E-PROCUREMENT IN THE MANUFACTURING INDUSTRY: PERCEPTIONS OF BRAZILIAN MANAGERS

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E-PROCUREMENT IN THE MANUFACTURING INDUSTRY: PERCEPTIONS OF BRAZILIAN MANAGERS

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ABSTRACT

The possibility of using the Internet to source suppliers and to carry out corporate purchases has caught the attention of the IT industry and procurement departments of many organizations. Enthusiasts say that, in addition to reducing cycle times, e-procurement generates substantial cost reductions. This paper discusses the results of two surveys involving 105 Brazilian manufacturing companies on the issue. Respondents were asked if the Internet had caused or was expected to cause changes to corporate purchasing. The results support findings of previously reported studies, which show that e-procurement is more often used to purchase indirect materials than for direct materials. They also show that larger companies use e-procurement more extensively. By revealing the current degree of use of the Internet for corporate purchases and for interaction with suppliers, this paper broadens discussion on this topic, which is extremely relevant to today's business organization.

Keywords: E-procurement, purchasing, Internet

INTRODUCTION

No one knows exactly how far Internet-based procurement systems can take corporate purchase activities, but the use of such systems is increasing steadily. There is even some discussion of what *e-procurement* actually means. For Bannan (2003), it is any method used for electronic interaction with suppliers. Roche (2001), by contrast, says that *e-procurement* refers to the automation of the purchase process as a whole, such as making order information available over the entire supply chain. Still other researchers, such as Pyke and Johnson (2003), consider that e-procurement refers only to the acquisition of materials that can be purchased from a broad range of potential web-based suppliers thereby stimulating competition and ensuring favorable prices are offered. In other words, for Pyke and Johnson (2003), e-procurement does not allow for collaborative relationships to develop with suppliers since it emphasizes competition as an inherent part of this process in its definition of the term.

Regardless of the extent to which one believes new technologies can be used or how they are used, the fact remains that the possibility of using the Internet to source suppliers and to carry out corporate purchases has caught the attention of the IT industry, as a whole, and procurement departments of many organizations, in particular. Its enthusiasts say that, in addition to reducing cycle times, e-procurement provides substantial cost reductions.

When highlighting the benefits of the addition of an electronic procurement system, Unisys (2001) points out that saving 10% on materials has the same impact on the organization's profitability as a 12% increase on sales or, alternatively, the reduction of 42% of labor costs. A survey of IT executives, mentioned by Unisys when polled on this issue, estimates that the pay-back of e-procurement systems occurs in less than one year. 53% of the survey's respondents considered e-procurement as important, or more important, than selling the company's products on the Web. Fisher (2000) also emphasizes the benefits of e-procurement, highlighting the fact that, in addition to reducing direct costs, those who implement these systems also improve efficiency, as they reassess the way they operationalize their purchases when doing so. In Fisher's opinion, when one significantly reduces the number of suppliers, administrative costs fall and the organization develops a more strategic focus with respect to corporate purchases.

Less enthusiastic about the positive impacts of e-procurement, Gilbert (2000) expresses some trepidation that Internet procurement systems implementations may resemble the frustrated ERP implementations of the 1990's. He thinks it is important that organizations are aware of the risks involved prior to embracing large projects that promise spectacular results. To support his assertion, Gilbert discusses the problems faced by several companies while implementing procurement systems and their integration to other corporate systems. Bannan (2003) also warns about the possible resistance of suppliers to the methods used for e-procurement. After all, companies do not like to see their products and services converted into commodities and that is what usually happens when a system is used that overemphasizes the price to determine purchases. Furthermore, reducing purchase costs is the main reason for customers to start using e-procurement, according to Tanner et al.'s (2008) findings. Besides, e-procurement systems usually demand additional work by the suppliers, who may need to feed information into a different system for each customer.

The Butler Group, quoted by Fisher (2000), points to four major reasons for the adoption of e-procurement:

- the possibility of aggregating the purchases of several departments or divisions, thereby improving the company's bargaining power and the chance of getting volume discounts;
- the reduction of purchases from unlisted suppliers that do not comply to quality standards;
- the creation of a more conservative purchase policy, balancing price and quality issues;
- the development of a better understanding of overall discrepancies in price, quality, delivery speed and reliability.

In addition to the benefits highlighted by the Butler Group, e-procurement may also:

- improve transaction processing, thereby increasing speed and making it more accurate while also allowing for lower levels of inventory to exist and for faster response to stock-out situations;
- improve order information traceability;
- reduce or eliminate unnecessary or redundant purchases and purchases made by unauthorized personnel;
- improve managerial information made available by the procurement function and the information flow over the supply chain, allowing for the identification of demand trends, improving forecast quality and reducing the devastating consequences of the Forrester effect, which consists of the amplification of demand for a product along the supply chain when

there is demand fluctuation in a stage closer to the consumer (SAAB e CORRÊA, 2004). The demand amplification causes inventory costs to increase or the service level to decrease (GRAEML and MARQUES, 2004).

The above mentioned benefits provide a practical reason for companies to consider e-procurement and for academia to further study its deployment.

This paper analyzes the current use of the Internet and other electronic networks to support pre-contractual phases of corporate purchasing processes (e-sourcing) and the execution of commercial transactions with suppliers (e-procurement). Data was collected by means of two surveys of 105 manufacturers in the state of Sao Paulo, Brazil. The surveys were carried out 3 years apart from each other and gathered information on 105 companies. Further details on the process of data collection and analysis will be provided in the Methodological Procedures section.

The next section will discuss some possibilities of the use of e-procurement for sourcing suppliers, and purchasing direct and indirect materials. After that, the methodology will be presented, followed by a discussion of the results and the conclusions of the study.

E-SOURCING

Internet search engines have turned the Web into a powerful source of easily accessible information about potential suppliers, which can be located directly by means of their own websites, via links from the websites of their customers or suppliers, in discussion or service lists, or via other Internet resources. Ozer (2003) considers that the Internet reduces the required time to locate a possible supplier significantly. He uses the example of a cut-device manufacturer that needed to source a supplier for a very specific part, which demanded very strict quality standards for the construction of a prototype. Since it was impossible to locally locate a supplier, the company performed a Web search. This resulted in four potential suppliers, all of which were technically capable of producing the required item, sending in their quotations in less than a week. Ozer says that, in the past, the same company would spend at least two months to identify possible local suppliers and then wait a few more weeks until it could receive a quotation in response to its request.

