

AN ASSESSMENT ON THE INFORMATIZATION OF BRAZILIAN INDUSTRIAL COMPANIES

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ABSTRACT

This paper reports on a study about the adoption and use of Information Technology by Brazilian industrial companies, related to technology infrastructure, information systems, Internet, human resources and investments. Concepts related to the subject are discussed and the results of a descriptive survey carried out in 326 small, medium and large Brazilian industries are presented. The results indicate that there are statistically significant differences among the three sizes of companies considered in the research. There are evident differences in the adoption and use of the technology and these differences seem to be related to the size of the company. These differences do not result from economic shortcomings or difficulties the companies have in accessing the investigated resources. Although the paper does not specifically address problems of policy making regarding the reduction of these differences, it presents a framework for analyzing the patterns of informatization in industrial companies, and the results themselves offer parameters for comparing IT utilization in industries in other countries.

1. INTRODUCTION

This work aims to study some of the key aspects involved with the adoption and use of Information Technology (IT) by industrial companies. The importance of the intensity and extension of IT use in private companies becomes clear when the great technological differences between developed countries and the so-called emergent countries, as is the case of Brazil, are taken into account. The process of adoption and dissemination of information technology use is important for the country to further develop and improve its capability to compete in the international business scenario. In Brazil this process is generally designated by the term “*informatization*” which will be adopted in this work. Later a more precise meaning will be assigned to the term.

Initially, our work proposes a model for the evaluation of organizational information technology adoption and use, establishing the dimensions according to which the extent of adoption and intensity of use by the companies may be considered. Based upon this model the work presents the results of a descriptive survey carried out on a sample of 326 industries in the State of São Paulo divided by size into small, medium and large companies. Several variables were analyzed for the purpose of comparing these groups of companies. Greater emphasis was given to the analysis of the extent of IT adoption in small and medium companies to identify differences and characteristics in relation to large companies. It is important to observe that the data were collected near the end of 2002. We consider that

our results remain valid considering that during the years 2000 and 2001 the country experienced expressive economic development and that it decelerated significantly starting at the middle of 2002, with a new acceleration beginning only at the end of 2004.

The results of this research allow several conclusions regarding informatization in Brazilian industrial companies and suggest that the proposed model may serve as a basis for the development of a method to quantify the extent of informatization in industrial companies. This method is at the present time being developed by the authors through a confirmatory factorial model based on indicators of IT resources, IT management and IT outcomes and which allows the computation of an "informatization level" for each company (Zwicker et al., 2005). The method is also being employed to evaluate the informatization level of industrial companies in the State of São Paulo and the results of this evaluation can be found at www.idigital.fea.usp.br (in Portuguese).

2. INFORMATIZATION AND ITS DIMENSIONS

According to Lim (2001) and Azad, Erdem and Saleem (1998), governments of various developing countries have shown concern about the level of IT usage by their organizations, companies and society. For these authors, competition within their countries and participation of their companies in the global market rests upon, among other factors, the attainment of certain levels of IT usage that have to be reached by their society and industries. Public policies and telecommunication infrastructure must be able to contribute to raise the levels of IT use. Another significant issue is the education required to graduate knowledge workers who will develop and use information technologies as a means of achieving business competition and social-economic development.

In this perspective, the South Korean National Computing Agency defines *informatization* as the process of "converting the main goods and energy of a social economy to information through the revolution of high data communication technology and utilizing information produced by gathering, processing and distributing data within the vast fields of the society" (Lim, 2001, p. 144). Here the importance of the generalized utilization of information technology in the entire society is implicit. Concern with this aspect is highlighted in Brazil through the *Green Book* edited by the Information Society of Brazil (Takahashi, 2000). Furthermore, several authors consider specifically the informatization of organizations as one of the important supports for adoption of information technology by the society as a whole. The term "informatization" may also be associated with the concept of "Digital Enterprise", defined as an "organization where nearly all significant business processes and relationships with customers, suppliers and employees are digitally enabled, and key corporate assets are managed through digital means" (Laudon and Laudon, 2001, p. 6).

An important aspect associated with the informatization concept is its evaluation. Tu (2002) presents a model to appraise IT use in industrial companies considering the extent to which an organization uses information systems (IS) to promote organizational integration and offers support to decisions and strategic planning. The four dimensions of organizational use of IS in the model proposed by the author are:

- (1) *operational decision support*: IS used to monitor, coordinate and improve the decision process related to operational activities;
- (2) *strategic planning support*: IS used to devise, coordinate and improve long term planning procedures;

(3) *internal integration*: IS used to facilitate the exchange of information and the coordination of activities within the organization and;

(4) *external integration*: IS used for communication with elements outside of the organization such as clients, suppliers, banks, etc.

Doll and Torkzadeh (1997) presented similar dimensions for the organizational use of information systems, dividing them into three categories: *decision support* (to assist problem solving); *work integration* (between processes and between hierarchy levels) and *client service* (IS used “to attend people” whether they belong to the organization or not).

We also can derive important aspects of informatization from the concept of “T(technology)-form organization” (Lucas, 1997). A T-form organization uses information technology to become highly efficient and effective. The intensive use of IT in such organizations leads to the following characteristics:

- Flattened organizational structure, due to the intensive use of support tools for work groups;
- High degree of assignment of tasks and of trust between subordinates and managers;
- Infrastructure composed of networks and computers internally and externally connected;
- Strong and qualified IT management;
- Setting up of temporary task forces for projects including elements within the organizations, suppliers and clients with use of remote labor.

In the T-form organization the technology is a transformation agent where the effectiveness of the transformation can be measured along the following dimensions: results of IT use, IT infrastructure adjustment, IT management and integration of processes and organizational hierarchies.

3. RESEARCH MODEL

In this work, *informatization* corresponds to a process of managed adoption and use of IT resources by an organization to support, develop, and optimize its performance. Each company possesses an informatization level which reflects its extent of adoption and intensity of use of the information technology. The dimensions that will be taken into account in this study to characterize the informatization intensity of an organization are:

- (1) *Infrastructure*, related to the availability of hardware, basic software and communication technology;
- (2) *Use*, related to the utilization of information systems and Internet resources and their outcomes on the company;
- (3) *Management*, related to the human resources and investments of the IT area.

The *use* dimension encompasses the horizontal integration (between processes and activities of the value chain), the vertical integration (between hierarchy levels), the external integration (with partners, clients and suppliers), decision support and the achievement of competitive advantage based upon innovative use of IT. This defines the research model, shown at figure 1, which delineates the structure and content of the descriptive survey carried out at the companies.

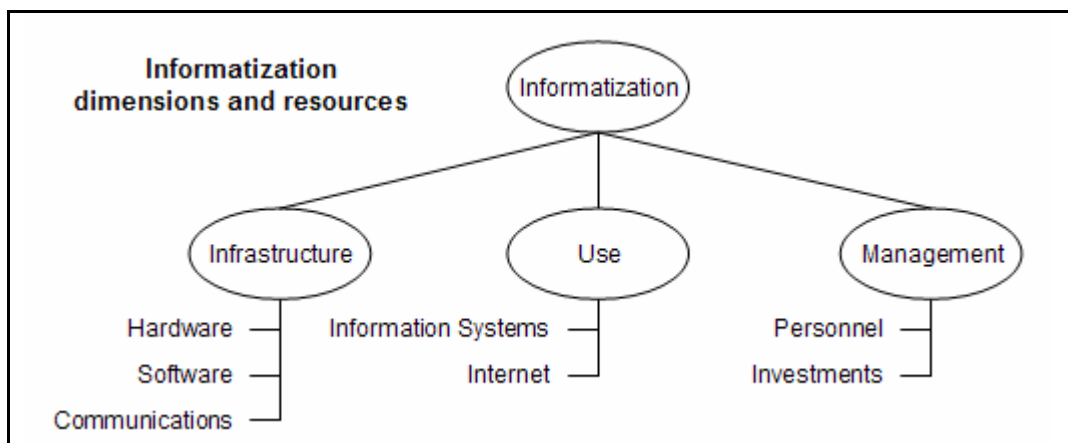


Figure 1 - Research model

This model relies upon the typical IT resources available in the companies as a means of analyzing their informatization. These are resources of a concrete nature which in principle can be immediately accounted for. The respondents also subjectively measured IT contributions to the companies to assess the effects of the use of such resources. The model's main objective is to ensure a theoretical view of the informatization extent, consistent with the Brazilian context where the model was tested.

