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ABSTRACT

A questionnaire requiring respondents to rate the importance of key issues is the traditional data collection tool for investigating the key issues of Information Technology (IT) managers. Such an instrument does not force managers to confront the relationships between issues. Q-sort and interpretive structured modeling (ISM) force managers to consider the linkages among key issues. This article discusses the use of these methodologies for investigating key issues and demonstrates their application with data collected from Brazilian banking IT managers. This study illustrates how these approaches provide additional insights into the key concerns facing IT managers.

Keywords. Management of information technology, key issues studies, Q-sort, interpretive structural modeling

I. INTRODUCTION

The management of IT is becoming increasingly complex as the available technologies diversify and as the strategic importance of IT to achieving business goals and organizational transformation increases. One approach to understanding these challenges is to consult IT managers about their major concerns or key issues. The study of key issues was initiated by Dickson et al. (1984), and their methodology is used worldwide (Watson et al., 1997). This research allowed tracking the evolution of key issues over time and provides a comparison of the management of IT in different countries (e.g., Watson and Brancheau, 1991; Watson et al., 1997). The insights gained from these analyses are useful in understanding the concerns of IT managers, suggesting areas for research, and educating IT managers.

The intent of this paper is to present two techniques that provide greater insight into the concerns of IS managers than the traditional rating method used in most recent key issues studies. Q-sort (Stephenson, 1953) and interpretive structural modeling (ISM) (Warfield, 1976) allow researchers and participating IT managers to gain a deeper understanding of the relationships among key issues. A factor analysis of Q-sort data can potentially identify groups of IT managers with similar problems. Studies using a rating scale tend not to categorize managers and thus imply that key issues are homogeneous across IT managers. Clearly, this may not always be the case. The application of ISM typically forces IT managers to reassess perceived priorities and improves their understanding of the linkages among key concerns.

The present research was performed as part of a key issues study of Brazilian banking IT managers (see the Appendix for a discussion of the Brazilian banking industry). The research was supported by Febraban, the Association of Brazilian Banks, and was conducted between September 1993 and March 1994.

The organization of this paper is as follows: a discussion of the research methodologies (Q-sort and ISM), presentation of the findings of the research, and consideration of the implications. While we make use of data collected during the Brazilian study to illustrate the use of Q-sort and ISM, the intention is to discuss

these methodologies rather than present the complete findings of the study, which are reported elsewhere (Morgado et al., 1995a; Morgado et al., 1995b).

II. RESEARCH METHODOLOGY

Most key issues research uses the Delphi technique to promote consensus, allowing managers to add new issues during the initial round. Our research took a different path and was carried out in the following phases:

1. Questionnaire preparation. The set of key issues from a prior study (Watson, 1989) was translated into Portuguese and submitted in a series of meetings to banking IT managers of the Board of the National Center for Banking Automation. This group added some issues and required revision of the explanations for some other issues in order to adapt them to local conditions. We also added and tested complete instructions for using Q-sort for this list of key issues.

2. The survey. The Q-sort materials were sent to the highest ranked IT manager in each participating bank. The results of the Q-sort were factor analyzed to identify homogeneous groups of respondents and patterns of management concern or focus.

3. ISM workshop. A group of banking IT managers who had participated in the survey were invited to a meeting to discuss the results of the survey and to participate in an ISM session to review and structure the top 10 key issues of the survey.

We now discuss some of the methodological aspects of the research.

THE Q-SORT METHOD

The distinguishing feature of Q-sort, a ranking technique, is that respondents are required to sort the statements supplied so that they fall into a predefined, usually approximately normal, distribution (Brown, 1980). In this case, respondents sorted the 25 key issues into nine piles using the distribution shown in Figure 1. They were instructed to place one statement in the most

important position, two in the next most important position, and so on. Five statements could be placed in the middle or neutral position. A factor analysis of Q-sort scores can identify patterns or groups of respondents.