Dai *et al.* (2005, p. 142) also believe that Information technology (IT) is fundamental to e-sourcing, specially the Internet. They suggest some reasons:

- The Internet enables and enhances global sourcing practice, which is driven by pressure for purchasing savings exerted on purchasing managers by top executives.
- The Internet allows prequalified suppliers from around the world to bid for a firm's sourcing needs.
- The prevalence of ERP implementations provides operational data to feed the e-sourcing platform.
- The availability and affordability of on-demand computing, or third-party application services, makes e-sourcing cost-effective and easy.

Moreover, the authors summarize their *e-sourcing* definition as: “the use of business software (for example, using application service providers to conduct online procurement auctions) to automate or augment a firm's strategic sourcing - the key business process to identify, evaluate, configure, and negotiate purchases in important spend categories while managing long-term supplier relationships” (Dai *et al.*, 2005, p. 142).

In the same way, Engelbrecht-Wiggans and Katok (2006, p. 581) argue that “… *e-sourcing* has become an important tool for procurement”. For them, *e-sourcing* is “[…] a catchall term that refers to the use of internet-enabled applications and decision support tools that facilitate competitive and collaborative interactions among buyers and suppliers through the use of online negotiations, reverse (decreasing bid) auctions, and other related tools”.

Another interesting point of view comes from Dai *et al.* (2005, p. 144) that consider the entire *e-sourcing* business process, not merely the auction. According to them, this process includes not only the procurement auction but also activities that happen before the auction (e.g., purchasing process preparation) and after the auction (e.g., contract execution), which have been missing in the literature, but are crucial to *e-sourcing* business practice.

BARTEZZAGHI and RONCHI (2005) studied the buyer-operator-seller perspectives of *e-sourcing* and highlight a few benefits and criticalities: there is price reduction and efficiency increase in the overall process; the number of suppliers tends to decrease, while demand aggregation increases. They consider that the reduction of the purchase price is mainly due to the possibility of receiving many more bids than in the past, arguing that the more critical the purchase, the higher the reduction in the price. In the past the buyer had more bargaining power in dealing with the supplier for simple purchases. Now, even when the characteristics of the purchase required deep technical competences the buyer is able to set a competition between among several competent suppliers.

PURCHASE OF INDIRECT MATERIALS

Indirect materials are products and services that are used to support a company's operation, such as office gear, furniture, computers for the administrative area, business trips, entertainment, etc. (SCHENECKER et al., 1998; REID e SANDERS, 2004).

As such materials do not have a direct impact on the quality of the product/service, organizations are, in general, less strict about the adopted purchase procedure. For these types of products, price is usually the major purchase decision factor. As a result, companies are always looking for a means of establishing competition among possible suppliers, so that they can decide on the one that offers the best momentary conditions for the purchase. As indirect materials are not essential to the production process, they offer little risk to the company's performance in the market in case there is any problem. Thus, they are the first elements organizations feel comfortable buying through the Internet (or by any other new means) (FISHER, 2000).

Although there are companies that choose to create their own Internet hub to concentrate their transactions with suppliers, avoiding the risk of conducting their purchases through an external hub, electronic exchanges have spread throughout the Web. For most companies, the solutions that are widely available on the Web are enough. Among them, electronic markets (hubs) and online reverse auctions are the most common and will be discussed next.

Electronic exchanges

The appearance of electronic markets promises to generate great transformation in corporate procurement procedures. Unisys (2001), for example, estimates that 55% of companies' purchases online refer to cheap non-strategic products (indirect materials), which are bought in bulk.

In some industries, even otherwise competitors are creating or stimulating the use of electronic markets to carry out group purchases of indirect materials in order to achieve scale economies that would not be possible if each performed on its own (BANNAN, 2003). One such exchange, which received a lot of exposure recently, is Covisint, used for business transactions and collaboration among companies in the car making industry. Covisint is supported by the large automobile assemblers and has been in operation since 2000. Participating companies in the Covisint initiative expect to reduce their purchasing and development costs by 16%, which is expected to represent savings of ca. US$1,000 per car, according to Reid and Sanders (2004). These authors remind us that, in January 2003, Covisint already had more than 76,000 suppliers as members.

Online reverse auctions

Another Internet resource with which companies are experimenting for the purchase of indirect materials is the reverse auction, which follows an opposite logic to the types of auctions with which most people are familiar. In the case of online reverse auctions, companies stimulate their suppliers to bid and wait until they get the best offer. They inform the market of the maximum price they are willing to pay for the product or service and potential suppliers respond with their proposals in the form of successive bids, issued over a short period of time, until one of the bidders proposes a value that cannot be outbid by its competitors (OZER, 2003; MENEZES, SILVA e LINHARES, 2004). The auction is concluded after a set period of time without new bids or when the overall time for the auction expires.

As this kind of purchase arrangement concentrates on the price, it is useful for items that do not present great variability and for which there are plenty of possible suppliers. It is also important that suppliers clearly understand the specific requirements of a request, according to Ozer (2003).

As a purchase strategy, online reverse auctions only make sense for items of little impact on the company's product (OZER, 2003; MENEZES, SILVA e LINHARES, 2004), which are manufactured by companies with which the organization doesn't intend to establish a long term relationship based on trust and commitment such as are typical of a 'win-win' relationship. In the same way, also Engelbrecht-Wiggans and Katok (2006) belive that:

> In practice, reverse auctions are often combined with noncompetitive mechanisms when used for procurement. These combined (or hybrid) mechanisms are used as a way to capture the benefits of auctions (competition) while at the same time allowing the buyer control over whom to do business with (p. 593).

Engelbrecht-Wiggans and Katok (2006) remind us that price is not the only dimension used to generate value for the buyer. They also consider that hybrid mechanisms leave more room for communication, making them more attractive to suppliers than stand-alone auctions. An organization may choose to offer a noncompetitive contract to a long term supplier with a proven track record for quality and delivery reliability, after an auction is used to establish a reference price that could be negotiated with the noncompetitive supplier, accounting for the higher quality of its product. The authors suggest that "a small part of the business could be auctioned off to establish the baseline price and also discover new potential suppliers. Auction winners get an opportunity to prove themselves to enter into a longer term contract in the future" (p. 594).