The *management* dimension that appears in the model should not be interpreted in the broad sense of the IT management discipline. According to Prenkumar (2003), IT management comprises many aspects (such as competitive advantage, planning and organization) that can have a decisive effect on the informatization of an organization. The proposed model does not take into account all these aspects nor does it characterize the influence of the external environment and the organizational environment on the process and corresponding informatization level.

Moreover, the managed dissemination process of IT adoption and use, according to the definition of informatization, must be carried out to develop the organization, striving to optimize its performance. This may be a controversial premise, since reliable causal relationships between IT use and the performance of an organization have not yet been established. In this survey the companies were requested to assess the contributions of IT use to some of the aspects of their performance; however, taking into account the objective of the study and the particularity of the gathered data, the discussion of the impact of IT use on performance aspects will not be expanded in this work.

4. RESEARCH METHODOLOGY

This study was conducted together with the Federation of Industries of the State of São Paulo (FIESP), which represents the trade associations of the controllers of industrial companies in this state, the most industrialized of Brazil. Data was collected by a questionnaire sent to 3,000 companies with a return of 383 replies. A total of 57 replies were rejected because they did not complete the questionnaire and 326 replies were considered adequate for this survey (about 11% of the total submitted). Data collection took place in November and December of 2002 and was carried out by sending the printed questionnaires and the access password for the Internet version to all selected companies.

The original sample was developed to meet the following premises: (a) FIESP decided on a total of 3,000 companies for the sample; (b) the 534 large companies of FIESP data base were included; (c) 50% of the sample should be of large and medium and 50% small size companies and; (d) 1,781 companies that had already participated in another similar survey, carried out in 2000 (FIESP/FIPE, 2000), were included in the sample. The remainder, chosen randomly, was based upon FIESP complete records.

There were 13,977 companies in the FIESP data base divided into 534 large (3.8%), 2,833 medium (20.3%), 9,497 small (67.9%) and 1,113 micro (8.0%) ones. Stratified sampling into 50% small and 50% large and medium companies aimed to include a significant number of medium and large companies that would allow for comparison among the three groups. Overall results cannot be directly extrapolated to the population (FIESP data base) but they can be analyzed and extrapolated by size. The respondent companies were divided by size according to FIESP criterion: companies with 1 to 9 employees are considered micro, those with 10 to 99 are small; from 100 to 499 are medium and above 499 are large. Companies that did not report the number of employees were ranked according to FIESP records. Due to the small number of micro companies obtained in the sample, for the analysis of this work, companies with 0 to 99 employees were considered small.

The survey instrument aimed to assess the intensity of IT use in internal management and business of the companies according to the proposed dimensions (*infrastructure, use and management*) is presented at appendix F. Results are presented according to these dimensions and describe the main IT resources (hardware, software, computer networks, information systems, Internet, personnel and investments) employed by the surveyed companies, as well as their application and impacts on business. Statistical analyses were performed with SPSS for Windows version 11.0.

5. DATA ANALYSIS

5.1 Description of the Sample

Table 1 presents the number of companies, according to size, in the sample obtained. The computed distribution maintains correspondence to the distribution of the sample that received the questionnaire. Observe that the standard deviation for the annual revenues is indeed high. Appendix A shows additional sample statistics.

Table 1
Sample characteristics

Size	Sample		Average Annual Revenues (US\$ thousands)		Total Employees			% of Blue-Collar Employees			
	n	%	mean	std dev	n	mean	std dev	n	mean	std dev	n
Small (<100)	149	45.7	1,700	2,300	120	45	26	139	64%	19%	138
Medium (100-499)	99	30.4	15,400	18,000	76	226	102	87	76%	16%	84
Large (>499)	78	23.9	168,300	217,900	57	1,998	1,912	63	76%	20%	55
Total	326	100.0									

5.2 Infrastructure Dimension

According to significance tests at appendix B and the graph at figure 2, the three groups of companies did not present significant differences regarding the total number of computers (amount of desktops, laptops and palmtops) per employee, and the sample's overall average is 0.30 units. If only the employees of the administrative areas are taken into account on the

denominator, then the test points to significant differences among the small, medium and large companies. Clearly, in the case of larger companies, the difference points to a significantly greater usage of computers than in the case of small companies. In the large companies the number of laptops and palmtops per administrative employee is significant, which may indicate that the production areas also use these equipments. The number of servers per PC in small companies is double of that in large companies. A possible explanation for this difference may be that large companies achieve “scale earnings” through the usage of more powerful servers and because small ones have networks with a lesser number of PCs, but requiring at least one server.

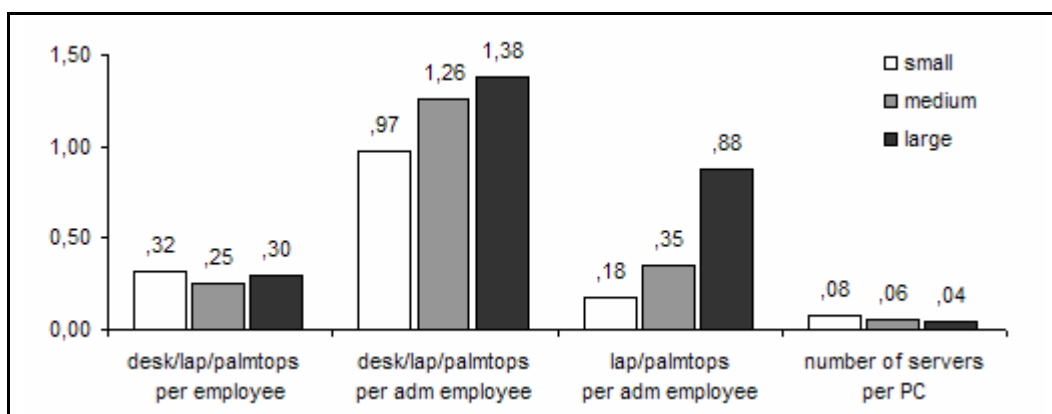


Figure 2 - Usage of computers

The percentage of medium and large companies that have networks installed and the percentage of network connected PCs in these companies, according to the graph at figure 3, are quite similar. In the case of the small companies a statistically significant difference was observed in relation to these queries, showing that 38% of these companies do not have networks and that networks encompass only 71% of the available units. In the case of the number of PCs connected to the Internet, small companies differ statistically from the large ones, with a higher percentage of units connected. Possibly this is due to the fact that in the large companies PCs are more likely found in sectors dedicated to internal processing such as the production area. The figure also shows that the small and medium companies have a lower percentage of mobile units than the large companies.

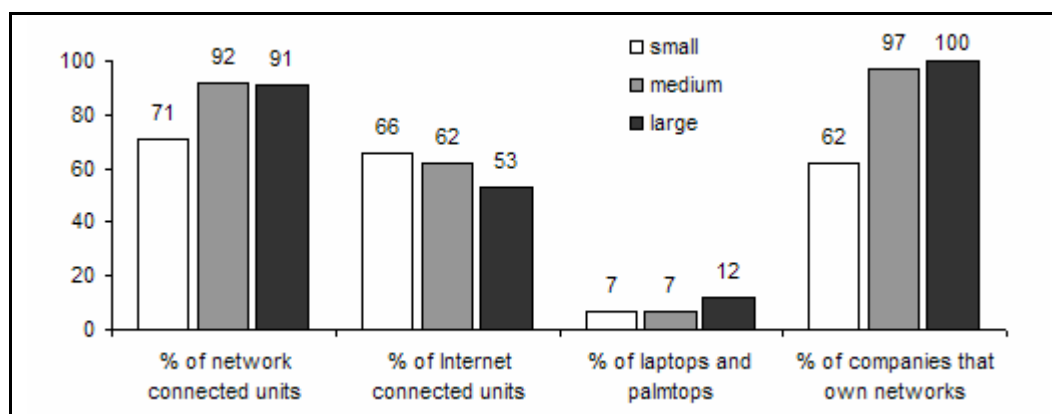


Figure 3 - Connectivity and mobile computers

With regard to Internet access Table 2 shows that large and medium companies connect primarily through high speed lines, while almost half of the small ones still utilize

access through a dialed telephone line to paid providers (such as ISPs). For the small companies, access to Internet by means of a dialed connection is a low cost alternative that currently fully meets the requirements of these companies.

