the way parts are described, for example, would allow participants to choose the underlying technologies and technology providers that best matches their needs, while also allowing the interoperability desired across companies. Many industries already have standard setting bodies, and it's natural that when an industry seeks standards, that it includes inputs from many players, even competitors. The Automotive Industry Action Group (http://www.aiag.org) is an example of an organization promoting standards for EDI, supplier quality initiatives like the auto industry's QS 9000 rating system, and electronic commerce. However, independent standard-setting bodies can accomplish standard setting and exchanges are not required to fulfill this function.

Aside from the standards setting function, there is little truly new functionality that's being proposed by multi-company industry consortia. Buyers have been able to buy in consortiums on a selected basis for years. And the tools being used to assemble the exchanges are the same basic, off-the-shelf tools that individual enterprises can purchase.

Marketplace Predictions and Analogies to Financial Markets

When trying to predict how B2B exchanges will evolve, it is instructive to look at the financial markets, because capital markets are comparatively more evolved and classically efficient than many industrial markets. Far from being simple, the capital markets are full of diverse roles, often containing many competitors. If B2B evolves like the capital markets, however, we can make some predictions about the future structure of B2B marketplaces:

- ***Buyers will adopt a common transactional infrastructure and use a portfolio of best-of-breed providers for high value activities***. In the capital markets, there are high value activities like securities underwriting and portfolio management, and lower value activities like trade clearing. Typically, these functions are independent businesses, or at least independent business lines within large businesses. Pension funds are the financial equivalent of big purchasers. When it comes to low-value activities like trade clearing, pension funds almost always select a single custodian bank to perform that function. They typically do not select multiple custodian banks, because that would introduce coordination cost, with little if any additional value added from picking specialists[16]. However, when they conduct the high-value activity of money management, they almost always select multiple portfolio managers, each specializing in a particular type of investing. They select best-of-breed approaches because the value of specialization can be very high, measured in investment performance, while the cost of

[16] One exception, however, is that they may pitch a different custodian to work in non-U.S. markets. Global custody remains a more specialized market niche.

coordination is reasonably low. Picking the right money manager can quickly pay back a lot of coordination cost. The results of this high-value/low-value dichotomy are already seen in the capital markets. While transactional exchanges like the NYSE and the NASDAQ National Market have been consolidating, there remains much fragmentation among money managers, and the barrier to starting a new money management firm are low. In B2B, the analogy suggests that companies should choose one common order-processing infrastructure, because it isn t worth coordinating multiple providers of a low value activity. But for the high value activity of managing their purchase decisions, other things being equal, they would be expected to use multiple specialty solutions, where performance matters. So when it comes to purchasing decision support activities, they would be expected to allocate their volume across multiple exchanges, independent auction markets, or homegrown solutions. This is consistent with their historic practice of segmenting purchasing behavior on many dimensions: local versus global buys, long term versus spot buys, competitive versus partnership buys, and others.

- ***Specialists are industry-specific while infrastructure is not industry-specific.*** The NYSE is a common marketplace for all kinds of companies. High-tech companies, low-tech companies, retail companies, and manufacturers are all traded on the NYSE. The basic activities of the exchange infrastructure are reasonably blind to the underlying assets. By contrast, the high value roles of money management yield specialization. Certain funds focus on technology stocks, while other funds focus on small-cap stocks. Many technology stock funds and many small-cap stock funds compete against one another for business. For B2B, the analogy says that basic transaction processing activities may not necessarily be an industry-specific function but may be more general infrastructure, available from banks and other transaction processing companies. But the high value decision-support activities would be expected to be the purview of specialists, and each specialty niche would sustain multiple competitors.

- ***Companies will retain their purchasing technology behind their own firewalls.*** Again, if the financial markets are an indicator, companies are unlikely to consign the operation of their purchasing technology or their purchasing staff to one exchange. Turning back to the pension example, one reason pensions use custodian banks is to prevent being locked into the use of any one broker. If a consumer has a brokerage account and buys 100 shares of stock, it is almost guaranteed that the consumer must use the same broker to sell those 100 shares of stock. Because the broker houses the consumer's assets, the broker has locked the consumer in. Pensions, because they use third party custodian banks, can buy shares through one broker and sell those same shares immediately through another broker if desired. They are not locked in. In B2B, it is unlikely that big buyers would elect to have their purchasing technology hosted by an exchange, because that creates lock-in to that exchange. It would violate common sense to find that if buyers are given the technical capability to forward electronic orders to an exchange, and suppliers are given the technical capability to receive orders from an exchange, then why wouldn't buyers just forward their orders directly to suppliers, especially if the exchange charged for transactions? In all likelihood, they would elect to forward orders directly to suppliers, just as they would tend to send e-mail directly to suppliers rather than routing e-mail through a third party exchange. Buyers can only retain the ability to forward orders directly if they maintain their own purchasing technology such as catalogs. If they give up control over this technology, they may get locked into a costly solution, repeating the mistake of EDI.

