

Instituto Cultural Minerva  
Institute of Brazilian Issues – IBI  
The George Washington University  
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**SISBACEN – CENTRAL BANK INFORMATION SYSTEM:  
AN INSTRUMENT FOR IMPLEMENTING BRAZIL'S EXCHANGE POLICY**

**By Augusto Ornelas Filho**

**Central Bank of Brazil**

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## INTRODUCTION

The Central Bank of Brazil was created, out of the Superintendency of Money and Credit (SUMOC), through Law 4,595 of December 31, 1964. This Law set up the legal framework for the Brazilian monetary and banking system. According to Law 4,595/64, which has had many changes over the years, the National Financial System is composed of the National Monetary Council (CMN), the Central Bank of Brazil, the Bank of Brazil, the National Bank for Economic and Social Development (BNDES), and other public and private financial institutions.

Law 4,595/64 defines the functions of the CMN and of the Central Bank of Brazil. The CMN should formulate the policies related to the currency and to credit, aiming at the economic and social development of the country.

Exchange policies formulated by the CMN, should aim at the regulation of the external value of the national currency and at the equilibrium of the country's balance of payments, maximizing utilization of the foreign currency resources. Focusing on the foreign exchange market, the role of the CMN is to establish basic guidelines regarding foreign exchange rules and policies, including those associated with dealing in gold. In the foreign exchange market, the role of the Central Bank of Brazil is to implement these rules and policies related to the foreign exchange market. More specifically, according to Law 4,595/64, the Central Bank is the sole depository of the country's official reserves in gold and in foreign currencies (subclause VII of article 10), i. e., it is responsible for guaranteeing the regular functioning of the foreign exchange market, the relative stability of exchange rates, and equilibrium in the balance of payments.

Brazil, as several other countries of the so-called third world, has problems, there is a long time, of imbalance in its balance of payments. The causes of this imbalance have been the object of countless studies by economists of numerous tendencies and nationalities. Regardless of the reasons for the deficit, to identify them is fundamental to have qualitative and quantitative information about the country's balance of payments and the use of appropriate tools for the analysis of available data. If the government has information on foreign currency flows, involving all different kinds of exchange operations, the government will be able to monitor the exchange market and to implement the necessary policy and regulation changes that would lead to the equilibrium of the balance of payments.

In the early 1980s, government authorities had some challenges conducting the country's economy and, by this time, government felt the lack of information and of instruments to implement policy changes. The Central Bank of Brazil decided to develop a nationwide, computer-based, online and real time information system to take care of all exchange transactions of the country. The Central Bank had until that time information systems receiving data with a delay at that time, in some situations, of three months. These were computer-based systems that were constructed to process in the batch mode; they were not online systems. Using these batch systems, government could not make decisions using information of the real situation of the market at the moment of the analysis and, worse than this, most of the decisions could not be implemented and monitored in a short period of time. It was clear that Central Bank had to improve the quality of the available information and the agility to obtain it. The Information Technology Department developed a system of centralized registration of exchange operations, called CAMBIO (means "exchange" in Portuguese), with real time input of data. After the implementation of this system the government started to have analytical and consolidated information of the foreign exchange market with no delay, or, in some cases, a delay of one day. Furthermore, the Central Bank of Brazil was allowed to monitor the market with good quality information and was able to act in a very fast and efficient way.

After the implementation of the exchange information system, CAMBIO, in September of 1985, the national financial system and agencies of the federal government required an accelerated

development of the whole Central Bank Information System (SISBACEN). At that moment, the importance of information technology to the monitoring and supervision of the national financial system was very clear, in fact, it was clear at that time that computer-based information systems are very efficient in the enforcement of some regulations. The Central Bank Information System represents all the technological resources that provides the Central Bank of Brazil the necessary infrastructure to capture, store and assure the availability of information that helps the government, more specifically the Central Bank of Brazil, in its economic actions. These government actions should guarantee the desired monetary and exchange equilibrium. The SISBACEN is a very powerful instrument that allows the Central Bank of Brazil to act rapidly and efficiently in the economic and financial market. It is an instrument that really reduced the lag of implementation and the lag of reaction of the market in the process of monetary and exchange policies.

It is not difficult to imagine the importance of a nationwide, computer-based information system to the Central Bank of Brazil. The size of the national financial system in Brazil; the complexity of the finance operations; the high inflation during many years; the necessity of an instrument to implement monetary and exchange policies with a minimum lag and with immediate reaction of the market; the necessity of efficient supervision; and, primarily, the necessity of updated, precise and global information about the economy of the country required the development of the system.