On the other hand, according to Jap (2007), the online reverse auction experience can affect the buyer's interorganizational relationship with suppliers in two ways: through the supplier's experience over the course of the auction and through the auction outcome itself. He still adds: "The buyer cannot determine the auction outcome *ex ante*. However, the supplier's experience in the auction is, in large part, a function of the buyer's *ex ante* choices regarding the auction design" (p. 146).

PURCHASE OF DIRECT MATERIALS THROUGH THE WEB

Direct materials are those that are used directly as raw materials or components in the organization's production process (SCHENECKER et al., 1998; REID e SANDERS, 2004).

Although companies still resist using electronic exchanges to purchase raw materials, it is possible that the level of acceptance of this procedure will increase in the future. This may occur if electronic exchanges prove to be a safe and reliable means for trading goods. Many researchers, notably Fisher (2000) and Bannan (2003), however, believe that electronic exchanges may never become the best way of purchasing products for which there is a great level of specification demanding a closer relationship between buyer and seller. Gilbert (2000) mentions the Texas

Instruments case in which that company considered that the problems that need to be solved for the purchase of direct materials were completely different to those related to the purchase of indirect materials. Checking operational costs, negotiating discounts with suppliers and ensuring that purchases are carried out according to the contracts were details that had been resolved long ago with regard for the purchase of direct materials, in the opinion of Alan Daniel, Texas' e-procurement manager, when interviewed by Gilbert. The challenge now is, according to Daniel, to improve the communication with suppliers about levels of inventory, cycle times and delivery dates, i.e., it involves intensifying the integration and collaboration with business partners.

Companies will achieve better results from their *e-procurement* systems if they are integrated into the supply chain of the other participants, allowing for better communication among partners and the exploitation of the advantages related to a more efficient information flow with direct impact on the level of inventory. Fisher (2000) reminds us, however, that, such integration is "easier said than done". The problem is that there are many cultural, organizational and technological barriers to be overcome, before the organizations are able to adopt complete integrated e-business solutions along the whole supply chain.

The issues related to the improvement in the coordination and integration of business partners will be discussed in the next section.

Extranets

Organizations started using the Internet to visualize content that was being openly made available by other companies and in order to publish information about themselves that they considered to be convenient and relevant for general access. However, the Web soon also began being considered a good platform for the publication of content of restricted interest, as users became acquainted with its environment and available resources, reducing the cost and the need for additional training. As a result, many organizations started to structure internal networks using tools and services that were similar to those of the Internet but that protected them from external access. Such internal networks, used to make information available and to share it among the company's employees, are the so-called intranets.

After developing intranets, the next step was to allow business partners to have access to part of such a network or to networks developed specifically for them with the purpose of improving the communication and integration of the supply chain links. That is how extranets came about. They are networks that use the Internet's infra-structure and services, uniting the organization and its suppliers/customers, in a protected way, while preventing the access of other parties (O'BRIEN, 2001).

Having presented the most common uses of the Internet to support corporate purchases, based on the review of the literature, the next section will describe the methodological procedures adopted to collect the data for this study.

METHODOLOGICAL APPROACH

The research project that provided the data analyzed in this paper was developed to improve the understanding of how Brazilian manufacturing companies use the Internet to support their strategies and business practices. This paper, specifically, discusses possible uses of the Internet for e-procurement and corporate purchases.

Manufacturing companies of Sao Paulo, the most industrialized state in Brazil, were surveyed on two different occasions:

- from November 2003 to February 2004
- from November 2006 to February 2007

The questionnaire was pre-tested in 2003 with respect to the content, having been presented to a group of executives working in the field. They gave important contributions that made questions more accessible and understandable to the actual participants, at a later stage. With respect to the format, the authors randomly separated one per cent of the whole database and sent the questionnaire to those companies a month in advance, for the 2003/2004 survey. No changes in format were required as a result of the pre-test. No pre-test was carried out for the 2006/2007 survey, because the questionnaire was almost identical to the one applied in 2003/2004.

The convenience sample used for this research project consisted of respondents that participated of both surveys (2003/2004 and 2006/2007). The fact that the sample was a convenience sample (only companies that agreed to participate were taken into account) means that it could not be considered a probabilistic distribution of the population. Although no simple and definite solution was found to ensure sample representativeness, measures were taken to improve the 2003/2004 survey's sample acceptability. One hundred companies whose e-mail addresses contained in the database proved invalid were contacted by telephone and asked to provide an alternative (working) e-mail address. In addition to that, one hundred companies that did not have any e-mail address in the database were contacted by telephone, with a request for an existing e-mail address. The great majority of them did provide a valid e-mail address.

The researchers were especially concerned with issues of similarity between the convenience sample and population because the survey was about the manufacturing companies' use of the Internet and companies were being contacted electronically, which could be argued to be biasing. The two hundred additional phone calls to non-respondents (invalid e-mail and no e-mail in the database) helped refute that possibility and led the researchers to assume that surveyed companies did not represent a biased sample of the population.

For the 2003/2004 sample, comparisons were also carried out with respect to demographic data available in the database about the population. No evidence was detected of significant differences between sample and population. On the contrary, χ^2 tests based on the location of companies (region within the state of Sao Paulo) and size were very favorable.

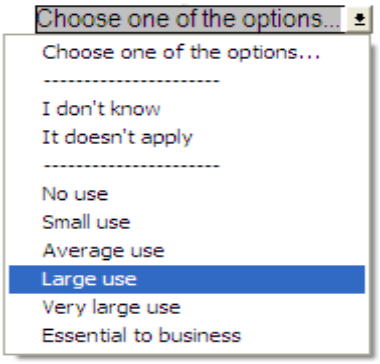
For the 2006/2007 sample (a sub-sample of the previous one) the only additional precaution was the χ^2 test with respect to the size of surveyed companies. It was not possible to check similarity with the population with respect to location because location possibilities were many and the size of the sample was not large enough (105 respondents).

In 2003/2004, companies were contacted through an e-mail message that had an MS Word automated form attached to it. The questionnaire needed to be returned by the respondent after completion. 655 answers were obtained, which represented ca. 8% of the companies with valid e-mail addresses in the database.