- ***Buyers continue to make their own purchasing decisions.*** Consider the chain of events if a company publishes pricing to the members of a huge buying exchange. That company's competitors aren't likely to ignore the competitor deal and slink away. In a dynamic market, they react, and in this case, it's likely that they send their direct sales force to undercut the competitive pricing posted on the exchange. They cannot afford to let the entire market share represented by all exchange members go away, so they

selectively discount to some members. At this point, the member-company purchasing agent realizes that the best deal in the market isn t necessarily the one published on the exchange, but rather, is the one they negotiate offline with the competing sales force. The benefit of maintaining the purchasing department operation and making independent decisions becomes readily apparent. As a result, while companies might rely on exchanges for standard setting, they are unlikely to reduce their complement of buyers, because buyers add strategic advantage and value beyond that offered by the exchange. It would be unusual to find that companies who have historically sought competitive advantage over one another would suddenly be content buying the same products at the same prices as competitors. Their natural reaction is to buy better than competitors and to beat the average result.

- ***Sales forces do not disappear.*** While the capital markets have very efficient transactional infrastructures, there are huge direct sales costs borne by the financial services companies. Complex services like corporate finance are sold by highly specialized investment banking partners. Institutional sales forces, backed up with sales research literature, sell stocks and bonds. And companies listed on exchanges still do road shows, investor conferences, and conduct investor relations activities. For B2B, the implication is that while exchanges may emerge, direct sales do not go away. The competitive advantage of an excellent sales force will remain, and companies will use their sales forces to sell around B2B sites.

- ***High-value activities are managed using proprietary information***. Professional portfolio managers rarely make investment decisions based on information found in public sources. They don t fully rely on brokerage house analysts. Typically, they assign an internal analyst to build financial models, meet company management, and interview a company s customers. It is through these activities that they develop a trading strategy. Portfolio managers rarely reveal their models, because the model represents

their proprietary edge. In B2B, it is typical that buyers make decisions based on the information they know about suppliers, not the information that is publicly available. And they don't tend to share this information because it is part of a company's competitive edge. This is a further reason why companies will maintain their own purchasing departments and retain control over their purchasing technology.

- ***In the endgame, market share is won purchase-by-purchase, not company-by-company***. Financial market evidence comes this time from consumer financial services. Banks measure market share in deposit balances. Banks are likely to win the deposit of a person's monthly paycheck. But if a year-end bonus is paid, the consumer is just as likely to place those funds with a brokerage account or a mutual fund. And just because a consumer has a brokerage account doesn't mean that the bonus check doesn't end up in a mutual fund. Consumers are constantly re-balancing their "share of wallet." Similarly, pension funds constantly re-balance the funds assigned to each asset manager. For B2B, we would expect that companies allocate back and forth between the solutions offering the best value at any given time. So they might be expected to purchase from an exchange on one occasion, directly from a supplier on another occasion, and select an independent Internet marketplace on other occasions. This allocation activity is a further reason why they would prefer to control their own purchasing technology platforms into which they integrate their desired solutions.

- ***Marketplace offerings segment by service level.*** In consumer financial markets, the same exact checking account product is available at different service levels: private banking, full service banking, and online banking. The difference is service. Customers self-select which level of service they want. Service levels complement each other, rather than replacing one another--the emergence of the Internet hasn't wiped out retail branch banking. And it's not unusual to see a private banking customer who also has a discount broker trading account. Consumers don't always select the same service level, but select

the service level appropriate for a given activity. For B2B, the implication is that big buying organizations are going to seek both high service and low service solutions depending upon the need. This is another reason that, other things being equal, they would tend to divide up their market share between exchanges, high-service independent marketplaces, and homegrown solutions.

- ***Marketplaces succeed on execution, roles, and rules.*** It is illustrative to remember that capital markets had reasonably efficient exchanges like the New York Stock Exchange before computers, databases, or the Internet. The success of the NYSE has resulted from infrastructure like the SEC whose oversight provides information transparency, and the legions of attorneys and accountants who prepare the information the SEC examines. It has also resulted from the market maker roles, where specialists are obligated to take the other side of trades and provide liquidity. It has resulted from legions of research analysts at money management firms and brokers, whose job is to further enhance price transparency. Most of these roles are absent in the industrial markets. While the financial markets have had years to attempt to replace attorneys and accountants and analysts with computer systems, these roles are still necessary. B2B marketplaces will have to define similar roles, and it's a mistake to believe these marketplaces succeed on technology alone.

If the capital markets analogies are to be believed, we would expect proliferation of high-value specialist roles, and consolidation of low-value transactional activities. We would expect buyers to each select the set of tools or solution providers they believe is optimal for their own situation, and they would be expected to constantly rebalance these selections as priorities change.

Summary

B2B has exploded on the scene as the capabilities of new Internet technologies developed to fill deficiencies in older business purchasing technology. The primary deficiencies of older purchasing

technology included a lack of automation for the purchase of indirect materials, and a general lack of functionality to help decision makers find and select suppliers and negotiate true market prices.

Buyer catalog tools have emerged to solve the former problem, providing automation to the previous manual process for purchasing indirect materials, and improving cost control features at the same time. Dynamic pricing technologies such as auctions have emerged to solve the latter problem, providing price transparency even in fragmented and complex global marketplaces. Other Internet tools are emerging as well, to improve upon previous purchasing technology, including collaboration tools for use within and across organizations, supply chain optimization tools that leverage Internet technology, and XML-based document standards to replace previous Electronic Data Interchange technology.