Table 2
Internet access mode

Access Mode	Small		Medium		Large	
	Cases	%	Cases	%	Cases	%
Free dial-up providers	7	4.5	0	0.0	1	1.0
Paid dial-up providers	66	42.0	2	3.1	15	15.6
Broadband access with up to 256 kbps	61	38.9	24	37.5	42	43.8
Broadband access with up to 512 kbps	14	8.9	16	25.0	25	26.0
Broadband with more than 512 kbps	9	5.7	22	34.4	13	13.6
Total	157	100.0	64	100.0	96	100.0

5.3 Use Dimension

5.3.1 Information Systems

Surveyed companies were requested to tell how they obtained their information systems and the scope of these systems. Concerning scope, companies were requested to say if they had or did not have information systems or modules of integrated systems that encompass the areas shown in figure 4.

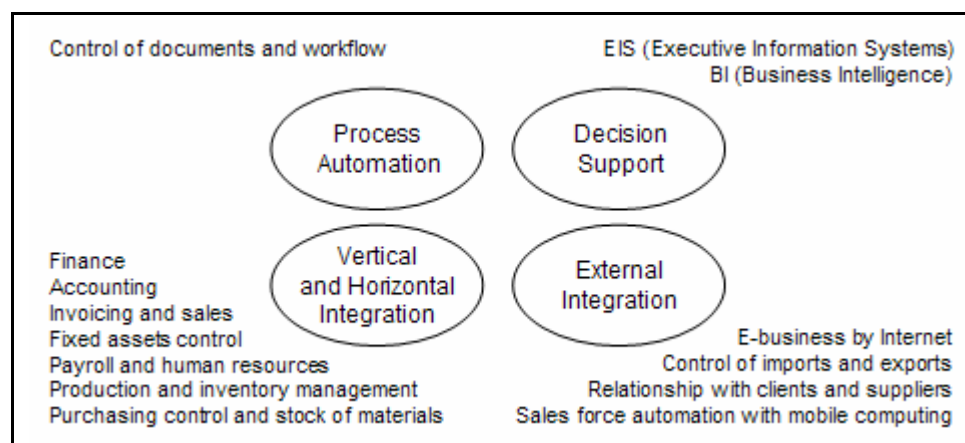


Figure 4 - Scope of the companies' information systems

The companies described how the modules or information systems were obtained as follows:

- Internal development*: software developed by technical personnel from the staff of the company;
- Outsourced development*: software developed by outside specialized personnel or by a hired company;
- Isolated package*: ready-made software, purchased from a specialized supplier, encompassing only one type of function or sector (for instance: accounting package) and;
- Integrated package (ERP)*: ready-made software, purchased from a specialized supplier that meets in an integrated manner more than one type of function or sector.

All types of packages described by the companies as integrated, either Brazilian or foreign, were considered as ERPs independently of the size or extent of the product or

supplier. It is noteworthy that this understanding agrees with the use of the term ERP by Brazilian suppliers of software to the small and medium size companies. In Brazil the term “ERP” is utilized in a more encompassing manner than in other countries and even companies that implement the package without the modifications required in their planning and production processes, regard themselves as users of ERP systems.

It is interesting to observe that many solutions adopted by the Brazilian companies, especially the small and medium, combine different types of implementation. To support the simpler and standardized business processes (such as like accounting, payroll and patrimony control), often subject to the rules of the Brazilian legislation, the companies tend to adopt readymade packages (integrated or not). On the other hand, to support more specific business processes that are directly related to the goals of the company, such as planning, manufacturing programming and control, sales and customer relationship, companies tend to adopt software developed internally or by third parties, so as to obtain a customized solution for their business, even though most of the time it will be incomplete. Especially in the case of the small and medium size companies, where the control of operations and the management style reflect the actual experience of its controllers -- depending on the activity sector -- the solutions result from specific, specialized and adaptive development. This development is usually led by small size software companies, which implicitly also end up supplying consultancy services for the company businesses.

Relative to vertical and horizontal integration, figure 5 shows that large and medium companies have more transactional systems or modules implemented than the small ones. The numbers are 6.7 for large, 6.5 for medium and 5.2 for small companies out of a total of possible 7. Relative to external integration, figure 5 shows that for the case of the front office modules, large companies stand out in contrast to the medium and small companies. However, even in the case of the large ones it can be seen that the implementation of modules of this group is still at the early stages (1.4 out of a possible 4). As shown in figure 6, the percentage of transactional systems which are ERP modules is significantly lower in small companies. The option of using ERP system modules to supply front office systems is more limited, as shown by the percentage of these systems that are ERP modules in each company. The corresponding significance tests are outlined at appendix C.

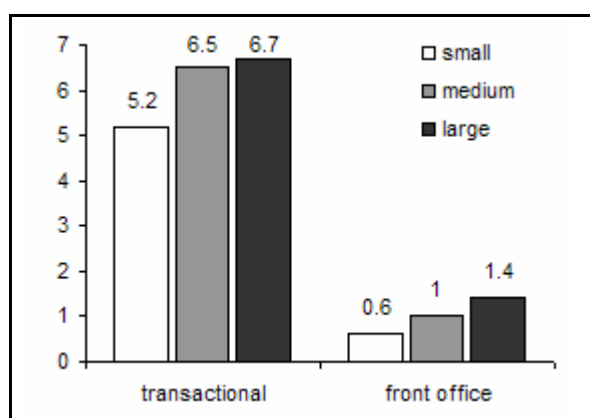


Figure 5 - Number of systems per company

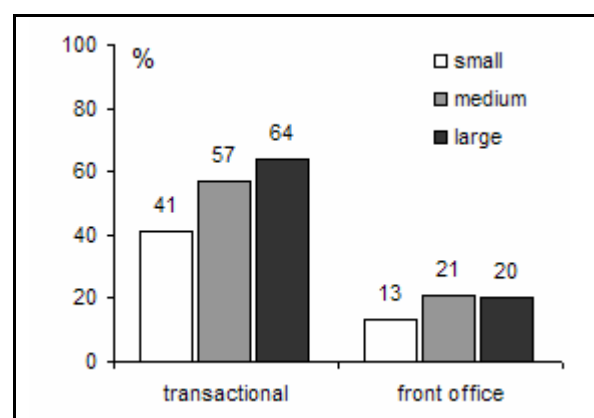


Figure 6 - % of systems that are ERP modules

Figure 7 shows that relatively few companies own Business Intelligence systems, and the same occurs regarding the workflow systems. It should be noted that in Brazil the term “business intelligence” is used by software vendors to designate systems with information recovery and statistical capacities that are eventually very simple. It is not

uncommon for the acronym BI to constitute a menu identification for simple computational resources of transactional information system. The percentage of companies that have at least one installed ERP module is larger. In the small companies the index of 49% is higher than the presented value on the survey carried out in 2000 (FIESP/FIPE 2000) where only 19% of the companies informed own a commercial ERP type package. This may point towards an evolution in the use of packages in small companies over the last two years. However the rate of utilization of ERP systems in small companies remains significantly lower than in medium and large companies.