The investments required to implement the whole infra-structure of the SISBACEN in the early 1980s were very large. At that time, the use of new technology and of large area networks of computers were not very common in governmental institutions. Although the great results that the government would achieve with the SISBACEN considering the capacity of supervision, the quality of the information of the economy and the capacity of implementation of the monetary and exchange policies, the operational costs reduction was an important factor in justifying the investments. The operational cost reduction brought with a computer-based system are considerable. The decision of a large investment in technology considered that many activities would be implemented in computer-based systems and, as a consequence, many people who worked in back-office functions could be transferred to work in other functions related to the end functions of a classic central bank.

This paper will present the Central Bank Information System, SISBACEN. It will mention the beginning of it, the development, the current situation and the future tendencies. The focus will always be the importance of the system for the international area. The paper will explore the main systems related to the exchange policies of Brazil: System of Centralized Registration of Exchange Operations (CAMBIO), System of Electronic Auction of Foreign Currencies (LEILAO) and Foreign Trade Integrated System (SISCOMEX).

## **1. An Overview of the SISBACEN**

### **1.1 The necessity of a flexible, agile and reliable information system**

The rapid evolution of technology during the decade of the 1980s in the world made possible for institutions, mainly large private companies and government institutions, the development of large computer-based projects which aimed at the reduction of costs in most of the cases and, in many others, aimed at solutions and results that could not be reached before. Specifically in Brazil, during the 1980s, we had market protection for computer goods, mainly for microcomputers. This policy led most of the computer-based solutions to high capacity computers, the mainframes, that were very powerful and expensive.

The necessity of many controls in the economy of the country in the 1980s and the lack of good-quality and updated information of the national financial system demanded from some departments of the Central Bank of Brazil, in addition to the Information Technology Department, the development of new information systems. These new information systems, using the new available technology, should replace the old systems.

In the early 1980s, due to the difficulties caused by the 1982 Mexican payment default, Brazil suffered a severe reduction in the inflow of foreign capital. It devalued the national currency and implemented exchange controls because of the severe balance of payments stress. The necessity of an instrument to gather information about the foreign exchange market and that could be used in the implementation of monetary and exchange policies with no lag in implementation nor lag of market reaction was indispensable. Beside the foreign exchange market, the controls of the national financial market, that the Central Bank of Brazil should do, could be done much more efficiently using appropriate tools.

The solution planned and implemented in the 1980s used mainframe computers, with very high capacity for that time. All the banking system of the country should have been able to access the system from anywhere in Brazil using video terminal or telex terminal. Since that time, it has been a nationwide system. The system is designed to be an integrated, corporate system, easy to be modified, safe, reliable and available without undesirable interruptions. The system has been developed by the Information Technology Department of the Central Bank of Brazil.

## **1.2 The beginning of the SISBACEN and its evolution**

Before the existence of SISBACEN, the Central Bank had computer-based systems to assist, specifically, some of its non-end functions that involved a great volume of data or many workers to perform them (e.g., payroll systems and accounting systems). These computer-based systems were developed using the traditional computer languages of that time. The languages used were COBOL and ASSEMBLER. All these systems were not online systems. Rather, they were processed in the batch mode, demanding a lot of centralized fingering of the data and punch of computer cards. There was almost no integration among the systems.

At the beginning of the 1980s, given the great evolution in available technology, and the identified urgent need for agile, flexible, and safe systems to assist the execution of the main functions of the institution, the Central Bank started developing the system of centralized registration of exchange operations. It is called CAMBIO. As was stated before, the international crisis of that time, and mainly the Mexican crisis of 1982 and the significant reduction in foreign capital inflows to Brazil, necessitated this system. The CAMBIO system was a new experience for the Information Technology Department of the Central Bank. The system was developed using a fourth generation language to write the programs, called NATURAL (provided by Software A G). The whole system, based on the data base management system ADABAS (also provided by Software A G), was a nationwide system allowing online access by all financial institutions in the country that had exchange operations. It allowed also online access by many other government agencies.

The first release of the CAMBIO system was developed to be accessed by video terminals or by telex terminals. Due to the high costs of computer products at that time, 1985, the Central Bank, although very interested in the implementation of the system, had difficulty convincing the national financial system to accept it. The Central Bank negotiated a solution that made the project possible, i. e., the system had to permit access by video terminals (computers) or by telex terminals. All institutions at that time had telex terminals that enabled them to access the CAMBIO system. They did not have to make any additional significant investment. Approximately three years after introduction of the system, in 1988, the Central Bank decided that every institution that had exchange operations had to use the CAMBIO system and had to do it using video terminals; at that time the telex access was discontinued. Since then, all the exchange operations are registered in the system in real time. Any institution that has an operation that is not registered in the system on the same day suffers penalties.