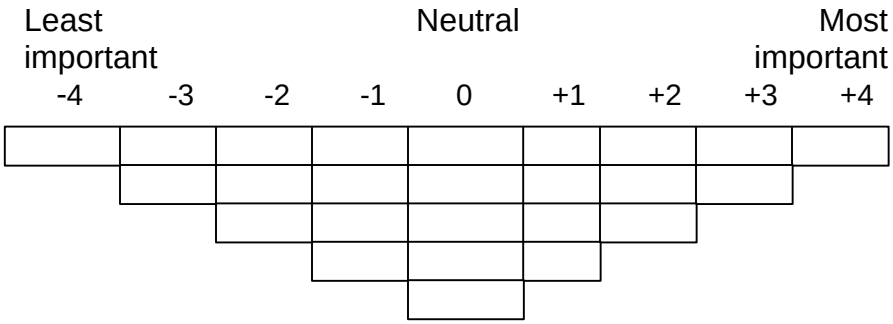

Figure 1: Q-sort distribution for key issues

In this study, we refer to items falling in the –4 to –2 range as the left pile (6 items), -1 to +1 as the middle pile (13 items), and +2 to +4 as the right pile (6 items).

THE ISM WORKSHOP

We conducted the ISM workshop with a group of participants from phase 1. Developed by Warfield (1994), ISM is a technique to structure complex problems. It is particularly useful when used with groups where a structured debate can help participants to reach consensus and for problems with multiple dimensions and issues. ISM forces participants to relate the issues to the larger problem, explicitly defining their interrelations. ISM builds directed graphs of these issues, based on a previously agreed upon relation. In our research, after considerable debate the group chose the relation “the correct approach to (issue A) helps solve (issue B).” For example, “the correct approach to using IS to achieve competitive advantage helps solve improving the strategic planning of IS.” The linking of independent statements in this manner sometimes leads to an ill-formed sentence, but this did not pose a significant problem to the participants,

as they understood the intent of the technique and the original meaning of the issues.

ISM is a technique that allows groups to create structured models of qualitatively defined elements and relations among these elements. In an ISM session, the collective knowledge of a group is used to build a directed graph that represents the understanding of the group. ISM, therefore, does not provide the general solution to a problem, but consolidates the knowledge a group has about a problem. The development of a collective vision of a problem's structure is a great help in understanding that problem.

III. RESULTS OF THE Q-SORT

The results of the survey, based on 69 usable questionnaires, are shown in Table 1, which follows the traditional format of presenting key issues findings. That is, all issues are listed in rank order, and there is no further analysis that groups respondents or investigates how issues are interrelated.

Q-SORT ANALYSIS

The Q-sorts were factor analyzed to detect groups of managers who had similar opinions on the importance of the key issues.[2] The results of a Q-factor analysis can be reported using normalized factor scores. Alternatively, it is possible to use these scores to determine the item with the highest score and assign it a value of +4, then the two items with the next highest scores are assigned a value of +3, and so on. These so called *rounded factor scores* introduce a small amount of error, but are usually reported since they match the format of the data collection method (Brown, 1980, p. 243). We have elected to use rounded factor scores in reporting the factors identified in this study.

Following the guidelines for Q-factor analysis (Brown, 1980), eight factors were initially extracted using the principal component method. After varimax

Table 1: Key Issues

[2] Analysis was conducted using MQMethod 2.03.

Rank	Issue	Average rank
1	Building an IT architecture for prompt reaction	2.28
2	Improving IS strategic planning	2.06
3	Using IS to achieve competitive advantage	1.75
4	Developing a data architecture	1.14
5	Improving decision making through use of DSS	0.81
6	Integrating IS and telecommunication systems on diverse platforms	0.77
7	Using IT to leverage organizational resources	0.66
8	Planning, implementing and managing telecommunication systems	0.33
9	Recruiting and developing IS human resources	0.30
10	Improving the productivity of IS development	0.27
11	Improving information security and control	0.17
12	Improving the effective use of data resources	0.17
13	Integration with customers and suppliers	0.03
14	Building an effective disaster recovery system	-0.06
15	Planning the change toward global systems	-0.20
16	Facilitating organizational change and use of IT	-0.41
17	Developing distributed systems	-0.69
18	Managing the relationship with users	-0.81
19	Planning and managing the application portfolio	-0.84
20	Reducing costs	-0.86
21	Planning and using CASE technologies	-1.09
22	Positioning IS in the organizational structure	-1.19
23	Improving understanding of the role and contribution of IS	-1.33
24	Facilitating and managing end-user computing	-1.50
25	Outsourcing	-1.75

Following the guidelines for Q-factor analysis (Brown, 1980), eight factors were initially extracted using the principal component method. After varimax rotation, three factors were retained for further analysis because they explain 50 percent of the variation and embrace 24 of the 38 managers loading on one

factor. Also, after the first three factors, the number of managers in each group is relatively small (Table 2).