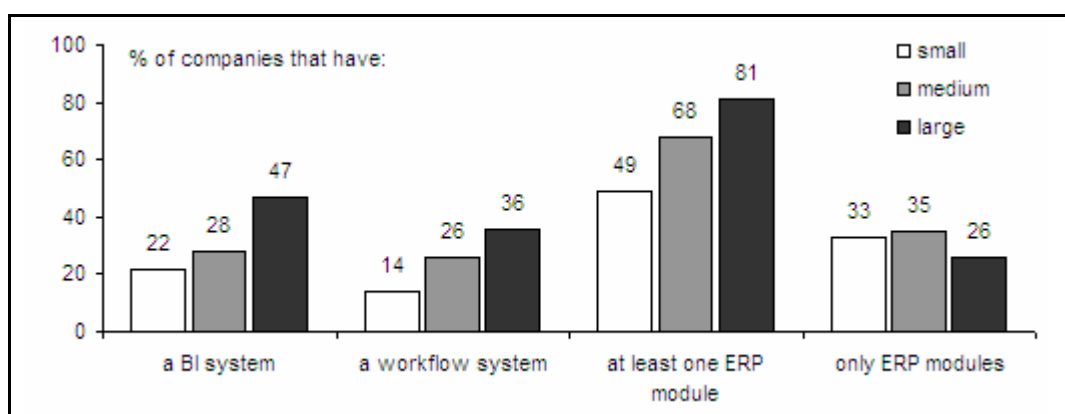


Figure 7 - Systems owned by the companies

The percentages of companies that only have ERP modules suggest that most companies do not use a single and complete ERP. Usually they combine its use with isolated packages, outsourced modules or internally developed modules. With regard to large companies, the data may also reflect the fact that payroll and asset management software purchased as part of foreign ERP systems were not initially adequate with respect to Brazilian laws.

Table 3 shows the percentage of modules broken out by how they were obtained taking into account the total of modules of transactional nature reported by the companies. As noted earlier, for the large and medium companies there is a more intense reliance on commercial packages (ERP and isolated). In the small ones a higher rate of utilization of internally or outsourced developed systems is perceived. As observed before, this may reveal a characteristic of the small companies that try to implement simpler information systems that are mirrors of "how things are done" in the company. As they lack resources to maintain professionals for the internal development, companies use third parties to carry out development.

Table 3
Acquisition mode of transactional modules

Acquisition Mode	Small		Medium		Large	
	Cases	%	Cases	%	Cases	%
Self development	143	20.4	96	16.1	108	22.9
Outsourced development	184	26.2	103	17.3	18	3.8
Isolated package	65	9.3	52	8.8	49	10.4
Integrated package (ERP)	309	44.1	344	57.8	297	62.9
Total	701	100.0	595	100.0	472	100.0

Companies were also requested to report their perceptions of the adequacy of and dependence on the systems they had, using a scale ranging from 1 (very low) to 5 (very

high). For adequacy, “very high” means that little or no change was needed for the adjustment of the module to the business procedures carried out in the company. For dependence, “very high” means that, in the event of the system becoming non-operational, consequences would drastically affect the companies’ operation.

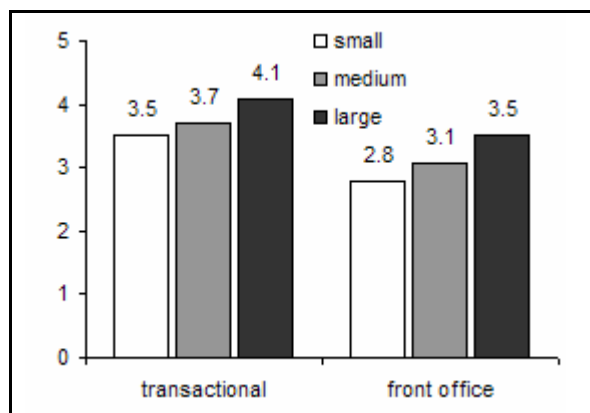


Figure 8 - Dependence of the systems

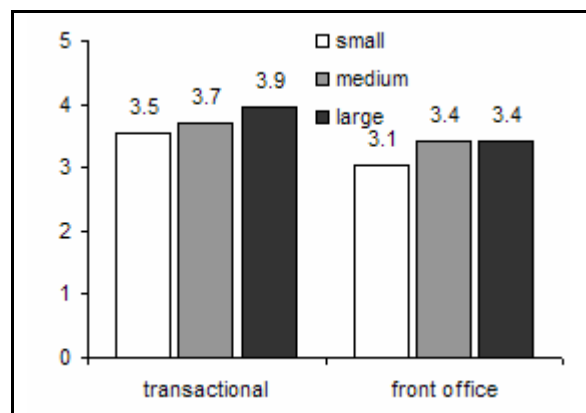


Figure 9 - Adequacy of the systems

According to figure 8 and significance tests outlined at the appendix table C3, the dependence of companies’ operations on transactional modules confirms expectations because it increases with the company’s size. Statistically the small and medium differ from large companies, stressing that the information systems support business procedures in an effective manner in the large companies. According to figure 9 the adequacy of these transactional modules also increased with size, but to a lesser extent (only the difference between small and large companies is statistically significant). Dependence of companies’ operations on *front office* modules as well as the adequacy of these modules did not vary significantly among the three groups. Note that only a small number of companies reported owning such modules.

5.3.2 Internet

Companies were also requested to report the Internet usage for their business. According to the appendix tables C4 and C5 and as shown on figure 10, the percentage of invoicing made through business to business (B2B) and the percentage of purchases made through B2B did not differ significantly among the groups. Although values are different, mainly for purchases in the medium companies, these variables present a high dispersion in all categories and outliers in each of the groups, which could not be excluded from the sample. For the percentage of B2B invoicing, the overall average observed among the 157 companies that replied to the queries about Internet was 15.5%. For the percentage of business to business purchases the perceived average was 12.4%. In the case of direct sale to consumer (B2C) only a difference between the small and large companies was significant; the small ones had a larger percentage of invoicing made by this means (7.2 against 2.5%). This is an interesting result and may be due to the fact that large companies usually do not carry out direct sales to the end consumer. These results, despite dispersion of values, lead to the conclusion that Internet utilization in the companies’ operations is still limited.

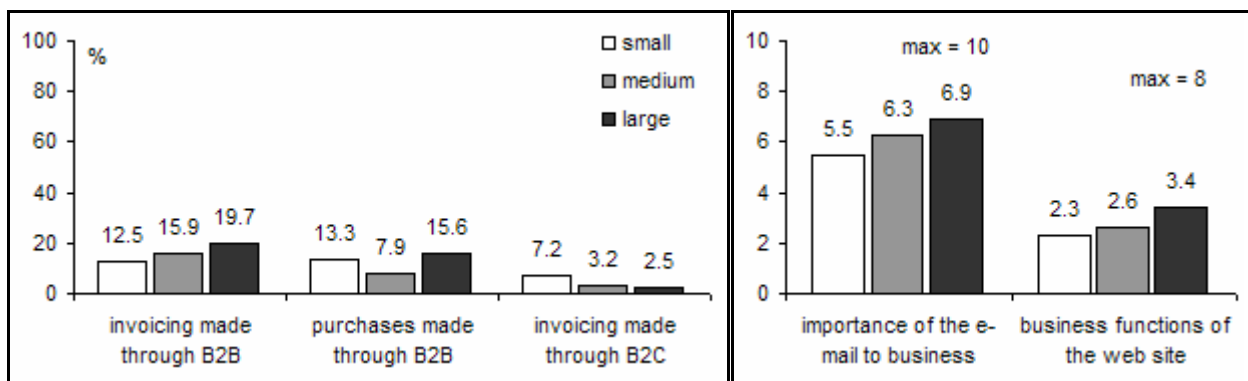


Figure 10 - Operations made through the web

Figure 11 - E-mail and web site

Figure 11 shows the sum of the importance evaluations by the respondents to the following two queries: use of e-mail for carrying out business and use for employees' activities. It can be noted that medium and large companies attribute greater importance to the use of electronic mail than the small ones. Also is shown how many functions in a list of 8, presented on table 4, are made available on the company's web site. Table 4 shows the percentage of companies that use their web site for each of the listed functions. In general utilization can be considered low, since most companies, independently of their size, still limit the use of their web sites to institutional information or information on their products and services. However, there is a trend to increase client services with the web site since 35% of the companies use it for this purpose.