Since 1985, the SISBACEN has become an instrument used every day by the national financial system. It also has become an important instrument of communication between the Central Bank and the national financial system. Many monetary and exchange policy decisions were implemented, and achieved expected results, just because of the availability of this nationwide system, the SISBACEN.

During the last 13 years the evolution of the SISBACEN has been very fast. Computer use in the institution is very wide spread; the quality standards and the efficiency demonstrated by computer-based systems are a reality. Nowadays, the SISBACEN is available 24 hours a day, every day of the week, with just indispensable occasional pre-programmed stops on some weekends or holidays. More than seven billion characters move through the computational complex every day, using more than 120 integrated, interlinked and interdependent systems that share more than 500 data base files updated at real time. The system is accessed by more than 60,000 individual clients, using more than 20,000 work stations spread throughout the country. It is not an exaggeration to say that the national financial system, including the Central Bank, is quite dependent on the SISBACEN.

## **2. The Computer Platform of the SISBACEN**

The computer platform of SISBACEN includes the high capacity computers (mainframes), the servers computers, the work stations used directly by the users, the connection between the computers, the communication solutions available for remote access, all the software used by the computers, peripheral devices and many others components. There are several models of servers, work stations, and the respective software, used by the SISBACEN. The platform specified bellow considers the main computer system: high capacity computers, respective software, connection and communication solutions.

- **MAINFRAME COMPUTERS**

- IBM 9021-9X2, 480 MIPS, 2048 MB (CS) + 2048 MB (ES)
- AMDHAL 5995-10670M, 480 MIPS, 2048 MB (CS) + 2048 MB (ES)
- IBM 9672-R44, 156 MIPS, 2048 MB (CS + ES)

- **OPERATIONAL SYSTEM (mainframe computers)**

- IBM OS/390 2.4 e VM/ESA 2.2

- **Connection among the central computers and the peripheral devices using optic fiber**

- architecture IBM-ESCON

- **Storage capacity (magnetic disks)**

- 2000 gigabytes – IBM 3390 or similar

- **Telecommunication control units**

- in Brasilia: CPM 1475-B, 16 MB, 800 lines + IBM 3745-900, 8 MB, 800 lines
- in Sao Paulo: CPM 1445-B, 80 lines
- in Rio de Janeiro: CPM 1445-B, 80 lines
- in Belo Horizonte: CPM 1445-B, 32 lines

- **Magnetic tape units**

- 16 cartridge units model F6470 A11 (compatible to IBM 3490E)
- 8 cartridge units model F6470 A (compatible to IBM 3480)

- 5 spool units IBM 3420-8
- **Main printers**
  - 2 laser printers XEROX 4890
- **Data Base Management System**
  - ADABAS 6.2.2 (provided by Software A G) – 10 copies
- **Teleprocessing management**
  - IBM CICS/ESA 4.1 – 40 address spaces
- **Mainframe systems – main development language used**
  - NATURAL 2.2.8 (provided by Software A G)
- **Others software**
  - ROSCOE 6.0, LIBRARIAN 4.3, NCP/COMTEN, PREDICT 3.4.1, NATURAL CONSTRUCT 3.3.2, VISUAL BASIC 5.0, DELPHI 3.0, COBOL for MVS 1.2.0, High Level ASSEMBLER 1.2.0, DB2 5.2 (UDB), ENTIRE CONNECTION 2.2.7, NetView 3.1.0, Connect Direct 3.3.0, TCP/IP for MVS 3.2, VTAM 4.4.0, NPM 2.2, ACF/NCP 7.5
- **Local Area Network**
  - **main network (Brasilia):** ATM network, backbone with two IBM 8260-017 switches interconnected (622 Mbps), two route guides CISCO 7507 to connect to the mainframes via ESCON channels. Management of the network with RS 6000 (IBM) computers and TIVOLI (IBM) software.
  - **department networks (Brasilia):** implemented using 28 switches (IBM 8274-W93 and IBM 8274-913), with dedicated slots of 10 Mbps, connected to the backbone with optic fiber (155 Mbps).
  - **regional department networks (others cities):** fast-ethernet backbone (100 Mbps), implemented using IBM 8274 switches, with mixed solution of dedicated slots (10 Mbps) and IBM hubs. The connection to the main network is done with route guides IBM 2210, via frame relay of EMBRATEL, with an IBM 2216 in Brasilia.