All of these new technologies provide substantial benefits. In particular, auction marketplaces have consistently shown the ability to reduce prices by 15% or more, due to improved transparency of prices and information. Buyer catalog tools are successfully reducing the cost it takes to manage a purchase requisition from $150 dollars down to $30 or less.

While providing huge benefit, B2B will also set of a strong wave of industry restructuring. When pricing is transparent, there is no place to hide inadequate cost performance. If a business survived in the protected niche of opaque pricing, newfound transparency will expose that business to unprecedented competition. And if the key success factors for a business were in its sales and marketing reach, a world of huge liquidity benefits those with excellent operations but perhaps limited sales reach. The new reality will change who wins and who loses, and total factor productivity will be the deciding factor.

In parallel to the development of Internet technologies, new business models have emerged on the Internet. Business models can vary in directionality: seller-push models, buyer-pull models, and neutral models. For most large scale industrial procurement, the buyer-pull model has emerged as dominant. Internet business models can also vary in focus: vertical focus, where the application

centers on a particular product category, or horizontal focus, where the application covers a wide range of product categories. Again, for large scale industrial purchasing, the horizontal approach has emerged as preferred. Importantly, for any given purchasing situation, the winning business model is a function of the underlying market structure. Internet entrepreneurs cannot change market structures, but must adapt the model to the structure. One of the latest incarnations of Internet business models is the multi-company consortium marketplace, owned and sponsored by companies that are horizontal competitors in their own markets. These marketplaces are assembling the basic B2B technology tools developed by technology pioneers in the five years since the Internet's emergence as a commercial medium.

Finally, if clues about the future of B2B are to be found, they will be found in careful comparative analysis of the capital markets, which have for decades been far more classically efficient than industrial markets. Such an analysis will show that far from being a simplistic model, the capital markets support an incredible variety of complementary roles and businesses, all interacting and competing to create efficiency. In the capital markets, the diverse roles include trading, research, trade clearing, money management, investment aggregation, underwriting, financial auditing, and regulatory oversight. While the capital markets have seen convergence and consolidation in common transaction infrastructures like the exchanges themselves, they have also seen a proliferation of specialty banks, brokers, money managers, and planners. It is likely that market forces will cause B2B to develop a similarly diverse set of specialty roles.

Appendix A.

To understand how business purchasing differs from consumer, particularly for so-called direct materials, it is crucial to understand how companies use existing technology to manage these purchases. Material Requirements Planning, or MRP, is a technique that has been reduced to practice through technology in most manufacturing operations. MRP can stand alone, but is often included as one function performed by Enterprise Resource Planning software.

An Example of Material Requirements Planning (MRP)

Material Requirements Planning, or MRP, describes the technique many manufacturers use to manage the production of products and the purchase of parts into the production process. In order to understand recent B2B developments, it is necessary to understand some basic information about the way MRP works, and the way legacy computer systems drive the behavior of buyers.

MRP software packages often contain other sophisticated modules in addition to the basic MRP functionality. These modules often consist of human resource administration, financial accounting, and cost accounting. When software packages such as those sold by SAP, Oracle, and JD Edwards include these modules, they are often referred to by a more lofty term as Enterprise Resource Planning, or ERP software packages. Most ERP implementations also include the functionality to perform MRP.

MRP is a manufacturer's cookbook. While a recipe has an ingredient list, a product's ingredient list is referred to as it's "Bill of Materials", or BOM in MRP lingo. The BOM specifies the quantity of each part that makes up a product. In this example, let's consider a table. A simple table might be made from two basic parts: a tabletop, and a trestle base. The trestle base might itself be made from two basic parts: legs (2 per trestle), and a crossbar connecting the legs.

MRP stores this ingredient list, including the quantity of each part necessary to make a table, as a bill of materials. MRP breaks down the BOM into parts and "sub-assemblies." In the table

example, the trestle base would be a sub-assembly—a semi-finished product that itself is assembled into a final product. It isn't unusual for a complex product like a computer to be broken down into many levels of sub-assemblies.

MRP would display the bill of materials to users in a way that reflects the sub-assembly hierarchy of the product. MRP uses indentation to reflect sub-assemblies. The "indented" bill of materials for the table might look like:

Table (part number 123)

Top, Table (part number ABC) 1 per assembly number 123

Base, Trestle (part number DEF), 1 per assembly number 123

Leg (part number GHI), 2 per sub-assembly DEF

Crossbar (part number JKL), 1 per sub-assembly DEF

Just like a cook will compile a shopping list of ingredients for a week's worth of recipes, MRP compiles a shopping list of parts for a week's worth of production. In practice, companies choose how often to run MRP. Some run MRP daily and create new shopping lists daily. Others do so less frequently. We'll use a week in this example.

The basic logic of MRP is that a company's sales force is in the field selling tables (part number 123 in the example). Every time a sale is made, the company enters the quantity of part number 123 it needs. MRP automates the process of generating the shopping list. In the example, if a company sells 10 tables, MRP will generate a shopping list for 10 tops, 20 legs, and 10 crossbars.