Table 4
Functions of companies' web sites

Size	n	Does not have web site	Institutional information	Product information	B2C transactions	B2B transactions	Suppliers transactions	Post sale support	Client services	Employment opportunity
Small	153	19.6	63.4	77.8	13.7	17.7	11.1	13.1	34.6	4.6
Medium	96	10.4	86.5	84.4	7.3	16.7	5.2	12.5	39.6	9.4
Large	62	11.3	85.5	80.7	16.1	33.9	29.0	22.6	25.8	32.3

Note: values in %

5.4 Management Dimension

5.4.1 Personnel from the IT Area

Companies reported the number of employees and outsourced full time personnel of the IT area (noting that, for instance, two persons half-time were considered as one person full time). Data on table 5 points towards rather "lean" IT areas. However, it must be taken into account that the measures have a considerable variance for all sizes of companies. For instance, in the large companies' distribution, the average is 22.7 people but the standard deviation is 27.6 and the maximum number reported is 142, as shown on appendix D. Nevertheless, the asymmetry is positive in the three sizes which indicate a concentration in the lower values of the distribution. In the small companies' distribution the asymmetry can also be perceived to the left, indicating that they have one or no professionals engaged full time in the IT sector.

As expected, the larger companies, which traditionally have internal IT teams, employ a smaller proportion of outsourced personnel. In general outsourcing decreases with

company size, an expected fact considering that the small size companies have difficulty to maintain own personnel. The amount of IT internal activities measures the activities performed by the internal IT team (employees and outsourced personnel) in relation to three alternatives: traditional software development, internet based software development and support activities. According to the results, larger companies carry out more activities internally.

Table 5
Averages per company of IT personnel and IT activities

Description	Small	Medium	Large
IT personnel: total	1.7	4.1	22.7
IT personnel: employees	1.0	3.0	18.1
IT personnel: outsourced	0.7	1.1	4.6
% of outsourced IT personnel	36%	28%	20%
IT internal activities	1.13	1.71	2.08
IT shares planning with other sectors	31%	39%	46%

The study also queried whether or not IT shares planning with other sectors in the company. Although the result of the test pointed towards a similarity between sizes, at a 7% significance level results suggest greater participation of other areas as the company size increases. Despite the greater participation, less than half of the larger companies reported that they engage other areas in IT planning.

Figure 12 shows that the indicators corresponding to IT personnel per company employee (tot), IT personnel per administrative employee (adm) and IT personnel per PC decrease with the increase of company size. Again, that behavior may be associated with “economies of scale” of IT personnel in larger companies. In principle this does not imply that users of small and medium companies are better serviced, but that a more productive use of IT human resources takes place in larger companies.

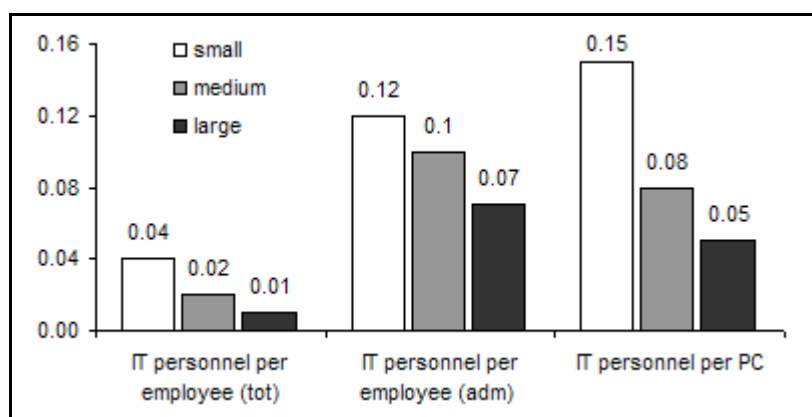


Figure 12 - Indicators of IT personnel

5.4.2 Investments of the IT Area

Table 6 shows the variables of interest related to IT investments and expenses. Expenses are monthly in nature, like hardware and software maintenance and IT payroll. Investments correspond to the initial acquisition of hardware, software and software development. The gathered data relate to years 2000, 2001 and 2002. The values were originally expressed in

Brazilian currency noting that the exchange rate remained stable until mid 2002. The obtained data show consistency during the three years and year 2001 was chosen the most adequate for this analysis (gathered revenues also correspond to this year).

Table 6
Averages per company of IT investments and IT expenses

<i>Description</i>	<i>Small</i>	<i>Medium</i>	<i>Large</i>
Annual IT investments	8.8	57.8	605.4
Annual IT expenses	4.7	40.0	730.1
Investments and expenses as % of gross revenue	1.3%	1.0%	1.1%
Annual IT expenses per PC	0.36	0.48	1.08

Note: values for the year 2001 in US\$ thousands

Investments and expenses of the IT area as percentage of gross revenue do not present a statistically significant difference, so the overall average of the 134 companies that made the information available was computed and corresponds to 1.1%. This value is consistent with results obtained by us on other research; however, Meirelles (2003) suggest that the percentage is much higher, perhaps as much as 2.2% of gross revenues. Contacted IT vendors doubt values are generally higher than 1.5%. On the other hand, IT expenses divided by the number of PCs is significantly greater in the large companies. Although the finding that the number of IT employees per PC decreases with company size, the overall cost per unit increases with size.

5.5 Benefits of IT Use

Companies assessed the benefits of IT use, indicating its level of agreement with the sentences presented on table 7 according to a scale ranging from 1 (fully disagree) to 5 (fully agree). Note that the values lower than 3 indicate a smaller benefit while higher values indicate a greater benefit. On appendix E are the statistical tests of the results between the groups of companies.

Table 7
Assessment of benefits of IT use

<i>Description</i>	<i>Small</i>	<i>Medium</i>	<i>Large</i>
IT contributed to sales increase	3.1	3.2	3.5
IT contributed to personnel reduction	2.8	2.8	3.5
IT contributed to stock decrease	2.7	3.1	3.6
IT contributed to improve services and products	3.5	3.5	3.6
IT contributed to improve client attendance	3.8	3.9	4.0
IT contributed to improve decision making	3.7	3.8	4.1
IT contributed to reduce operational problems	3.3	3.6	3.9
IT contributed to increase profit	2.9	3.1	3.4

The presumed benefit can be considered relatively greater in large companies because the results show that there are statistically significant differences between the large companies and the small ones, except for decision making quality and client attendance variables. It can further be questioned whether or not, for companies of smaller size, in the short term, the informatization process must necessarily bring about significant beneficial impacts. Since IT contribution is considered smaller especially for the benefits of personnel reduction, stock decrease and profit increase, this may indicate that the larger the company

the more complex is its business and consequently the greater is the perceived impact of IT usage.

6. CONCLUSIONS

Assessment of the technology *infrastructure* dimension provided some support to differentiate the levels of companies' informatization. As a rule, regardless of their size, companies seem to be satisfactorily supplied with equipment. As was to be expected, smaller companies have less support from communication networks and significantly less mobile equipment. This is not necessarily a shortcoming because, for companies of this size, commercial procedures might not benefit from the use of such resources.

Regarding the *use* dimension, there are significant differences in the number of systems used by companies in accordance with their size. However, this difference diminishes markedly in the case of transactional systems suggesting that for the more evident needs, companies are well supplied. Integration of these systems is lesser in smaller companies which in principle may not be satisfactory and may be related to the costs of this type of approach. Workflow and management information systems also are little used by these companies.

Dependence of companies on their information systems is much greater in larger companies, thereby suggesting that smaller companies may underutilize their system resources or even go without them, failing to gain any efficiency benefits that they might eventually yield. With regard to systems' adequacy to the company, no significant difference is observed among the sizes, but replies suggest that this adequacy in general leaves something to be desired. In the ambit of electronic business, results are not impressive; however the great variability of replies suggests that in this context companies are still exploring possibilities. Intensive use of electronic mail for business make evident the possibilities of intensive use of web based systems, especially by the smaller companies.