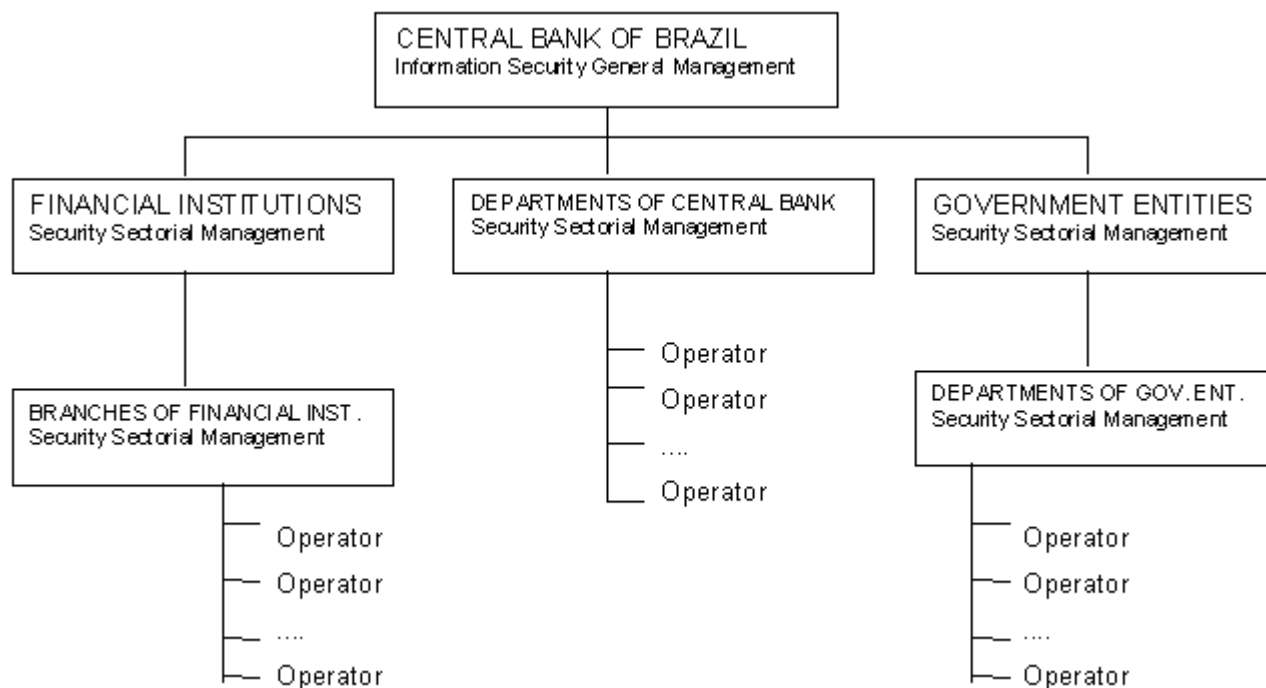
### 3. The Security Subsystem of the SISBACEN

The architecture of the security subsystem of the SISBACEN considers to identify the user of the system by four types of information: a code to identify the institution, a code to identify the branch of the institution, the name of the operator and the password of the operator. The institution is the entity that uses the system; it can be a financial institution, a government entity or a department of the Central Bank of Brazil authorized to access the system. Departments of the Central Bank are identified just by the code of the institution, they do not have code of branch.

The security subsystem has four levels, with defined hierarchy, to control the authorizations of institutions, branches of institutions and operators:

- Information Security General Management – executed by the Information Technology Department of the Central Bank;

- Security Sectorial Management of the Institution – executed by an administrator of each institution that is previously authorized by the Information Security General Management;
- Security Sectorial Management of the Institution's Branch – executed by an administrator of each branch of the institution that is previously authorized by the administrator of the Security Sectorial Management of the Institution;
- Operator – is the user of the system that will use the transactions to consult and update the data base of the SISBACEN.



#### 4. Solutions for the International Area of the Central Bank

At this moment, the SISBACEN is a computer-based information system integrated by more than 120 interlinked and interdependent subsystems that share more than 500 files managed by data base management systems. The goal of the Information Technology Department of the Central Bank is to provide computer-based solutions to the institution. The SISBACEN is a solution that brought reductions in costs, that made possible the implementation of monetary and exchange policies in a very efficient way, that gathered information about the national financial system and made it available to the government, and that enables the institution works with a reduced number of employees.

To help the Central Bank execute its institutional mission, many functional areas are automated through the use of SISBACEN. Considering the domestic area, we can highlight the control of banking operations, mainly the flows through the reserve accounts of the financial institutions, the administration of currency circulation, the agile and safe communication system with the financial market, the accounting system of the Central Bank, and the supervision system of the national financial market. In the international area, we can highlight the foreign exchange controls of the country, and mainly the supervision of the foreign exchange operations, the integration of the foreign exchange operations with the foreign trade operations, the management of international reserves, the electronic auction of foreign currencies, the management of the Brazilian external debt, the management of the financed import operations and other long-term operations, and the management of foreign direct investment in the country.