Table 2: Q-factor Analysis

	1	2	3	4	5	6	7	8
Eigenvalue	21.40	5.93	4.94	3.42	3.10	2.84	2.61	2.51
Cumulative explained variance	33	42	50	55	60	64	68	72
Subjects loaded	8	7	9	3	2	3	4	2

We review the Q-sort analysis by starting with those statements on which managers agree as to their importance (the consensus statements) and then consider those statements on which they disagree (the factors). Applying labels to groups of statements is an important element of a Q-sort analysis. Since it is impossible to apply labels without a context, we make use of the Brazilian findings to generate meaningful labels.

CONSENSUS STATEMENTS

Table 3 shows the statements on which there was consensus. That is, these statements do not distinguish between any pair of factors. The table shows that managers agree that a group of issues (ranked 8 to 19), around the middle of the Q-sort distribution, are of neutral importance.. They also agreed that two issues on the left side of the distribution (ranked 21 to 24) lack importance. It is clear that there is no unanimity about what is important because no items in the right pile (the most important issues) appear in the list of consensus statements. These differences are shown by the factor analysis.

FACTOR 1—DATA EXPLOITATION.

Creating infrastructure and making use of data are the prime concerns of this group of managers (Table 4). For the eight mangers in this group, the importance of the IT function in the organization has been established. They do not disagree about the position and value of IS. Management is now building an

Table 3. Consensus Statements—Those That Do Not Distinguish Between Any Pair Of Factors

Rank	Issue
8	Planning, implementing, and managing telecommunication systems
9	Recruiting and developing IS human resources
10	Improving the productivity of IS development
14	Building an effective disaster recovery system
15	Planning the change toward global systems
17	Developing distributed systems
18	Managing the relationship with users
19	Planning and managing the application portfolio
21	Planning and using CASE technologies
24	Facilitating and managing end-user computing

Table 4. Distinguishing Statements for Factor 1—Data Exploitation

Rank	Issue	Rounded factor score
4	Developing a data architecture	4*
1	Building an IT architecture for prompt reaction	3
12	Improving the effective use of data resources	2*
11	Improving information security and control	1*
13	Integration with customers and suppliers	1*
3	Using IS to achieve competitive advantage	0*
7	Using IT to leverage organizational resources	0*
18	Managing the relationship with users	-2
22	Positioning IS in the organizational structure	-3

($p < .05$; asterisk (*) indicates significance at $p < .01$)

efficient and effective structure to provide the services required by the organization. Business strategy issues are not the first priority. These banks have stable IT units who see that effective use of data is critical. Thus an appropriate label for this group of managers is *data exploitation.*

FACTOR 2—WEAK IT UNIT

Managers in this group are concerned with establishing that IS has a key role in the organization (see Table 5). These seven managers appear to be struggling with gaining acceptance of IS as a major player in determining organizational performance. They are still trying to convince the company of the importance of IT, which appears to have problems establishing its role within the organization. IT may not be serving the bank well. The IT manager is probably spending time defending the IT unit's position rather than planning the future. These IT units are organizationally weak, though outsourcing does not appear to be a threat. We label this group as *weak IT unit.*

Table 5: Distinguishing Statements For Factor 2—Weak IT Unit

Rank	Issue	Rounded factor score
22	Positioning IS in the organizational structure	4*
23	Improving understanding of the role and contribution of IS	3*
16	Facilitating organizational change and use of IT	2*
3	Using IS to achieve competitive advantage	2*
1	Building an IT architecture of prompt reaction	1*
7	Using the IT to leverage organizational resources	1*
6	Integrating IS and telecommunication systems on diverse platforms	1
5	Improving decision making through use of DSS	-1*
25	Outsourcing	-3*

$p < .05$; asterisk (*) indicates significance at $p < .01$

FACTOR 3 –ALIGNING IS WITH THE ORGANIZATION

The nine IS managers in this group have established the role of IS in the organization, hence assign very low importance to this issue. They focus on

using IT to improve organizational performance (Table 6). These banks seem to have a broader view of what is important than those constituting the first factor. IT management is focusing on the strategic issues of the organization. The effective use of data, a top concern in factor 1, is not an issue. These banks are mainly concerned with *aligning IS with the organization*, and thus this is an appropriate label for this group.