In 2006/2007, participants were also surveyed electronically. However, instead of the form being attached to an e-mail message, companies only received an electronic message indicating the survey's website and inviting them to participate. 105 companies provided valid answers, corresponding to 16% of the population (the convenience sample of the 2003/2004 survey).

The two surveys consisted on the same set of questions, which could be quickly answered by clicking the mouse on the suitable alternative from drop-down menus, such as those shown in Figure 1.

What is the level of usage of the tool [name of tool] made available by the Internet?



What is the level of change caused by the Internet in the way your company performs [activity]?

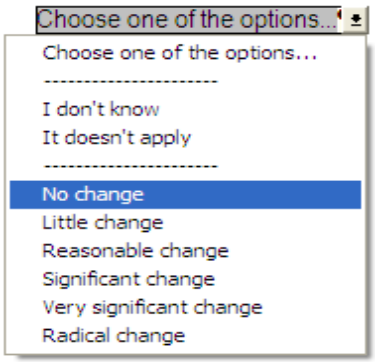


Figure 1 Drop-down menus used in the surveys

The next section presents the results that were achieved for the following questions included in the survey that the participants filled in Nov2003/Fev2004 and again in Nov2006/ Fev2007:

- Did the Internet change the way your company bought indirect and direct materials over the last 3 years?
- Does the company use, or intend to start using within the next 3 years, online reverse auctions, exchanges or the company's extranet to purchase goods or services?

The data from companies that only participated in the 2003/2004 survey was disregarded. The analysis focused on the answers given by the 105 companies that participated in the two surveys. That was necessary because the researchers wanted to depict the influence of time. Of course, collecting data at two different moments is not enough for a truly longitudinal study, but it helps when detecting trends, which can be further studied in the future using more suitable methods.

Another reason for using the 105 companies that participated in the two surveys was that the respondent was exactly the same person in the two occasions for 88 of them. It was not possible to identify the respondent for 11 companies and only 6 companies definitely had their data reported by two different people. The fact that, for the most part, the same people filled in the questionnaire in 2003/2004 and in 2006/2007 improves the comparability of the two samples. One should keep in mind that surveys deal with perceptions, which may vary from one person to another, even if they belong to the same organizations and are faced with the same situations.

ANALYSIS OF THE RESULTS

According to what was discussed above, the Internet may be used in order to source new suppliers, as well as to actually carry out corporate purchases and/or to exchange information with business partners. Several researchers stress the benefits of using the new media and technology, also remarking that e-procurement will develop faster for indirect materials (that do not have a direct impact on the products and services that are offered by the company to the market) than for direct materials. Next, the results of the two surveys will be presented, in a comparative way, showing how the Internet is being used by manufacturers in Brazil in order to source and purchase goods and services.

Changes to the way indirect materials are purchased

In Figure 2, as well as any of the other charts in this paper, the values that appear inside the rectangles that comprise the horizontal bars indicate the number of companies of that size that provided a specific answer to the question (see the color legend). The horizontal axis has a percentage scale, which is used to convert the absolute values contained in the rectangles into

percentages. This scale should be read from left to right. For example, 5 companies said that there was a radical change, 3 considered that it was very significant and 22 said it was significant, when questioned about the purchase of indirect materials in 2006/2007. As 105 companies answered the questionnaire (sum of the absolute values contained in all rectangles of the horizontal bar), the horizontal axis reads that a little less than 30% of the respondents ((5+3+22)/105) stated that the Internet's impact was at least significant. In 2003/2004, 22% ((5+18)/105) of the respondents had that perception.

Analyzing Figure 2, one realizes that the perception of the Internet's impact on the purchase of indirect products has grown over time for companies of all sizes, which may be an indication that companies are, in fact, increasing their use of the Internet for that purpose.

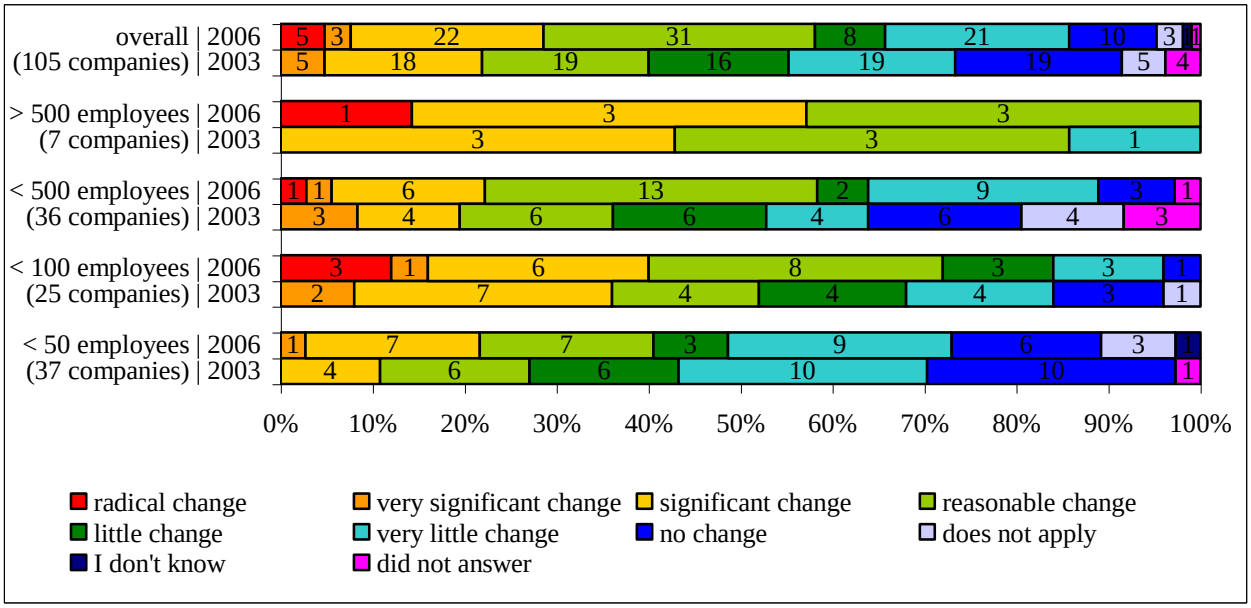


Figure 2 Participants' perception of the impact of the Internet on the purchase of indirect products, depending on the company's size (2003/2004 and 2006/2007)

Changes to the way direct materials are purchased

As the literature review predicts, although there is evidence of growth in the impact of the Internet on direct materials' purchase when the 2003/2004 data are compared to the 2006/2007 data (see Figure 3), this impact is less relevant, according to the respondents' perception, than the impact on indirect materials' purchase.