## 4.1 CAMBIO – System of Centralized Registration of Exchange Operations

### 4.1.1 The importance of the CAMBIO subsystem

The most orthodox instruments to adjust the balance of payments of a country are, without a doubt, the management of exchange rates, the management of domestic interest rates, and the use of customs tariffs. However, the economy of a country is always very complex, and the equilibrium in the external accounts is just one of the goals targeted by economic policies. Many times, the use of these traditional instruments, exchange rates, domestic interest rates and customs tariffs, cannot reach a successful and efficient result without affecting other government priorities. Other government priorities affected can be as important as equilibrium in the balance of payments, e.g., like the internal rate of growth, the stability of prices, low unemployment, the level of investments in the country, and the level of savings.

Brazil, like many other countries, chose to use together the traditional instruments aiming at the orderly of the external accounts, more direct controls that could lead to more efficiency in the allocation of the scarce resources available in foreign currencies in the national production system. Since 1931, we have in Brazil, sometimes in a higher scale than others, quantitative and qualitative restrictions over the imports. Since March of 1990, when Fernando Collor de Melo was the president of Brazil, started a new process reducing the restrictions over the imports, which led to a great increase in the volume of imports. The quantitative and the qualitative restrictions over the imports bring together with it an adverse collateral effect, that is the arising of demand with no supply by the regular commercial processes. This demand without supply by the regular commercial processes will lead to informal and illegal practices in the market; practices not allowed by the laws, that is contraband. Besides contraband, it will lead to the increase of internal prices because of the shortage in the supply, and, certainly, lead to inflation.

Considering the continental dimensions of a country like Brazil, it is not hard to imagine the amount of difficulties that has to be faced by the police and customs authorities in the repression of the contraband. The controls over the exchange operations appeared as a very important instrument in this case because, if we look at all alternatives that were available, the controls over the exchange operations were the most agile and efficient instrument able to correct, in a short period of time, the deviations that might occur in the commercial and financial external flows.

To have an efficient control over the exchange operations we needed a centralized management of the available exchange values of the country, what means that we had to work with the concept of unique cashier. In this system, of unique cashier, all the exporters and others receivers of exchange currencies must sell to the unique cashier the foreign currency resultant from their activities. At the other side, all the importers and other demanders of foreign currencies must buy it from the same unique cashier.

Nowadays, there is no significant restriction in providing the demand of exchange currencies. In the recent past, only some qualified demand could be provided, what means that only those people which the necessities of foreign currencies were according to some specific characteristics in the economic process could buy foreign currencies. Examples of qualified demand are: qualified import operations; payment of loans in foreign currencies, authorized by the Central Bank; foreign capital companies sending back their profits abroad; payment of royalties or other intellectual properties rights; and others.

The role of the Central Bank, in this process of foreign currencies exchange controls, is, fundamentally, the management of the unique cashier, making sure that:

- all revenues in foreign currencies should go to the unique cashier;



- all expenditures, using foreign currency, should be in situations of authorized and legitimate transactions;
- all available foreign currency should have the best possible utilization.

The Central Bank is not, certainly, the exclusive player in the foreign currency market; the Central Bank is not the only one to buy or to sell foreign currencies in the country. There are many agents in the market, financial institutions authorized by the Central Bank, that perform directly with their clients the operations of buying and selling foreign currencies in many cities in the country. To monitor the large number of transactions that are made by these authorized financial institutions in the whole country, the Central Bank needs agile and efficient tools, otherwise it could not be possible in a good degree of satisfaction.

To manage the exchange market is necessary to monitor the exchange operations. Monitoring the exchange operations we can avoid fraudulent operations that would cause losses for the country. It is also important to monitor the total amount of foreign currencies that all financial institutions have each day because there are rules defining limits to the stocks in foreign currencies. Considering that the controls of the stocks are done by the contract date of the operation, it does not matter the settlement date of the operation, the foreign currency stock of the institution, that we call exchange position, can be positive, in the case that the institution bought more of the foreign currency than sold, or it can be negative, in the case that the institution sold more of the foreign currency than bought. Of course that negative exchange position can occur in the case that there are operations selling foreign currency that will be settled in future dates. The Central Bank needs to have appropriate tools that permits the evaluation of the exchange market in a specific city, in a specific region of the country, or in the whole country. This is necessary to have a good management of the exchange policies of the country.