Table 6: Distinguishing Statements for Factor 3—Aligning IS with the Organization

Rank	Issue	Rounded factor scores
3	Using IS to achieve competitive advantage	4*
1	Building an IT architecture of prompt reaction	3
7	Using IT to leverage organizational resources	3*
2	Improving IS strategic planning	2*
20	Reducing costs	1*
22	Positioning IS in the organizational structure	-4

$p < .05$; asterisk (*) indicates significance at $p < .01$

THE RELATIONSHIP AMONG FACTORS

A cursory comparison of Table 4 and Table 6 suggests that groups 1 and 2 have much in common in their ranking of issues. This observation is confirmed by the high correlation (ρ=.50 and p= 0.01) between these factors, while none of the other groups are significantly correlated.

The major differences among groups are captured in Tables 7, 8, and 9. Clearly, the differences between groups 1 and 2 are related to the organizational role of IS. Not surprisingly, this is a major issue for group 2 (weak IT unit) and a minor issue for group 1 (data are the key resource). The groups are bipolar in their approach to positioning IS in the organization. For weak IT units, this is the paramount issue but is less important for the data exploitation group. Their disparate ranking of issue 22 is in accord with this assessment.

Table 7. Major Differences Between Groups 1 and 2

Rank	Issue	Group 1 Data Exploitation	Group 2 Weak IT
22	Positioning IS in the organizational structure	-3	4
3	Improving understanding of the role and contribution of IS	-3	3

Groups 1 and 3 are significantly correlated, as mentioned previously. Nevertheless, they differ with regard to the use of IS to achieve competitive advantage, the key concern for group 3, and the reduction of costs, the least important concern for group 1. These differences seem to fit with the strong identification of group 1 with data exploitation and group 3 with strategic alignment.

Table 8. Major Differences Between Groups 1 and 3

Rank	Issue	Group 1 Data exploitation	Group 3 Strategic alignment
3	Using IS to achieve competitive advantage	0	4
20	Reducing costs	-4	1

In the case of groups 2 and 3, the differences are the same as those of groups 1 and 2, which is not surprising given the strong correlation between groups 1 and 3.

Table 9. Major Differences Between Groups 2 and 3

Rank	Issue	Group 2 Weak IT	Group 3 Strategic alignment
22	Positioning IS in the organizational structure	4	-4
23	Improving understanding of the role and contribution of IS	3	-3

The three factors, representing different types of IS units, can be arranged by the phase of development of the IS unit. This arrangement is similar to

Nolan's (1979) concept of stages of growth. The least developed IS units are those where IT is weak. At the next level, IS units have established their role but are still internally focused with an emphasis on data. The third stage represents a shift from an internal data focus to recognition that IS needs to align with the organization. We are not suggesting that these findings provide support for Nolan's stages of growth thesis, which has been critiqued by King and Kraemer (1984). Rather, we are indicating that IT units should not be treated as homogeneous, as has been the case with prior key issues studies. IT groups can differ considerably in their assessment of the key issues. Key issues for some are non-events for others.

Our interpretations are presented as conjectures based on the factor analysis of the Q-sort data and knowledge of Brazilian banking. We did not have access to individual respondents to collect additional data to support or refute our interpretation. However, it is the Febraban Board's opinion that our interpretation is reasonably accurate.

IV. RESULTS OF THE ISM

Eleven IT managers participated in the Interpretive Structured Modeling seminar. They received the full rankings from the key issues survey at the beginning of the session, but were told to focus only on the top 10 issues. Consideration of more issues would have taken more than the two hours the managers were willing to spend with us. Using Resolver,[3] the participants were presented with pairs of issues (A and B) for which they had to evaluate the relation: "the correct approach to (issue A) helps solve (issue B)." The group then discussed whether the relationship was true or false. After some deliberation, which at times was quite heated, the group made a decision and moved on to the next pair of issues. The entire process took the allocated two hours.

ISM makes all possible inferences between each pair of issues by using transitivity to reduce the number of combinations to be analyzed by the

[3] Provided for the study by BarrettSaunders and Associates.

participants. In other words, if the participants decide that “A helps solve B” and “B helps solve C,” then ISM infers that “A helps solve C.” The resulting graph is presented in Figure 2.