Participants didn't show the same enthusiasm for using the Internet for direct materials' purchase as they did for indirect materials. That can be easily underlined by contrasting the data in Figure 2 with the data in Figure 3. This is in keeping with the literature, which stresses that companies first experiment with e-procurement of indirect materials because they do not affect their operation, if something goes wrong.

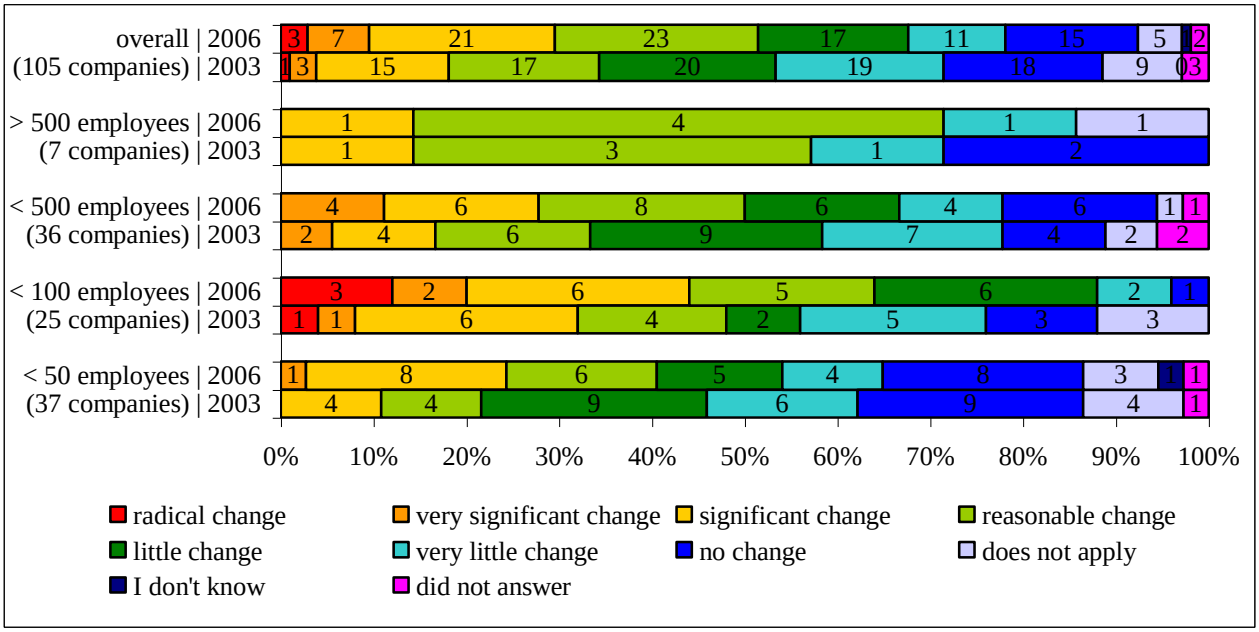


Figure 3 Participants' perception of the impact of the Internet on the purchase of direct products, depending on the company's size (2003/2004 and 2006/2007)

It is interesting that the difference between the percentage of companies that stated that the Internet had at least a reasonable impact on the purchase of indirect and direct materials was very significant for large companies. Mid-size and small companies did not feel such difference, according to Table 1 below.

Table 1 Percentage of companies that noticed at least a reasonable impact of the Internet on their purchase operations, over the last 3 years

Size	Indirect materials		Direct materials		Difference indirect - direct	
	2003/2004	2006/2007	2003/2004	2006/2007	2003/2004	2006/2007
Overall	41.0%	58.1%	34.3%	51.4%	6.7%	6.7%
> 500 employees	85.7%	100.0%	57.1%	71.4%	28.6%	28.6%
< 500 employees	36.1%	58.3%	33.3%	50.0%	2.8%	8.3%
< 100 employees	52.0%	72.0%	48.0%	64.0%	4.0%	8.0%
< 50 employees	27.0%	40.5%	21.6%	40.5%	5.4%	0.0%

This could be the result of a greater concern by large companies of the possibility of having the quality of their products affected by poor quality materials or unreliable suppliers sourced through the Web, when compared to smaller size companies.

E-procurement

Participants were also questioned about their intention to use e-procurement over the next 3 years (see Figure 4). Comparatively, the data shows an evolution in the intensity of use of e-procurement. Ca. 30% of the overall companies said that they used e-procurement tools at least moderately, in 2006/2007. This percentage was only 18% three years earlier (2003/2004). Still, a considerable percentage of the companies that had claimed that they would start using e-procurement soon, in 2003/2004 seem to have postponed their plans. Intentions didn't necessarily convert into action.

Another interesting finding is that there was a decrease in the number of participants that answered "I don't know", which could mean that respondents have become more aware of the importance of e-procurement (particularly in small and mid-size companies). Maybe this is a result of the fact that large companies are using this tool more aggressively, thereby calling it to the attention of managers of smaller companies.