This example so far has been reasonably trivial. In actual practice, three factors complicate MRP:

- ***High volumes***. When a company has many products and makes many sales per day, automation helps keep product flowing smoothly.

- ***Product complexity and part re-use***. Let's complicate this example and suggest the company sells tables with maple tops and tables with oak tops. Assume both tables use the same trestle assembly as a base. Like a cook combining the ingredients list for multiple recipes, MRP must combine the requirements of multiple product variations that use common parts.
- ***Lead-time***. In order to meet a production schedule, MRP must order product in time for it to arrive and be assembled by the required date. Managing lead times is one of the most important functions of MRP.

Adding lead-time complexity to the example illustrates why MRP is necessary for large manufacturing operations. If we make the following assumptions about lead times, we can trace through how MRP works. Assume that in manufacturing, once the table top and the trestle assembly are on hand, it takes 1 week to manufacture the table, allowing for finishing steps like sanding, varnishing, and packaging. Assume that tabletops are ordered from a supplier, and the supplier requires 2 weeks to deliver a top after it is ordered, allowing them to obtain wood, fabricate the top, and ship it by truck.

If a table just consisted of a top, the total lead time would be 3 weeks: 2 weeks from order to receipt for the top, and 1 week to complete manufacturing. However, let's complicate the example further. Assume it takes 1 week to assemble the trestle base sub-assembly, once the legs and crossbars are on hand. Now assume that crossbars are purchased from a supplier who can deliver in one week, but legs are purchased from a supplier that requires 3 weeks.

The trestle sub-assembly has a total of a 4-week lead time, found as the sum of the manufacturing time (1 week) with the maximum lead time for parts (3 weeks for the legs).

So if an order for a table comes in, we can expect the total lead time to produce the table to be 5 weeks (1 week to assemble the table, plus the maximum lead time for parts (4 weeks for the trestle, even though the top is available on 2 weeks lead time).

MRP stores all of this lead-time information. The manufacturer wishes to minimize inventory as well as meet production schedules. When an order for a table comes in, MRP would run through the following logic for this example:

- Immediately order a trestle sub-assembly, because that's going to take 4 weeks, and we need to leave 1 week for final assembly
- Wait two weeks and order the top, because it only takes 2 weeks, and we need to have it on hand in week 4 when the trestle arrives.

But as soon as MRP sees the order to make the trestle, it immediately executes the following steps:

- Immediately order 2 legs from the supplier, because they require 3 weeks to deliver and we need to have them on hand 1 week before the trestle is due
- Wait two weeks and order the crossbar, because it only takes one week and we don't need it until week 3.

MRP stores information about lead-time for every part found on every bill-of-materials. Every time new sales orders are entered, MRP recalculates what is necessary to order.

If the table manufacturer wishes to deliver tables in less than 5 weeks, they can adopt some other strategies to minimize the lead-time. For example, they could choose to maintain an inventory of finished tables, and ship immediately. Or they could maintain an inventory of tops and complete trestles, and ship one week after order. Alternatively, they could seek a different supplier for legs to seek a supplier able to deliver in less than 3 weeks. Shortening the lead-time on legs from 3 to 2 weeks shortens the entire manufacturing lead-time to 4 weeks. Because companies typically seek to minimize inventory, they often employ strategies intended to shorten lead times.

Optimally, if lead times could be shortened to nearly zero, a manufacturer could adopt a complete "build-to-order" strategy and eliminate inventory while also providing excellent product availability. "Supply chain optimization" software is often employed to work with MRP and minimize

lead times, thus minimizing inventory. It relaxes the assumption that parts have fixed lead times. Rather than assuming fixed lead times, it uses optimization technology to re-query suppliers about current lead time conditions. Often, it will find lead times are shorter than the assumed fixed lead-time, and can accelerate product output when that is the case. Supply chain optimization software may often integrate with a customer's systems to *anticipate* the need for a table, rather than waiting for the customer to order the table.

An important function of MRP is to also store information about the supplier from whom to order these parts. Most parts such as the tabletops and table legs in this example are custom made, based on a blueprint and other specifications. Buyers typically select suppliers only once in a while, and then repeatedly send replenishment orders for more parts. It is not typically the case to see a buyer shop for new suppliers every time a new table is ordered.

MRP's ability to separate supplier selection from ordering is one of the significant differences between business purchasing and consumer purchasing. A consumer will often go to a store or a web site, decide to make a purchase, and complete the purchase simultaneously. By contrast, businesses often select suppliers and set prices using long-term contracts, then wait for MRP to generate the actual purchase transactions.

For B2B commerce applications, it is perfectly natural for decision making to be completely isolated from actual transactions, because transactions flow regularly out of MRP while supplier selection happens at contract-setting time, perhaps annually or less frequently.

Appendix B.

While the body of the paper addresses two major deficiencies in historical purchasing technology, namely the lack of automated control for indirect material purchasing, and the lack of functionality to create price transparency and support purchase decision making, there are other purchasing applications that are being addressed by the Internet.