As could be expected, planning and infrastructure issues have precedence over issues related to business results. There are some significant differences between the implicit ISM priorities and the rankings from the key issues survey. In particular, notice how the ninth ranked issue from the survey appears as a key driver of other issues. The solution of many other problems is dependent on recruiting and developing human resources for IS. Furthermore, the third ranked survey issue appears to the far right of the ISM model. Using IS for competitive advantage cannot occur until many other issues are resolved.

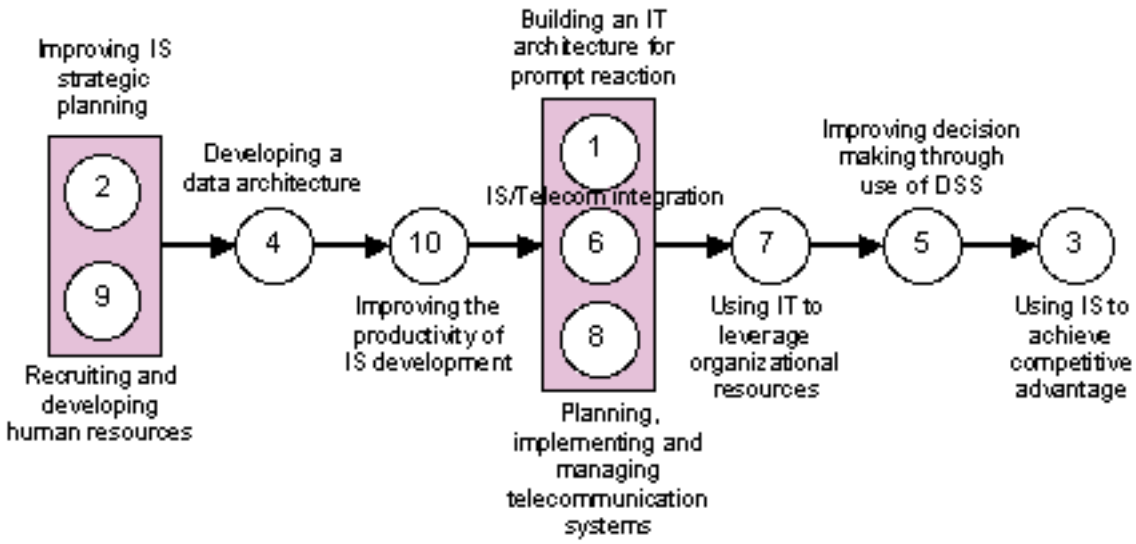

Figure 2. ISM Diagram

The display of the ISM diagram provoked considerable controversy, which focused extensively on issue 9 (human resources development). The group had to reconcile the low ranking of the issue with its key position in the ISM diagram. The group’s conclusion was that survey respondents might have misunderstood the question. The group argued that its decision was based on the critical importance of key technical personnel for systems development, who are in short

supply and difficult to develop. They thought the survey respondents might have focused more on operational and clerical personnel, who are less of a concern to IT managers.

Sets of interrelated questions are *cycles* (Warfield, 1991). In our graph, issues 1, 6, and 8 form such a cycle. This cycle's critical importance reflects existing deficiencies in the Brazilian telecommunications infrastructure and the long-term effects, until recently, of restrictions on importing small to medium sized computers and telecommunications equipment.

These results indicate the practical usefulness of complementing a key issues study with ISM, exposing important relationships among the issues that are not apparent in the survey ranking. ISM reveals how independent rating of issues, the *modus operandi* of key issues studies, does not reveal how one key issue can impact another. As a result, managers gain greater insights into the sequence of activities necessary to solve problems. For instance, ISM demonstrates very clearly that there is little sense in resolving the use of IT for competitive advantage until many other problems have been solved.

V. IMPLICATIONS

This paper presents useful additions to the traditional key issues methodology:

- The use of Q-sort to rank the key issues, followed by a factor analysis to identify three types of IS units, provides for a more detailed dissection of key issues. This analysis highlights that the consensus reported by the traditional key issues approach is somewhat illusory. Rather, what is reported traditionally is not consensus, but possibly an aggregation of concerns that are quite different for disparate groups of respondents. Without Q-sort, we would not have discovered that these IS managers' concerns fell into three distinct categories. As a result, the concerns of a particular group of managers can be targeted rather than providing a *one size fits all* solution to all managers. Of course, the benefits of using Q-sort

extend beyond key issues studies to other areas of IS research (e.g., Kendall and Kendall, 1993).