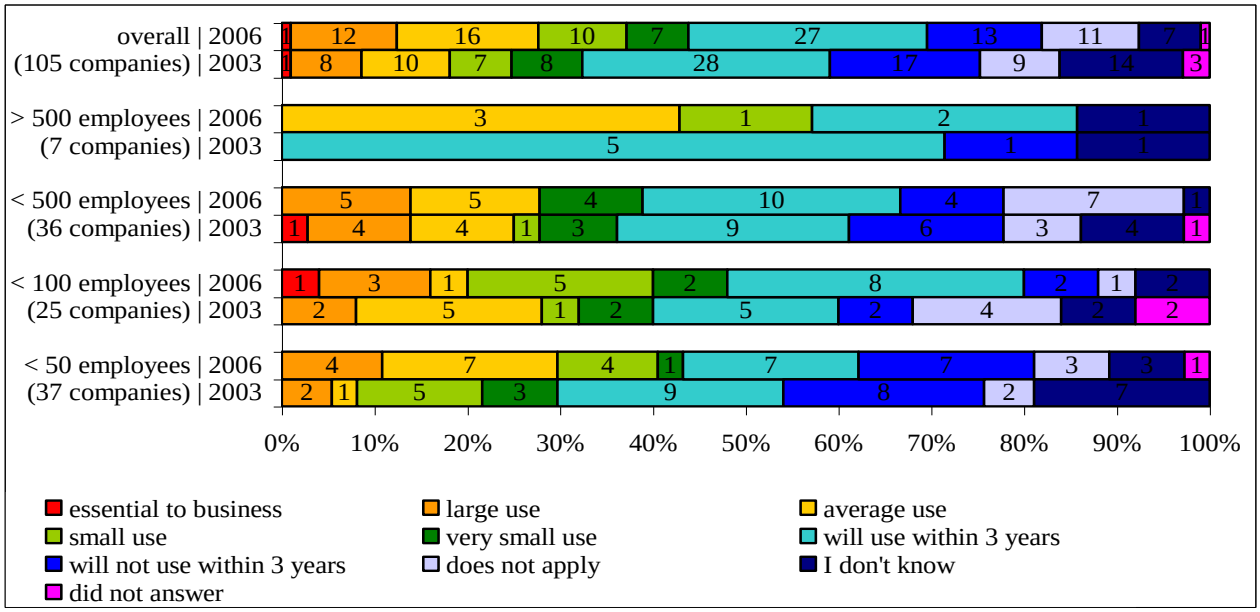


Figure 4 Current use and perspective of future use of e-procurement, depending on the size of the company (2003/2004 and 2006/2007)

Use of Internet tools to perform corporate purchases

The survey also included questions that intended to evaluate the intensity of use (or the intention to use in the near future) of some tools that are available on the Web and can be used by the procurement function. Thus, respondents were questioned about the use of reverse auction, exchanges and the company's extranet as ways to relate to suppliers. The results will be discussed next.

Online reverse auctions

Reverse auctions are a kind of auction where companies bid and the winner is the one that accepts the lowest price (or the most favorable terms to the customer) in exchange for a product or service, as was stated earlier. Naturally, there is a trend towards the concentration of competition in price, which can be easily compared. This characteristic makes this tool more suitable for products that do not have much variation in perceived quality.

Figure 5 shows the results for the question about the use of reverse auction.

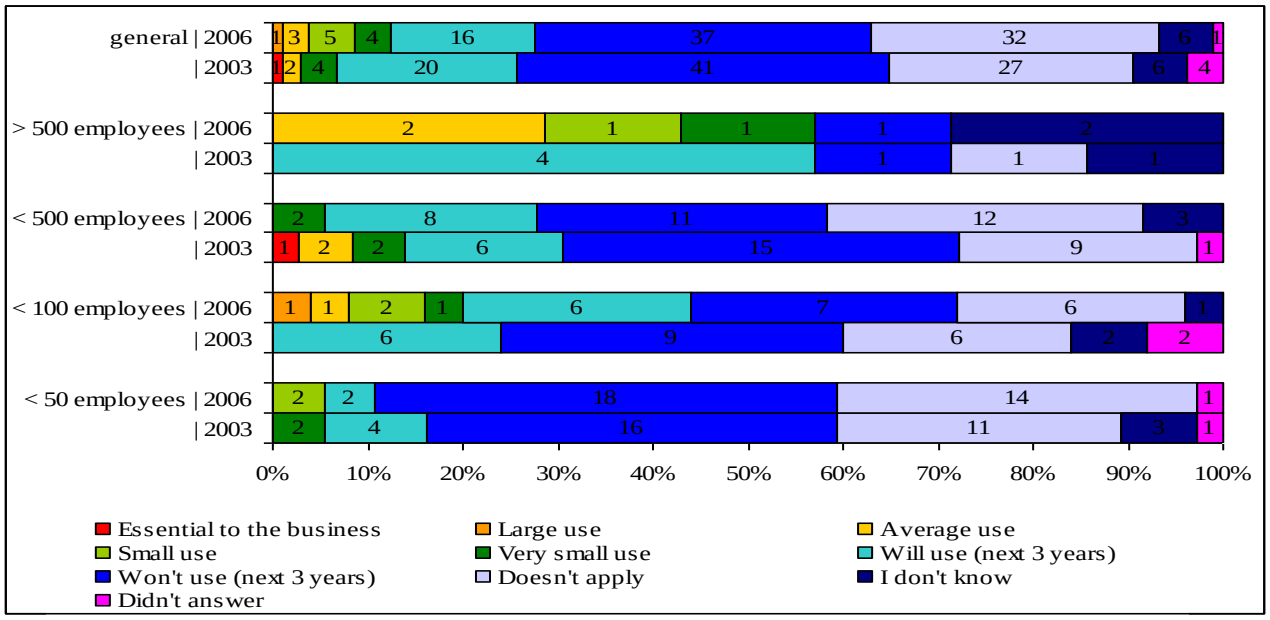


Figure 5 Current use and perspective of future use of reverse auction, depending on the size of the company (2003/2004 and 2006/2007)

A few e-mail messages were spontaneously sent by respondents, together with their answers to the survey, where they showed concern with the way Internet purchases are going. The respondents didn't seem pleased with having to participate in reverse auctions. They claim that the focus is only on the price and argue that this prevents them from exploring other possible competitive edges, particularly quality, as anticipated by Bannan (2003). In their opinion, this contributes to an undesirable "commoditization" of their products.

Maybe this is the reason for such low level of adoption of this resource (see Figure 5). One notices that only among large companies there was a more significant increase in use, although only two of the eight respondents claimed that that they make reasonable use of reverse auctions. More than 70% of all surveyed companies do not use this tool, will not use it within the next three years, or consider that it does not apply.