#### **4.1.2 An Overview of the CAMBIO subsystem**

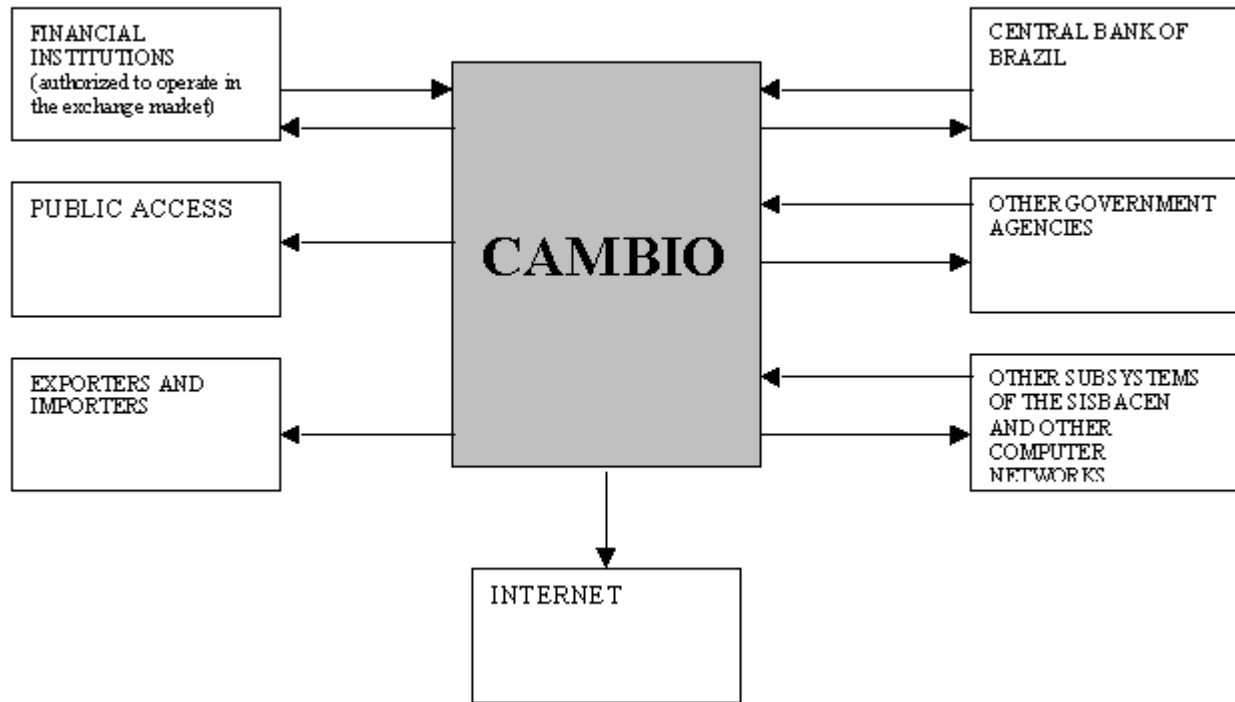
The CAMBIO subsystem is considered one of the major and more important subsystems of the SISBACEN. It was implemented on September of 1985 and the main reasons of the development of the system were related above.

It is an interactive and online system developed to offer to the Central Bank information of the foreign exchange operations that occur in Brazil, and to offer tools to the Central Bank that permit agile, precise and nationwide implementation of exchange policies. The system provides a rational and fast flow of information between the Central Bank and the financial institutions authorized to do exchange operations. It permits the Central Bank monitors the exchange market with more and better information; it permits the implementation of exchange policies with almost no lag of implementation and no lag in the market reaction. Examples of these implementations that occurred in the past are:

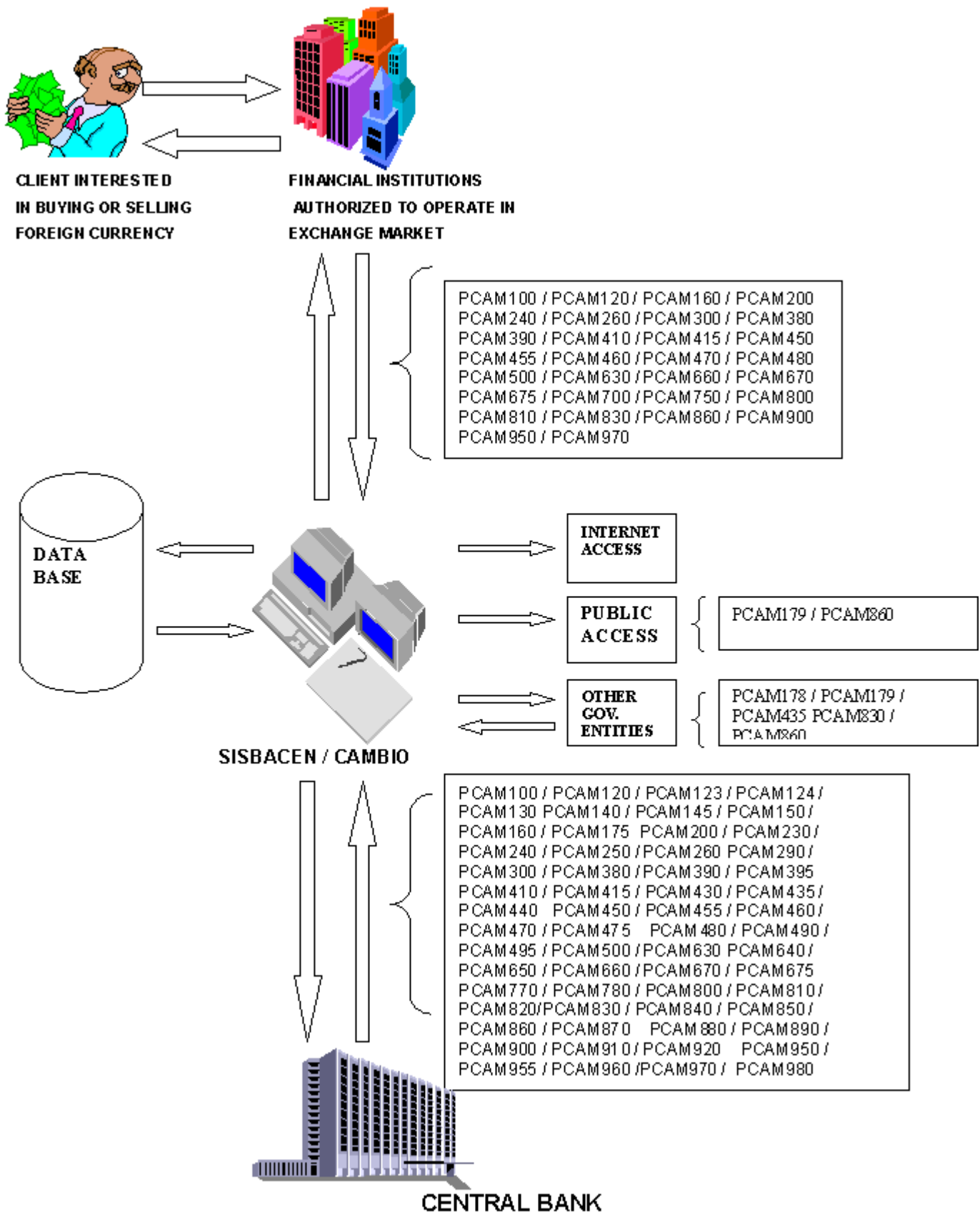
- a. in 1986 was implemented the Resolution 1208 that offered to the exporters the possibility of making deposits in foreign currency, in the Central Bank of Brazil, remunerated by interest rates. These deposits were linked to the export operations that originated the respective amount of foreign currency;
- b. in 1987 was implemented the Resolution 1263. This resolution obligated that most of the exchange contracts made to pay interest should be deposited in the Central Bank; it was a compulsory deposit of these values. This was a selective moratorium;
- c. in 1989 was implemented another moratorium, the Resolution 1564. The implementation of this resolution offered to the Central Bank tools that permitted managing a dynamic moratorium. The characteristics of the exchange operations that should be deposited in the Central Bank could be informed, and altered, to the CAMBIO subsystem and the system would consider it immediately in the processing of all exchange operations of the country;

- d. in 1989 the Central Bank decided to have in Brazil two exchange markets, with independent exchange rates and rules. Some operations, with specific characteristics, had to be done in a market that was called floating rate exchange market (tourism operation and others). The other group of operations, that represents the larger part of the market, had to be done in a market that was called the free rate exchange market (export, import, etc). The controls of stocks and flows of foreign currencies had to be done separately. There were specific rules that had to be applied depending on which market the operation was made;
- e. many other resolutions of the exchange policies were implemented. In fact, most of the exchange policies of the last 13 years would not have the same effects that it had if they were not implemented through a nationwide, computer-based, system as the SISBACEN.

To better understand the CAMBIO subsystem it is very useful to analyze the diagram below, which is a sort of context diagram. The objective of this diagram is, in a simple way, to show the actors and the scope of the system. As we can see, through the direction of the arrows, almost all actors, or entities, involved in the diagram update some information in the CAMBIO subsystem and get information from it. Of course that financial institutions, brokers and other institutions that are responsible for the exchange operations with the clients, are responsible for most of the data in the system. The exporters and importers just update the data base of CAMBIO subsystem through the use of another subsystem, the SISCOMEX, as we will see forward. They use the SISCOMEX subsystem to input the commercial characteristics of the export and import operations. The Central Bank is a real player in the exchange market, doing interbank and international transfer exchange operations, and also updates the system with parameters and operational functions. There are many functions available to the Central Bank to consult information about the exchange market and to change parameters of the system. Other government agencies, including the Ministry of Finance, others Ministries, the Republic Presidency, etc, use the system most of the time just to consult information about the exchange market. However, there are some specific situations when government agencies update the system. Considering that CAMBIO subsystem is linked to others subsystems of the SISBACEN and it is also linked to systems of other government agencies, that is other computer networks, we have automatic update and consultation between these systems. As shown through the diagram, the public access allows any person that wants to, obtain information from CAMBIO subsystem. Just like through the public access there is also available access through INTERNET. The objective of this diagram is not to identify all the flows of information between the entities and the subsystem, it would require much more detail and this is just an overview of the subsystem.