Two such historical applications include supply chain optimization and Electronic Data Interchange ("EDI"). This appendix describes some of the historical deficiencies in these technologies. Internet tools are promising to address the deficiencies in these two technologies, but the solutions are less well developed.

Historical Challenges in Supply Chain Optimization

Companies have historically used supply chain optimization technology to improve upon the limitations of MRP. While MRP does a reasonably good job of keeping track of which parts to order to satisfy production schedules, it can also lead companies to have excessive inventories and slow production throughput. Supply chain optimization technology helps to fine-tune the basic application of MRP in ways that reduce inventory and speed throughput.

The two fundamental limitations of MRP addressed by supply chain optimization tools are:

- ***Assumption of fixed product lead times***. Recall that not only does MRP store the list of materials needed to make products, but it also stores the lead-time between the time MRP orders a part and when that part can be available. MRP stores a static assumption of lead-time for each part in its files. The problem is that lead times can be highly variable. Capacity utilization at suppliers, material shortages, or urgency can all affect lead times. Because manufacturers don't like to stock out of materials and miss shipments, they tend to pad the lead-time assumptions in MRP. This has the effect of

driving additional material into the factory early, perhaps before it's really necessary, and raises inventory.

- ***Inadequate calculations of production capacity***. In order to manufacture product, a company needs to have the materials but also have the productive capacity, such as labor and machine time, to make the products. MRP allowed for only very rough capacity estimates during the scheduling process. In this case, the problem is that true output capacity is determined by the capacity through bottleneck operations, and the bottleneck operation often changes as orders move through the plant. True productive capacity is often lower than theoretical capacity due to this bottleneck effect. If MRP ordered material assuming theoretical capacity and true capacity was reduced, inventories rise as material piles up behind bottleneck operations.

Supply chain optimization technology helps to solve both problems by constantly measuring capacity, identifying bottlenecks, then tailoring material orders to reflect true capacity. It also constantly optimized production schedules to maximize plant output, reducing throughput time.

Early supply chain techniques managed the flow of materials and schedules within an enterprise. In theory, if optimization technology can be used to model the processes within a single enterprise, it could be used to model the processes across the many enterprises that make up a supply chain. Solving this problem is an enormously complex challenge, in part because a typical enterprise has many customers and many suppliers, so the number of interactions required up and down the supply chain is enormous. This challenge also introduces contention, because in order to "optimize" one customer's supply chain, a supplier may have to "sub-optimize" another customer's supply chain.

The Internet can possibly address some of the complexity of optimizing supply chains across whole industries, but the challenge remains difficult. The Internet's particular value would stem from its ability to share information at low cost. Interim solutions that fall short of complete optimization

are also possible due to the Internet. For example, it's theoretically possible to communicate to suppliers two steps back in the supply chain the daily demand for end products at retailers. Knowing this daily demand, suppliers further back in the supply chain may be able to anticipate replenishment orders rather than wait for them, reducing lead times and inventory as a result.

EDI—The Historical Multi-Enterprise Electronic Commerce Application

MRP excels in processing the repetitive orders that arise during the replenishment cycle. For years, however, MRP systems have been able to communicate electronically in direct links with suppliers through a technology known as EDI, or Electronic Data Interchange. A buyer and its suppliers could use EDI even if they used different MRP/ERP systems, because EDI software handled the translation.

EDI technology is built around standard templates or documents that can be shared electronically between EDI users. The American National Standards Institute (ANSI) maintains the EDI standards specification in North America. It is referred to as the ANSI X.12 standard, and defines the data fields on many standard documents shared between buyers and suppliers. An ANSI X.12 document type 850 is a purchase order, for example.

EDI doesn't replace the MRP system, per se, but serves as an electronic conduit to forward information to and from MRP systems. So for example, when MRP generates a purchase order, that order form might be forwarded to suppliers as a paper document through the mail, as a fax to the appropriate supplier, or as an ANSI X.12 document type 850. The same information is transmitted no matter which medium is selected.

EDI is most applicable in the replenishment ordering and payment cycle. When MRP generates a new shopping list, EDI can automatically broadcast orders directly to suppliers. Because some manufacturers run just-in-time inventory replenishment systems, the daily volume of replenishment orders can be large. By receiving the order in electronic form, the supplier can automatically route the order into their systems as a sales order, speeding the flow of information

and eliminating keypunching time, cost, and clerical error. Buyer/supplier relationships that generate high volumes of transaction flows have often automated the transaction flow using EDI.

One of EDI's chief benefits is that, through the standard documents, it could connect different types of computer systems. But EDI has limitations that have led users to seek alternatives. Among EDI's limitations are:

- ***Little decision support functionality***. EDI is essentially a way to automate the clerical tasks, but adds little value to the knowledge worker who must make decisions.
- ***No user interface***. EDI historically connected mainframe computers to other mainframe computers. EDI didn't support graphical displays of complex information such as product pictures, like the Internet does through web browsers.
- ***Little specific detail about products***. While EDI can handle the basic information that constitutes a purchase order, such as quantity ordered and order price, it has little ability to carry additional information such as photos, blueprints or more technical descriptions of specific types of parts, all of which have different technical characteristics to describe.
- ***Bilateral partner architecture***. EDI installations required much time and expense to establish connections between each pair of desired trading partners. If a supplier and buyer wanted to connect with EDI, they needed to conduct a joint implementation. If a supplier used EDI with different buyers, it was possible to have to go through separate implementations for each buyer. Conceptually, a hub-and-spoke architecture that allowed everybody to connect to a single hub would present less implementation barriers.
- ***Required use of value added networks***. EDI uses private, proprietary networks that charged significant fees for usage. These proprietary networks, also called "value added networks" or VANs were offered by companies such as GE Information Services, Harbinger, and Sterling.