Exchanges

Although there is high expectation about the possibility of using Internet exchanges for corporate purchases in the literature, the current level of use of this resource is low, as can be seen in Figure 6. If one examines the bars concerning the consolidated data for companies of all sizes (overall), one notices that boxes "does not apply" and "we will not use within the next 3 years" actually expanded. That was partially the consequence of boxes "I don't know" and "did not answer" shrinking, but it also results from the decrease in the intention of use ("will use within the next 3 years"). Once more, this seems to reflect the increase of the respondents' awareness about the possibilities offered by the new technologies, which allows them to take a stand and decide what is good for their organizations, even when that means not using, or intending to use, a tool that is made available. However, in spite of the retraction of the number of those who intend to use exchanges for their corporate purchases from one survey to the other, many companies still plan to do so. Note that the light blue boxes are the largest ones in Figure 6.

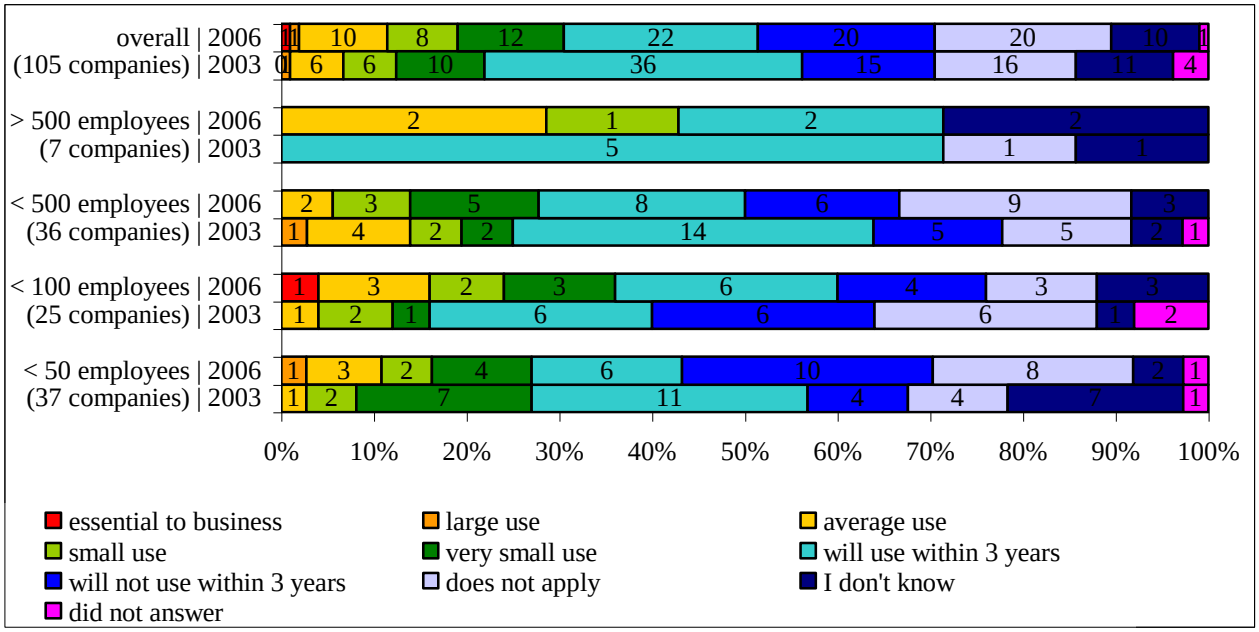


Figure 6 Current use and perspective of future use of Internet exchanges, depending on the size of the company (2003/2004 and 2006/2007)

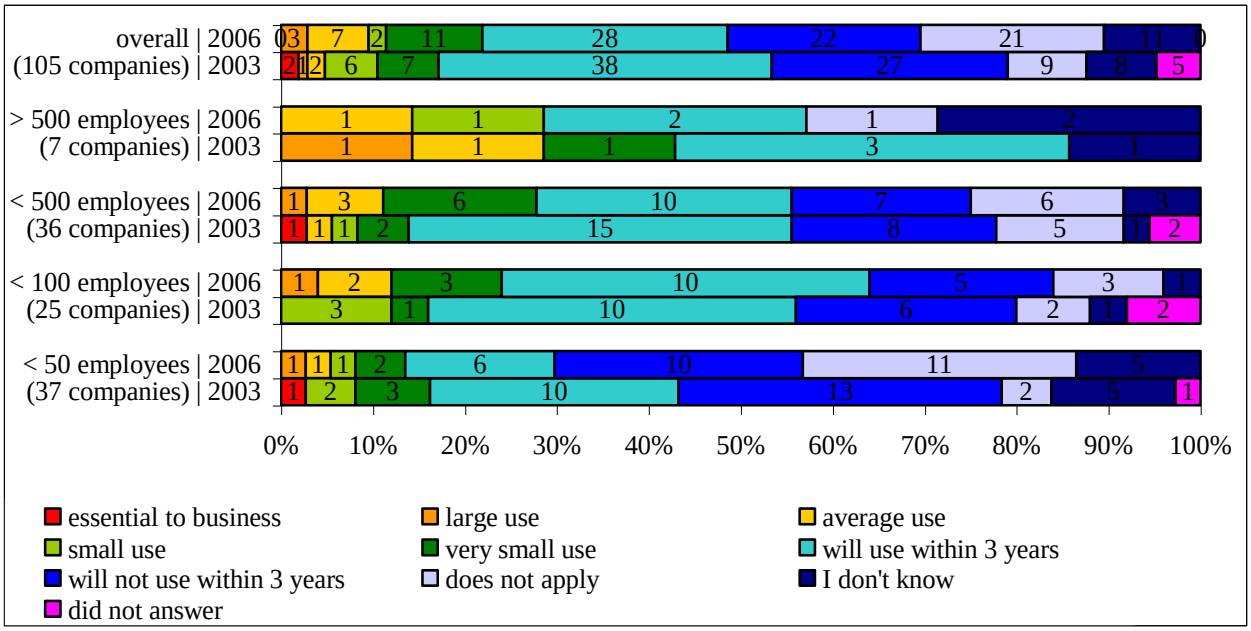


Figure 7 Current use and perspective of future use of extranets, depending on the size of the company (2003/2004 and 2006/2007)

Extranets to communicate with suppliers

Similar to what occurred with the exchanges, extranets also presented low levels of use. It should be highlighted, though, that, in spite of the little increase in extranet use, the intention of future use remains high for the next few years. For very small companies, i.e. those with less than 50 employees, one notices a curious fact: after 3 years, many of the small companies that intended to use it, changed their minds or realized that extranets are not applicable to their businesses (see Figure 7).