Regarding the *management* dimension, the researched companies' IT areas may be considered of modest size. About 1/4 of the IT personnel is outsourced and larger companies retain significantly larger teams. It may be presumed that the profile of professionals acting in small, medium and large companies is quite distinct, tending towards more qualification in the large ones. In small companies the IT area is clearly identified and in general comprises only one person. In these companies outsourcing of IT is greater than in large companies, probably because of the cost of keeping internal teams and of the lower cost of packages and of their maintenance by third parties. Investments plus expenses in IT are homogeneous among the companies' sizes, but larger companies have a proportionally higher level of IT expenses. Clearly, such expenses are worthwhile for these companies.

Survey results suggest that, the larger the company's size the greater its reliance on IT and the better the technology is employed. They also show that larger companies achieve much more evident scale benefits than the smaller ones. Part of these effects may be attributed to the lack of integration of processes and systems in small companies. Based upon this interpretation there must be a point of company size beyond which, through IT use, the organization obtains earnings which compensate for the expenses. The dilemma is that apparently the growth of a company up to this point is not favored by IT use. This argument is compatible with that presented by McKeen and Smith (1993) stating that IT use in companies becomes really effective and offers benefits only after a given size threshold.

Efforts are being undertaken to lessen this dilemma, for instance the ASP (Application Service Provider) solution has been regarded as an effective alternative for

small companies. The IT supplier in this case provides remote information systems services without the company owning a technology and personnel infrastructure. However this solution requires organization and obedience to well-defined working processes. This way flexibility, which may be the only competitive advantage of many small companies, is jeopardized and again the company will not benefit from IT use.

Survey results disclose that informatization is pursued by companies of all sizes and that the more intensive the IT use is, the larger will be its impact on companies' performance. Larger companies tend to attribute proportionally greater impact to IT use. That seems natural considering that in these companies more people are strongly involved with the use of the technology and that these companies in general relate with other organizations through the technology. This corroborates Premkumar (2003) who states that the utility of a technology increases insofar as more people and companies adopt it and, therefore, increment of IT use and its success are also subject to network externalities.

Differences between small and large sized companies are also noticed in other contexts. Ravarini *et al.* (2002), studying Italian companies point out that smaller companies devote less resources to the IS department and, whenever they do, IS staff competence is strictly narrowed to technical issues. According to these authors, "the consequent lack of internal expertise limits IT specification and selection policies and inevitably leads SMEs to develop information systems that are inadequate to the organizational needs" (p. 63). But these differences might be more profound in the developing countries context. Rovere (1998), mention that in developing countries firms perceive IT differently from their counterparts in developed countries, since the conditions of infrastructure, awareness and availability of trained personnel may vary greatly.

The results of this exploratory study suggest the suitability of the proposed model of informatization dimensions considering that, to a greater or lesser degree of certainty, it was possible to detect in all dimensions significant differences between the surveyed variables and that are related to company size. But caution is recommended because in some cases the variances observed may suggest that the surveyed variables might not be understood nor interpreted in the same way by the companies and even more so by the respondents. This requires that certain questions and corresponding analyses be more detailed. Furthermore various questions are difficult to answer and evaluate, for instance, the different levels of IT sophistication in the companies, which have distinct effects on the possible strata of the model. The discussion of these and other issues was not the purpose of this work. However they are important questions that are being addressed in a survey that follows this work and is directed towards the development of an instrument to quantify the level of informatization in industrial concerns.

Appendix A. Statistics of the Sample

Table A1 shows the distribution of the companies that replied correctly the questionnaire according to the origin of the companies' capital and table A2 shows a summary according the expressed economic activity of the companies.

Table A1

Origin of the companies' capital

Type	Small	Medium	Large
National Private Capital	91%	70%	51%
Foreign Private Capital	5%	11%	33%
Mixed Private Capital	2%	9%	5%
Others	1%	2%	5%
Not reported	1%	8%	6%

Table A2

Summary of the economic activity of the companies

Economic Activity ⁽¹⁾	Total	Small	Medium	Large
Manufacture of machines and equipments	16%	19%	15%	10%
Fabrication of metal products (except machines and equipment)	11%	14%	10%	8%
Fabrication of chemical products	10%	9%	9%	13%
Food processing and beverage fabrication	9%	7%	11%	10%
Production of rubber and plastic articles	8%	7%	9%	8%
Production and assembly of automotive vehicles and complements	6%	5%	2%	10%
Remaining codes	40%	39%	43%	41%

⁽¹⁾ according to the Brazilian code of economic activity

Appendix B. Statistics of the Infrastructure Dimension

Table B1 shows the descriptions and statistics of variables of the technology infrastructure dimension. The sample mean (M), the standard deviation (S) and the number of valid cases (n) for each variable in each group of companies are presented. Also the asymmetry coefficient (AC) is computed using the SPSS *skewness* measurement divided by its standard deviation. The observed distributions are considered symmetric when the resulting value ranges from -1.96 to 1.96.

Table B1

Technology infrastructure variables

Description	Small				Medium				Large			
	M	S	AC	n	M	S	AC	n	M	S	AC	n
V01 Units (desk/lap/palmtops)	12.8	12.2	14.9	149	57.8	50.3	8.3	99	786.8	1481	17.9	78
V02 Units per employee	0.32	0.24	9.8	139	0.25	0.19	6.7	87	0.30	0.2	3.4	63
V03 Units per administrative employee	0.97	0.66	8.6	137	1.26	0.89	6.5	84	1.38	0.9	3.5	55
V04 Lap/palmtops per adm employee	0.18	0.30	8.0	133	0.35	0.57	12.6	78	0.88	1.1	7.2	51
V05 Servers per PC unit	0.08	0.09	11.6	145	0.06	0.04	4.7	98	0.04	0.0	9.9	78
V06 % of network connected units	71%	39%	-5.4	149	92%	12%	-9.0	90	91%	15%	-7.5	67
V07 % of Internet connected units	66%	30%	-1.2	132	62%	31%	-0.7	88	53%	30%	1.1	67
V08 % of laptops and palmtops	7%	11%	11.3	149	7%	9%	12.3	98	12%	14%	7.3	78
V09 % of companies that own networks	62%	---	---	149	97%	---	---	99	100%	---	---	78

The ANOVA test was applied to verify if there is a statistically significant difference regarding the three groups of companies. According to Glass and Hopkins (1996) the ANOVA test is robust for non-normal distributions however, when comparisons take place

between groups with different variances, the test may not supply exact results. In this case the *Brown-Forsythe* test may be used (Glass and Hopkins, 1996, p. 405) which does not assume variance homogeneity and supplies a corrected result for the *F* coefficient (*F**). To verify the null hypothesis of homogeneity between variances of the groups the *Levene* test may be used. After rejection of the null hypothesis of equality among the groups supplied by the ANOVA, it is necessary to perform *post-hoc* tests that carry out the comparison of the groups in pairs for assessment of groups differing from one another.

Table B2 shows the significance of the ANOVA *Levene* test and the *Brown-Forsythe* test for variables with rejected hypothesis of homogeneous variances among groups. Also presented are the significances of the *Tukey-Kramer post-hoc* test, which is adequate when the variance is homogeneous among groups but the groups have different sizes, or of the *Games-Howell* test adequate for non-homogeneous variances (Garson, 2003).

Table B2

Significance tests for technology infrastructure variables

Variable	Levene Test	ANOVA		Brown-Forsythe		Games-Howell or Tukey-Kramer		
		F	Sig.	F*	Sig.	SM vs MD	SM vs LG	MD vs LG
V02	0.06	1.97	0.14	---	---	---	---	---
V03	0.01	6.71	0.00	5.94	0.00*	0.03*	0.01*	0.69
V04	0.00	24.42	0.00	14.80	0.00*	0.05*	0.00*	0.01*
V05	0.00	7.28	0.00	10.64	0.00*	0.29	0.00*	0.00*
V06	0.00	18.39	0.00	28.95	0.00*	0.00*	0.00*	0.80
V07	0.78	4.25	0.02*	---	---	0.62	0.01*	0.14
V08	0.01	5.68	0.00	5.42	0.01*	0.98	0.02*	0.01*
V09	0.00	44.62	0.00	---	---	0.00*	0.00*	0.19

* statistically significant difference at 5% level

Appendix C. Statistics of the Use Dimension

Table C1 shows the descriptions and statistics of variables of the information systems category. Test results of the differences between groups are on table C2.