- The use of ISM provides a deeper understanding of the relationships among the key issues. The model obtained in our case showed a partial inversion of the key issues survey's priorities and gave managers insights for the implications of these issues. ISM forces IT managers and researchers to move beyond the independent consideration of key issues to evaluation of how issues interact. As a result, both parties obtain a better understanding of what needs to be done to resolve key issues. ISM reveals with greater clarity the steps that managers must take to solve their problems. ISM helped us, and the IS managers, to discover that a root cause of many of their problems was developing human resources—a finding that was clearly not apparent in the ranking of key issues because this issue was placed ninth.
- ISM is a general-purpose decision making tool. It is part of a three-phase approach to problem solving. First identify the issues (generate), then rate or rank them (evaluate), and finally determine how they interact (relate). Traditional key issues research, stopping at the evaluate stage, does not investigate the relationship between issues. Clearly, a major benefit of ISM is that it forces managers to consider the interaction of issues and creates a greater understanding of what drives their major concerns.

VI. CONCLUSIONS

Our findings suggest that the traditional single method approach to key issues analysis can be readily extended to a multimethod approach. Additional insights into the key concerns of IS managers were gained because Q-sorting enabled grouping of managers with common concerns and ISM produced a model showing the relationships among key issues.

In their conclusion to a comparative analysis of multiple key issue studies, Watson et al. (1997) argued that there needs to be a redesign of the traditional

approach to key issues studies. They assert that there should be a set of theoretically based international issues that could be used for many studies across nations and periods. We believe that as well as gaining a stronger theoretical foundation, key issues studies need to move beyond descriptive lists of rankings and examine what causes particular concerns to preoccupy IT managers. If this can be achieved, then we gain greater insights into IT management. For example, an Australian key issues study showed that lack of communication with the CEO could explain the high ranking of strategic planning (Watson, 1990). Furthermore, questions such as "What makes a weak IT unit?" are raised by a methodology, such as Q-sort, that enables researchers to dig deeper than traditional key issues surveys. ISM extends the value of a key issues study because it provides insights to IT managers on how to solve their major problems. Thus, the managers participating in this study realized that recruiting and developing human resources was far more important than they initially realized. Forced to explore the causal relationships among their major concerns, IT managers gained new understanding about the interactions among their problems.

Key issues studies always contain a strong practical element. They are conducted with practitioners to help them understand the issues that concern their peers and to alert MIS scholars to areas of practice-focused research. We can enhance the practical and theoretical value of key issues research by adopting methodologies such as Q-Sort and ISM that deepen and broaden analysis.

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APPENDIX

THE BRAZILIAN BANKING INDUSTRY

The Brazilian banking industry is characterized by a small number of financial conglomerates with a large nationwide network of branches (Tables A-1 and A-2). In addition, many small banks provide corporate and investment banking services to external customers or their parent industrial groups. In 1994, for the total of 244 banks 15.7% were owned by the government, 62.8% were private Brazilian owned, and 21.5% were foreign owned.

Table A-1: Evolution of the Banking Sector in Brazil 1964-88

	1964	**1988**
Number of banks	336	106
Number of branches	6,319	13,837

Source: Frischtak (1991)

The banking industry is highly profitable, allowing significant investment in infrastructure, including branches and IT. The banks see IT as strategic, with some of the larger banks even investing heavily in the local computer industry. The banking sector is responsible for almost 30 percent of total Brazilian IT

expenditure. IT investments in 1992-93 were estimated at between two and three billion U.S. dollars.

The significant growth, both in volume and diversity of banking services offered, was made possible by high investments in IT (Frischtak, 1991). High inflation rates also required an increase in the speed of transaction processing. For example, checks are cleared nationwide in 24 to 48 hours. Major banks offer instant nationwide transaction processing. Most retail banks offer a large instant

Table A-2: The Brazilian Banking Sector

Number of banks	**244**
Number of branches	31,000
Number of accounts	44 million
Number of employees	670,000

Source: Informática Hoje (1994)

instant nationwide transaction processing. Most retail banks offer a large spectrum of financial products and services, including bill and tax collection, due to the deficiencies of the postal service.

The importance of IT goes beyond increasing quality and productivity of services. It is essential to the stability of the financial system. Large retail banks are at the forefront of automation, mainly for competitive reasons. IT is considered to be a major strategic resource in the introduction of new products and services.

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