The costs of EDI, both in terms of network fees and in implementation costs, have severely limited the penetration and value of this technology.

Users have sought ways to use the Internet to replace EDI. Their rationale has been to:

- ***Eliminate the WAN provider***, under the logic that the Internet should be less costly.
- ***Provide more advanced functionality***, such as graphical user interfaces, collaboration, and tools useful for the intellectual decision-support functions.
- ***Incorporate more product-specific detail***, such as the technical description of many different part types, and link related documents like blueprints.
- ***Introduce a simple hub-and-spoke architecture***, where a supplier or buyer can implement "once" and be electronically connected to all other buyers and suppliers, rather than having to forge new electronic links one-at-a-time. This has the possibility of much greater penetration than under the point-to-point architecture.

While EDI has limitations, it is useful to examine how the EDI experience can be helpful in designing new electronic exchange functionality. Among the experiences from EDI that will likely be repeated in Internet applications are:

- ***Standard translation architecture for documents***. No matter what underlying technology is used, electronic transactions between buyers and suppliers will rely on agreed-upon standard document types and data definitions. An ANSI X.12 document type 850 is useful to computers because the computer can parse the information in the document and pass that information on to other electronic applications. So no matter what underlying format the document takes on, that document must be structured so that everybody agrees how to translate it.
- ***Standard-setting authority***. Some third party must typically establish the standards that define documents. In the case of EDI, the standards setting body has been ANSI. In the case of other common technologies, various standard setting bodies have taken on

the oversight role. In the case of Internet browser standards it has been the World Wide Web Consortium (W3C).

Appendix C.

While the body of the paper describes auction technology in detail, owing to the author's expertise in that area, this appendix describes how three further Internet tools are likely to provide value to commercial procurement in the near future. Collaboration tools use Internet technology to tie together into a virtual workgroup many members within a company or across company boundaries. XML-based tools will likely replace EDI as a transaction standard, using the Internet rather than value-added networks. And the Internet is a natural forum for enhancing the functionality of supply chain optimization.

Collaboration Tools

Collaboration across functions within a company and with suppliers is an increasingly important commercial activity. After years of outsourcing functions to suppliers in a drive to focus on core competencies, companies are more reliant than ever on suppliers to perform high value activities.

Collaboration has always happened. Documents have been shared through courier services, faxes, and e-mail. Interaction has happened on the phone or in person, often requiring travel cost, time, and inconvenience.

Internet tools have the promise of allowing a richer set of collaborative interactions than are available through other low cost media like telephone[17]. The Internet's ability to render multi-media content allows the convergence of voice, video, and text in one place. And the Internet's ability to reach users around the world using only simple browser technology has the promise to connect even businesses that have limited budgets for information technology.

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[17] Collaboration tools are available from companies like MatrixOne and Nexprise. FreeMarkets Desktop™ is an Internet collaboration tool customized for the purchasing function.

Internet collaboration tools promise a number of benefits. Some collaborative activities are directly related to purchasing, while others are useful even within companies and across divisions. Among the benefits:

- ***Up-to-date information***. One barrier to good decision-making is keeping a whole team of people up-to-date with current information. Information often gets dated when document revisions are not made available. It has been hard historically to know whether a document draft is the latest, or has already been superceded. One of the hallmarks of most Internet collaboration tools are document management systems to ensure that documents of all types are kept up-to-date. When a document has been modified, other users can be notified.

- ***Clear workflow and project management***. Complex team structures and project plans are difficult to manage. It is hard to keep everybody working on the correct tasks when schedules are changing. Most collaboration tools include excellent project management and workflow features. Workflow automatically forwards information to approvers, for example. And if a team wants to add another approver, they can merely program that addition and the new approver gets included at the next possible interaction. Collaboration tools can present personalized information to users, showing them all of the projects with which they are currently involved.

- ***Speed***. Because travel time is eliminated and workflow tools move information along, the time spent waiting for decisions, approvals, or meetings is reduced. This allows more iterations of work to occur in shorter periods, speeding completion. In so many industries, time-to-market for new products is among the most important marketing objectives. Any time saved due to collaboration tools helps achieve time-to-market goals.

- ***Better decisions***. Poor decisions often result when the proper team members aren t included in the decision making process, or when decisions get behind schedule. Internet collaboration tools, by reducing the cost of participation, can accommodate more

complete teams. The one extra design engineer or the expert from overseas might be the source of a breakthrough.