Table C1

Information systems variables

Description	Small			Medium			Large		
	M	S	AC	M	S	AC	M	S	AC
V10 Number of transactional systems or modules	5.2	1.9	-3.4	6.5	1.1	-11.0	6.7	0.8	-17.8
V11 Number of front office systems or modules	0.6	1.0	10.3	1.0	1.1	5.1	1.4	1.3	1.8
V12 % of companies that have a MIS	22%	---	---	28%	---	---	47%	---	---
V13 % of companies that have a workflow system	14%	---	---	26%	---	---	36%	---	---
V14 % of companies that have at least one ERP module	49%	---	---	68%	---	---	81%	---	---
V15 % of companies that have only ERP modules	33%	---	---	35%	---	---	26%	---	---
V16 % of transactional systems that are ERP modules	41%	47%	1.7	57%	43%	-1.4	64%	39%	-2.7
V17 % of front office systems that are ERP modules	13%	34%	10.4	21%	40%	5.8	20%	37%	5.2

Table C2
Significance tests for information systems variables

Variable	Levene Test	ANOVA		Brown-Forsythe		Games-Howell or Tukey-Kramer		
		F	Sig.	F*	Sig.	SM vs MD	SM vs LG	MD vs LG
V10	0.00	31.61	0.00	41.15	0.00*	0.00*	0.00*	0.17
V11	0.01	14.47	0.00	13.40	0.00*	0.02*	0.00*	0.05*
V12	0.00	7.06	0.00	6.65	0.00*	0.59	0.00*	0.04*
V13	0.00	6.61	0.00	5.96	0.00*	0.08	0.00*	0.40
V14	0.00	12.52	0.00	13.47	0.00*	0.01*	0.00*	0.14
V15	0.02	0.82	0.44	0.83	0.44	---	---	---
V16	0.00	7.15	0.00	7.59	0.00*	0.03*	0.00*	0.55
V17	0.01	1.48	0.23	1.43	0.24	---	---	---

* statistically significant difference at 5% level

Table C3 presents the adequacy and dependence variables and their results of the comparison tests between the groups when a significant difference is detected by the ANOVA or *Brown-Forsythe* tests.

Table C3
Significance test for adequacy and dependence variables

Description	Small		Medium		Large		Sig. of F or F*	SM vs MD	SM vs LG	MD vs LG
	M	n	M	n	M	n				
V20 Dependence of transactional modules	3.50	111	3.71	86	4.09	62	0.00*	0.33	0.00*	0.02*
V21 Dependence of front office modules	2.80	46	3.08	46	3.52	44	0.15	---	---	---
V22 Adequacy of transactional modules	3.54	117	3.70	84	3.94	62	0.01*	0.44	0.00*	0.14
V23 Adequacy of front office modules	3.05	47	3.43	46	3.42	46	0.24	---	---	---

* statistically significant difference at 5% level

Table C4 presents the Internet variables and table C5 shows the corresponding statistical tests of the differences between groups.

Table C4
Internet variables

Description	Small				Medium				Large			
	M	S	AC	n	M	S	AC	n	M	S	AC	n
V30 % of invoicing made through B2B	12.5	17.9	7.9	68	15.9	25.3	5.6	45	19.7	30.0	4.6	44
V31 % of purchases made through B2B	13.3	19.2	9.2	69	7.9	12.5	6.7	46	15.6	23.0	4.7	45
V32 % of invoicing made through B2C	7.2	10.7	8.9	68	3.2	7.0	6.7	46	2.5	12.4	16.8	44
V33 importance of e-mail to business	5.5	1.9	1.4	148	6.3	1.8	-0.5	93	6.9	2.0	-2.1	69
V34 business functions of the web site	2.3	1.7	3.8	145	2.6	1.6	3.1	94	3.4	2.2	2.3	68

Table C5
Significance tests for Internet variables

Variable	Levene Test	ANOVA		Brown-Forsythe		Games-Howell or Tukey-Kramer		
		F	Sig.	F*	Sig.	SM vs MD	SM vs LG	MD vs LG
V30	0.01	1.21	0.30	1.08	0.34	---	---	---
V31	0.00	2.05	0.13	2.07	0.13	---	---	---
V32	0.12	3.54	0.03*	---	---	0.10	0.05*	0.95
V33	0.99	14.65	0.00*	---	---	0.00*	0.00*	0.10
V34	0.01	7.31	0.00	6.77	0.00*	0.56	0.00*	0.03*

* statistically significant difference at 5% level

Appendix D. Statistics of the Management Dimension

Descriptions and statistics of variables related to IT personnel and IT activities are shown on table D1 and D2. Test results of the differences between groups are on table D3.

Table D1
IT personnel variables

Description	Small					Medium					Large				
	M	S	AC	max	n	M	S	AC	max	n	M	S	AC	max	n
V40 IT personnel: total ⁽¹⁾	1.7	1.8	7.0	9	124	4.1	3.2	8.4	19	87	22.7	27.6	8.2	142	67
V41 IT personnel: employees	1.0	1.3	10.5	8	124	3.0	2.7	7.4	17	87	18.1	22.3	6.7	98	67
V42 IT personnel: outsourced	0.7	1.1	7.3	5	124	1.1	1.6	7.6	8	87	4.5	10.5	14.0	67	67

⁽¹⁾ includes companies without IT personnel

Table D2
Other variables related to IT personnel and IT activities

Description	Small				Medium				Large			
	M	S	AC	n	M	S	AC	n	M	S	AC	n
V43 % of outsourced IT personnel ⁽¹⁾	36%	39%	1.8	81	28%	33%	3.2	81	20%	26%	3.9	67
V44 IT internal activities	1.13	1.00	2.2	149	1.71	1.00	-0.9	99	2.08	1.04	-3.2	78
V45 IT shares planning ⁽²⁾	31%	---	---	149	39%	---	---	99	46%	---	---	78
V46 IT personnel per employee (tot)	0.04	0.05	7.8	120	0.02	0.01	6.2	82	0.01	0.01	4.3	61
V47 IT personnel per employee (adm)	0.12	0.14	6.9	118	0.10	0.10	8.0	79	0.07	0.05	4.9	53
V48 IT personnel per PC	0.15	0.22	14.4	120	0.08	0.11	7.1	86	0.05	0.04	0.0	67

⁽¹⁾ considers the percentage of each company that owns IT personnel

⁽²⁾ with other sectors of the company

Table D3
Significance tests for variables related to IT personnel and IT activities

Variable	Levene	ANOVA		Brown-Forsythe		Games-Howell or Tukey-Kramer		
	Test	F	Sig.	F*	Sig.	SM vs MD	SM vs LG	MD vs LG
V43	0.00	0.65	0.52	0.71	0.49	0.28	0.01*	0.31
V44	0.53	24.12	0.00*	---	---	0.00*	0.00*	0.05*
V45	0.00	2.74	0.07	2.67	0.07	---	---	---
V46	0.00	16.03	0.00	25.15	0.00*	0.00*	0.00*	0.00*
V47	0.00	4.77	0.01	6.69	0.00*	0.43	0.00*	0.01*
V48	0.00	10.31	0.00	15.09	0.00*	0.01*	0.00*	0.00*

* statistically significant difference at 5% level

Descriptions and statistics of variables related to IT investments and IT expenses are shown on table D4. Test results of the differences between groups are on table D5. Only investments reported for the year 2001 were taken into account, because the information supplied by the companies for the year 2002 was a projection.