CONCLUSIONS

The surveyed companies have gone through considerable change with respect to the way they purchase goods and services, over the last 3 years, using the Internet to support sourcing and procurement activities. This was shown in Figures 2 and 3. The study confirmed that the Internet is being used more intensively to acquire indirect materials rather than direct ones, as shown in Table 1. This supports the findings of other previous academic studies on the issue.

Here, it was found that larger companies use the Internet for corporate purchases to a greater extent than smaller ones.

The interval of time between the application of the two surveys was 3 years, with the purpose of determining if the respondents' expectations since the previous term were confirmed. After all, most questions in the survey included an alternative that showed the respondent's intention to use a tool within the next 3 years, in case the company still didn't use it. The authors were particularly interested in finding out how intentions about the future would convert into action, considering that intending to do something does not involve assigning resources for that to happen, which makes it easier to foresee future use rather than actually doing it.

A new application of this survey after another period of 3 years (maybe in 2010) will help to determine if larger companies will always use electronic means to perform corporate purchases to a greater extent than smaller ones, or if they are just ahead of the curve in the adoption of such practices. The same survey may also be used in different geographic areas, to check if the patterns detected here (the State of Sao Paulo, in Brazil) are similar in other places.

The success of e-procurement does not result from just the automation of the existing purchasing activities. They need to be reconsidered and adapted. The Internet allows companies to communicate and interact with suppliers in a way that was not previously conceivable. But, for that to happen, it is necessary to provide the suppliers with information that used to be considered strategic and secret, such as, for example, the inventory profile for raw-materials and finished goods.

When that happens, suppliers may assume a more active role in commercializing their products, offering them to customers at the precise time they become necessary. They may even have to gain control over the customers' inventory, becoming responsible for their replenishment decisions. This will only take place, however, when companies understand the supply chain as one large enterprise - at least in the sense that it is not possible for one of its links to succeed alone in the market at the expense of the other links in the chain. From this perspective, it will be important to carry out further studies that check if the use of the Internet is contributing to the improvement of collaborative relationships between manufacturing companies and their suppliers or if win-lose relationships will prevail through the Web.

Some of the changes discussed in this paper will likely cause changes in power relationships within companies and along the supply chain, which will result in resistance by those who consider the current situation more comfortable. This may delay changes or even block them, if there is not good organizational leadership to show the way.

REFERENCES

BABCOCK, C. (2003) The network effect. **InformationWeek**, n. 950, p. 62-63, Aug 4-11, 2003.

BANNAN, K. J. (2003) The pulse of the supply chain. **Internet World**, v.9, n. 1, p. 22-25, Jan, 2003.

BARTEZZAGHI, E.; RONCHI, S. (2005) E-sourcing in a buyer-operator-seller perspective: benefits and criticalities. **Production Planning & Control**, 16(4): 405-412.

DAI, R.; NARASIMHAN, S.; WU, D. J. (2005) Buyer's efficient e-sourcing structure: centralize or decentralize? **Journal of Management Infoftnation Systems**, 22(2): 141-164.

ENGELBRECHT-WIGGANS, R.; KATOK, E. (2006) Theory and behavior in reverse auctions with noncompetitive contracts. **Management Science**, 52(4): 581-596.

FISHER, A. (2000) Understanding e-procurement. London: **Financial Times** (FT.com), 2000. Available at: http://specials.ft.com/eprocurement/FT3AC3PXKFC.html. Visited: 26/02/2007.

GILBERT, A. (2000) E-procurement: problems behind the promise: **Informationweek.com**, 2000. Available at: http://www.informationweek.com/813/eprocure.htm. Visited: 26/02/2007.

GRAEML, A. R.; MARQUES, R. F. (2004) The Beer Game, an implementation for use over the Web. In: Second World Conference on POM and 15th Annual POM Conference, Cancun, Mexico. **Proceedings of POMS**, 2004. p. 1 CD-ROM.

JAP, S. D. (2007) The impact of online reverse auction design on buyer–supplier relationships. **Journal of Marketing**, 71 (1): 146–159.

MENEZES, R. A.; SILVA, R. B.; LINHARES, A. (2004) Leilões eletrônicos reversos multiatributo: uma abordagem de decisão multicritério agregando valor às compras públicas no Brasil [Multiattribute reverse auctions: a multicriteria decision approach adding value to government purchases in Brazil]. In: Encontro da Associação Nacional dos Programas de Pós-Graduação em Administração, 29o., Curitiba. **Proceedings of ANPAD**, 2004. p. 1 CD-ROM.

O'BRIEN, J. A. (2001) **Sistemas de informação e as decisões gerenciais na era da internet** [Information systems and managerial decisions at the Internet era]. São Paulo, : Saraiva, 436 p., 2001.

OZER, M. (2003) Using the Internet in new product development (managers at work). **Research - Technology Management**, 46(1): 10-16, Jan/Feb, 2003.

PYKE, D. F.; JOHNSON, M. E. (2003) **Sourcing strategy and supplier relationships: alliances vs. eProcurement.** the practice of supply chain management. Boston,: Kluwer Publishers, 2003, 749 p.

REID, R. D.; SANDERS, N. R. (2004) **Operations management**. New York: John Wiley & Sons, 704 p., 2004.

ROCHE, J. (2001) Are you ready for e-procurement? **Strategic Finance Magazine**, 17 Apr, 2001.83(1): 56-59.

SAAB, J.; CORRÊA, H. L. (2004) The Forrester effect reduction: one size fits all? In: Second World Conference on POM and 15th Annual POM Conference, Cancun, Mexico. **Proceedings of POMS**, 2004. p. 1 CD-ROM.

SCHENECKER, M., *et al*. (1998) Goodbye to old-fashioned EDI. **InformationWeek**, 73: p. 73-80, Dec 14, 1998.

TANNER, C., et al. (2008) Current trends and challenges in electronic procurement: an empirical study. **Electronic Markets**, v. 18, n. 1: 6-18., Jan, 2008.

UNISYS. (2001) e-Procurement: buying into the future, 2001. Available at: http://www.unisys.com/home/e-procurement/ Visited: 01/11/2001.