Collaboration tools are often purchased for use internally across departments and divisions. Recent use has turned to using collaboration with outside suppliers. User companies can choose how much they elect to integrate collaboration tools with other enterprise applications, but less integration is typically required than with tools that touch accounting or ordering systems.

Collaboration tools can be mixed with other B2B building blocks. During the preparation stages of an online auction, for example, collaboration tools can be used to manage the workflow and communication with participating bidders.

XML-based EDI Replacement

If an Internet technology replaces EDI, it's likely that XML, or Extensible Markup Language, will be the technology used to do so. XML does not per se provide standards for the exchange of business documents, but is a language that can be used easily to describe and process standard document types. As an underlying technology, standard documents based on XML would have some fundamental advantages over traditional EDI. Among the advantages would be:

- ***Natural language features***. A human being can read a well-structured XML document. Rather than being a long list of characters in special format, XML documents can contain instructions in natural language that can be read.
- ***Browser enablement***. Rather than being a computer-to-computer protocol, XML documents can contain formatting instructions and use certain browser features to display information to users in attractive and useful formats.
- ***Ability to define rich documents***. While EDI documents define the "least common denominator" information needed to conduct commerce, such as prices, part numbers, and quantities, XML is seen as a way to define much richer information in standard documents. So instead of just describing price and quantity, parts could be described by

their material type, dimensions, finish specifications, color, and packaging. This richer information would allow companies to further automate order processing software, optimization software, and logistics management.

- ***An open integration layer technology***. When companies have different computing systems and wish to share information, they must typically define interfaces or data formats by which they exchange information. XML is an excellent technology to use in creating data formats and exchanging information, because it is inherently customizable. XML is the core technology that software companies promote to make different software systems compatible with one another.

Because XML is a technology and not a commercial standard, users of XML could cause proliferation of different document formats just as easily as they could cause consolidation of document formats around standards. With no obvious standards setting body for commercial XML documents, software vendors have created their own document definitions. Standards for such documents typically either result from coordinated standard-setting activity by a body like ANSI or the W3C, or through the commercial success of one commercial version until it becomes a de facto standard. The advantage of a standards body can be a shorter time to full adoption, although standards setting bodies tend to work slowly. The advantage of commercial competition is that innovation may create a faster and/or better solution than would be chosen by a standards setting body.

In XML, standards are being pursued for business commercial interaction by at least a few standards setting bodies. Rosetta Net is a not-for-profit standard setting consortium principally involving companies in the electronics industry. Microsoft has been sponsoring its BizTalk initiative to promote some commonality in document definition.

While XML promises interesting and powerful new applications, the legacy implementations of EDI will likely persist for some time. First, XML does not yet have widely adopted standards. Second, while the value of new XML tools might be high, the switching cost out of EDI and into a replacement

will be significant. Third, while some technologies like auctions are easy to phase in, EDI represents more of an "all-or-nothing" infrastructure approach requiring a complete replacement rather than a phasing-in. Fourth, EDI does have its proponents, as well as a significant installed base, providing adoption resistance to replacement technology.

It is likely that commercial competition between XML applications will persist for some time, and because the technology is in its infancy, this innovation competition is probably good for the future of the medium. It is also likely that traditional EDI, while not growing, will continue to run for some time

Internet-Based Supply Chain Optimization

While supply chain optimization technology has been very successful when implemented within a single enterprise, few have mastered the art of optimizing up and down the supply chain. There is great promise, for while manufacturers have eliminated inventory and sped throughput within their own walls, inventory and slow throughput elsewhere in the supply chain still results in costs passed through to consumers.

The Internet's potential to assist in supply chain optimization stems from its ability to distribute or share information in real time. Suppliers benefit greatly by being able to view weeks into the production schedule at their customers, so they may anticipate the timing and volume of orders. When manufacturing schedules change, suppliers would like to be able to react.

Before the Internet, this type of information sharing required trading partners to implement sophisticated complementary technology. Because buyers deal with many sellers and vice versa, the number of implementation combinations could be excessive and conflicting. One implementation of XML-based document standards is to allow a common way for buyers and suppliers to exchange production-planning data, and to exchange requests and acknowledgements between systems as they seek optimal schedules.

Another key driver of Internet-ready supply chain management systems is to tie customer-facing sales applications through to back-end manufacturing applications in a way that allows true build-to-order manufacturing. Dell Computer has shown the world how a sophisticated supply chain management approach to manufacturing can be turned to advantage in sales. Customer orders on the Dell website are automatically scheduled through manufacturing in real time, allowing the website to nearly instantly tell a customer the date an order should be ready for shipment. And as soon as the order is received, the manufacturing orders are issued. Suppliers are able to very quickly adjust to the flow of inbound orders.

Many industries have sought to emulate the Dell example, including automotive, where there would be tremendous value in a high-speed, inventory-free supply chain. Finished automobiles typically spend 2-3 months in transit and on dealer lots, creating costs for interest, storage, damage, and discounting that occurs for clearance sales.

Appendix D.

Buyer catalog tools are one of the significant Internet innovations for business purchasing. Some of the functionality of buyer catalogs is explained in the paper's body, but further detail is incorporated here, owing to the importance of these tools to buyers and consortia marketplaces.