Table D4
IT investments and IT expenses variables⁽¹⁾

Description	Small				Medium				Large			
	M	S	AC	n	M	S	AC	n	M	S	AC	n
V50 Annual IT investments	8.8	10.1	5.5	77	57.8	96.7	12.1	60	605.4	1,449.3	13.2	36
V51 Annual IT expenses	4.7	5.5	5.6	59	40.0	126.8	22.2	60	730.1	1,543.2	10.7	35
V52 Inv&exp as % of gross revenue	1.3%	1.5%	8.7	53	1.0%	2.3%	17.0	49	1.1%	1.7%	11.3	32
V53 Annual IT expenses per PC	0.36	0.32	3.8	56	0.48	0.60	10.5	59	1.08	0.84	1.2	35

⁽¹⁾ values for the year 2001 in US\$ thousands

Table D5
Significance tests for IT investments and IT expenses variables

Variable	Levene Test	ANOVA		Brown-Forsythe		Games-Howell or Tukey-Kramer		
		F	Sig.	F*	Sig.	SM vs MD	SM vs LG	MD vs LG
V52	0.05	0.359	0.699	0.368	0.693	---	---	---
V53	0.00	17.07	0.000	14.32	0.00*	0.60	0.00*	0.00*

* statistically significant difference at 5% level

Appendix E. Statistics relative to Benefits of IT Use

Descriptions and statistics of variables related to IT use benefits are shown on table E1. Test results of the differences among groups are shown on table E2. The number of companies with responses considered valid is: 78 for large, 99 for medium and 149 for small size companies.

Table E1
Benefits of IT use variables

Description	Small			Medium			Large		
	M	S	AC	M	S	AC	M	S	AC
V60 IT contributed to sales increase	3.1	1.3	-0.2	3.2	1.2	-1.3	3.5	1.1	-2.3
V61 IT contributed to personnel reduction	2.8	1.3	0.5	2.8	1.2	0.0	3.5	1.0	-1.1
V62 IT contributed to inventory reduction	2.7	1.3	1.2	3.1	1.3	-1.1	3.6	1.0	-2.1
V63 IT contributed to improve services and products quality	3.5	1.2	-2.4	3.5	1.1	-2.4	3.6	1.0	-2.7
V64 IT contributed to improve client attendance	3.8	1.1	-4.0	3.9	0.9	-3.2	4.0	0.9	-3.5
V65 IT contributed to improve decision making	3.7	1.1	-3.7	3.8	1.0	-3.9	4.1	0.8	-2.6
V66 IT contributed to reduce operational problems	3.3	1.1	-1.9	3.6	0.9	-2.0	3.9	0.9	-3.4
V67 IT contributed to increase profit	2.9	1.3	0.4	3.1	1.1	-1.4	3.4	0.9	-1.9

Table E2
Significance tests for benefits of IT use variables

Variable	Levene Test	ANOVA		Brown-Forsythe		Games-Howell or Tukey-Kramer		
		F	Sig.	F*	Sig.	SM vs MD	SM vs LG	MD vs LG
V60	0.44	3.12	0.05*	---	---	0.98	0.05*	0.10
V61	0.01	9.00	0.00	9.70	0.00*	0.97	0.00*	0.00*
V62	0.01	15.77	0.00	16.92	0.00*	0.04*	0.00*	0.00*
V63	0.13	0.13	0.88	---	---	---	---	---
V64	0.00	0.87	0.42	0.95	0.39	---	---	---
V65	0.01	3.32	0.04	3.62	0.03*	0.81	0.02*	0.11
V66	0.00	10.90	0.00	11.99	0.00*	0.12	0.00*	0.01*
V67	0.01	5.03	0.01	5.57	0.00*	0.18	0.00*	0.29

* statistically significant difference at 5% level

Appendix F. Survey Instrument

Observe that in the description of the questionnaire some terms were translated to a reduced form in English. The original text in Portuguese is eventually more compatible with the jargon and Brazilian context.

1. Information Technology Benefits

To what extent do you agree/disagree with the following statements, related to IT impacts in your company?

	completely disagree				totally agree
IT definitively contributed to sales increase	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT definitively contributed to reduction in staff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT definitively contributed to reduction in inventories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT definitively contributed to improve services and products quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT definitively contributed to improve client service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT definitively contributed to improve decision making	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT definitively contributed to reduce operational problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT definitively contributed to increase profit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. IT Resources and Infrastructure

2.1 Number of computers currently used in your company.

Equipment	Quantity
Desktop Computers (PC, Mac, etc.)	
Notebooks	
Palmtops/Handheld	
Intel Servers (Windows/Novell/Linux)	
RISC Servers (Unix)	
Mainframes	
Others	

2.2 Number of computers connected to a network or Internet in your company.

	Quantity
Number of computers connected to a LAN	
Number of computers connected to a WAN	
Number of computers connected to the Internet	

2.3 Which types of Internet connection does your company have?

<input type="checkbox"/> There is no connection to the Internet
<input type="checkbox"/> Dial up over telephone line - free providers
<input type="checkbox"/> Dial up over telephone line - paid providers
<input type="checkbox"/> Broadband connection (up to 256 kbps)
<input type="checkbox"/> Broadband connection (up to 512 kbps)
<input type="checkbox"/> Broadband connection (above 512 kbps)

2.4 Which of the following internal security facilities does your enterprise use?

<input type="checkbox"/> Virus checking or protection software installed on client computers
<input type="checkbox"/> Virus checking or protection software installed on servers
<input type="checkbox"/> Proxy/Firewall servers
<input type="checkbox"/> User accounts management (login and password to network access)
<input type="checkbox"/> Internal staff dedicated to corporate network security
<input type="checkbox"/> Outsourced staff or service dedicated to corporate network security
<input type="checkbox"/> Internal staff dedicated to web site security
<input type="checkbox"/> Outsourced staff or service dedicated to web site security

3. Internet Use

3.1 What is the importance of the Internet to the business of the company?

Internet Use	Importance				
	Low			High	
e-mail for business purposes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e-mail for employees' communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Institutional information publishing and marketing of company' s products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information research about market, products and competitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Business-to-Consumer transactions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Business-to-Business : transactions with customers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Business-to-Business : transactions with suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Providing after-sales support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Providing services to clients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Offering employment opportunities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3.2 Estimate the percentage of revenues and purchases that resulted from orders received or placed via Internet.

Transactions	% of \$ total
Business-to-Consumer	
Business-to-Business (with customers)	
Business-to-Business (with suppliers)	

4. Enterprise Software

For each area or activity indicate the kind of systems used, the level of dependence of the activity on the system and the level of adequacy of the system to the activity.

Activity or Area	Internally developed	Outsourced development	Isolated package	Integrated package	Dependence of the activity on the system		Adequacy of the system to the activity	
					low	high	low	high
Sales	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accounting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Payroll/HR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Finance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Production/Inventory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Purchasing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fixed assets control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Import/Export	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Workflow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e-Commerce	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sales Automation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CRM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Business Intelligence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. IT Department

5.1 In relation to IT use in your company, indicate if:

<input type="checkbox"/> Exists a specific IT area or person exclusively dedicated to software development in the company
<input type="checkbox"/> Exists a specific IT area or person exclusively dedicated to Internet development in the company
<input type="checkbox"/> Each user area or department is responsible for the development of its own software
<input type="checkbox"/> Each user area or department is responsible for the acquisition of its own software
<input type="checkbox"/> Each user area or department is responsible for the acquisition of computers, printers and other hardware
<input type="checkbox"/> Exists a specific IT area or person exclusively dedicated to technical support to users
<input type="checkbox"/> Other areas, besides the IT area and top management, participate on IT planning

5.2 If there is an IT department in your company, inform its personnel structure:

Functions	Employees	Outsourced personnel
Executives (CIOs, directors, VPs)		
Coordinators and supervisors		
Analysts and programmers - traditional systems		
Analysts and programmers - Internet systems		
Technical support, operations and network configuration		
Others		

6. IT Investments and Expenses

Inform the amount of IT investments and expenses in R\$ thousands for year 2000, 2001 and 2002 (forecast).

	Item	2000	2001	2002
Investment	Hardware (computers, servers, network equipment, notebooks, etc.)			
	Software (systems, operating systems, personal productivity, etc.)			
	Outsourced software development			
	Others			
Expenses	Hardware and software maintenance			
	Telecommunications			
	Outsourcing (help desk, support and network configuration)			
	IT personnel payroll			
	Others			

7. Company Profile

Annual revenues (in R\$ thousands for year 2001)	
Origin of company' s capital	
Total number of employees	
Blue collar employees	
National economic activity code	

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