Buyer Catalog User Experience

An end-user buying through a catalog tool would typically conduct some variant of the following steps:

- ***Link to the catalog on corporate intranet site***. The browser-based catalog is often displayed to users through a corporate intranet site. The user would use the intranet to link through to the catalog.
- ***Log into catalog application***. The catalog application can provide security features so only authorized users may make orders. Once logged in, the system can retrieve information pertinent to the individual user, such as authority levels and past purchases. The system can deliver user-specific authorized content.
- ***Browse and select products***. The catalog will present to the user lists of commonly ordered items, such as toner cartridges, paper supplies, and shop tools. Rather than filling in a traditional paper requisition, the user checks off items to purchase and indicates quantities. The catalog content may be maintained by the buying company's purchasing organization, or may be maintained by a supplier previously selected to populate items into the catalog. In some cases, the user will be sent out to a supplier's own website for additional product information, or to find items not maintained in the official catalog.
- ***Launch orders***. When finished selecting products, the user can launch the order. One of the control features the catalog tool provides is instant authorization checking. Because the catalog knows which user is logged in, the catalog tool can instantly look up

in a database the previously stored purchasing approval information for that user. For example, say the user has a $2,000 limit on purchases, and is restricted to ordering products in the office supplies category. If the order falls within those limits, the catalog can instantly approve the purchase based on these stored rules for that user. The catalog might further check whether the accounting system has sufficient budget to cover the purchase, and in the event the company is already over budget, it may reject the order or flag it for additional approval. Should the user submit an order in excess of his or her previously stored limits, the catalog can look up the name of the supervisor who would be required to approve the order, and automatically forward that supervisor an e-mail indicating that an order needs to be approved.

- ***Approvers approve orders***. When a supervisor receives e-mail notification of an order that must be approved, that e-mail will direct the user with a link to the catalog application. The approver will log in and be presented with a queue of one or more orders requiring approval. After review, the approver can either check off his or her approval, or can reject or amend the order. In some cases, approval is sought in parallel from two supervisors. For example, when purchasing a new computer, the approval might go to a user's supervisor for budget approval, and to the systems manager to evaluate compliance with company standard equipment policies.

- ***Orders are placed with vendors***. Once an order is approved, the catalog automatically forwards the order to the vendor previously approved to provide that product. Typically, the buyer and vendor will have a blanket contract in place to establish the prices and terms under which products are bought. Buying organizations typically negotiate specific discounts in these contracts, so the prices stored in the buyer's catalog will differ from the seller's list prices.

- ***Products or services are received***. While direct materials are typically shipped to a receiving dock and logged into inventory, indirect materials are typically shipped directly to the end user. Office supplies, for example, are typically sent directly to the

department that requested them. However, the receiving function is an important control typically lacking for indirect material. The catalog tools typically provide the user a way to log receipt of product back into the system, so that the order can be closed out and the vendor paid.

The buying organization gains huge benefits from the functionality of the buyer catalog. First, it eliminates much of the manual effort needed to complete paper-based requisitions. Second, it constrains end-users to buy only approved product from approved vendors, maximizing the value of negotiated discounts. Third, it completes the control cycle by creating a receiving function, preventing suppliers from duplicate invoicing. Finally, it creates a record of all purchases at the part-number level of detail that allows managers and financial analysts to measure the results of better deal negotiation or campaigns to reduce usage.

Buyer Catalog Setup

Buyer catalog tools require a significant investment to set up. A typical buyer catalog implementation would experience the following steps:

- ***Catalog installation***. The company or a systems integrator configures servers and installs the catalog software tool. The tool typically requires complex systems interfaces into the underlying accounting and human resources systems in place at the company. These interfaces are necessary for the catalog system to look up budgets, for example, or know when an employee is terminated and should no longer be allowed to access the catalog.
- ***Vendor selection and price negotiation***. Because the buying organization uses the catalog as an electronic gatekeeper, one of the most important setup steps is to determine which suppliers to admit, and to negotiate the terms of purchases made through the catalog. This step is not automated per se by the catalog, but is traditional sourcing. Auction marketplaces can be helpful at this stage.

- ***Catalog content population***. Once vendors have been selected and prices negotiated, the catalog has to be loaded with the data that is presented to users. Typically, suppliers are asked to provide data in a specified format that can be loaded into the catalog database. However, suppliers may not always be capable of supplying the information in catalog-ready form. It is not unusual to have many thousands of items to maintain in a buyer catalog.

- ***Authority and budget maintenance***. Each catalog user must receive user identification and login credentials. For each user, the system must store information about their authorized purchase categories and budget limits. The catalog uses this information to filter what is displayed to each user.

- ***Approval workflow configuration.*** Companies must determine to whom to route approval requests based on various rules. Rules can be tailored to specific departments, specific product categories, specific dollar values, or based on whether budgets are sufficient.

- ***Catalog operation.*** Once the catalog is installed and running, it needs to be monitored and maintained. Users invariably begin to request new product categories. Certain suppliers fail to perform and must be replaced. Information about purchasing trends can be mined from the catalog databases. These ongoing functions are required to make a successful catalog implementation.