The functions of the CAMBIO subsystem are gathered in groups that are called transactions. The security system of the Central Bank manages the transactions and the authorizations to access these transactions. To avoid the use of technical instruments of systems project to explain the structure of the system, as entities and relationships diagram or data functional diagrams, the best way to present the system is by the view of the users of it, presenting the available transactions. Each transaction has a short name to identify it, has a descriptive name to identify the main goal of the transaction, a specific group of users allowed to use it and a specific group of functions supported by it. The CAMBIO subsystem is integrated by more than 60 transactions. It is a dynamic system and there are many transactions that are already disable, and many others that are only partially used nowadays. The figure bellow indicates the transactions available to be used by the entities that interact with the system. Just after it, the main transactions of the CAMBIO subsystem are listed, with a short description of it:



### PCAM300 – REGISTRATION OF EXCHANGE OPERATIONS

The PCAM300 is the main transaction of the CAMBIO subsystem. This is the transaction used to register the export operations, import operations, international transfers and some interbank

operations. Since 1993 an exchange operation in Brazil is valid only if it is registered in the CAMBIO subsystem and it received an automatic identification number from the system; it is called an electronic exchange contract. The registration in the system has all financial characteristics of the operation between the buyer and the seller of the foreign currency. At one side is the financial institution that is responsible for the registration of the contract in the system, and, at the other side, is the client of the contract that can be an exporter, an importer, a company sending profits back to its headquarter, etc. Of course that, in some cases, the financial institutions are buying foreign currency and, in some others, they are selling foreign currency; the same situation occurs with the client of the operation. All the occurrences of the contract are registered through the PCAM300: the initial registration of the contract, the settlement of the contract, the cancel of the contract in some cases, the link of the contract to the commercial operation of export or import, the link of international transfer contracts to the authorizations of the Central Bank and many others. It would be a long explanation to go through all the occurrences and this is not the objective of this description. It is important to emphasize that this transaction has many functions, more than 50 different functions, and through the use of this transaction by the institutions, we gather information of all the export operations, import operations, etc, of the country. Another important point is that any exchange policy that the Central Bank intends to implement concerning to these sort of operations can be done changing the PCAM300 and the effects will be immediate. This transaction use to be accessed more than 12,000 times on working days.

### **PCAM500 – SPECIAL REGISTRATION OF EXCHANGE OPERATIONS**

This transaction is almost the same of PCAM300. There are two specific uses for this transaction: 1) in the case that the financial institution did not register the operation in the system in the same day that it occurred, the register can be done in a different day using PCAM500. This registration will not be effective until the Central Bank analyzes the reasons of the delay and decides to accept it or to reject it. If the Central Bank does not accept it, this registration will be logically excluded from the system and the institution has to register it using PCAM300 on current date; 2) there are special situations that the operation does not have all the characteristics normally accepted by PCAM300; the operation is rejected by the automatic validation of PCAM300. The PCAM500 accepts some cases rejected by PCAM300, but, just like the first situation above, the Central Bank can approve it or reject it.

### **PCAM290 – CONFIRMATION AND CONSULT OF EXCHANGE OPERATIONS**

The PCAM290 transaction is used by the Central Bank, by its ten representations spread in the country, to manage the operations registered in the CAMBIO subsystem through PCAM500. As described above this transaction is used to analyze and approve or reject operations registered with delay of one or more days, or operations with some special characteristics. When PCAM290 shows the exchange operation to the user who will make the decision, it highlights the reasons that made the exchange operation be submitted to approval.

### **PCAM450 – CONSULT OF EXCHANGE OPERATIONS AND SISCOMEX INFORMATION**

This transaction is used by financial institutions to consult all the information of the exchange operations and its occurrences. It also allows the users to access information about commercial characteristics of export and import operations that are captured by another system, the SISCOMEX. Each branch of the institution can consult its own registers; there are security routines to guarantee this.

### **PCAM430 – CONSULT OF EXCHANGE OPERATIONS AND SISCOMEX INFORMATION – CENTRAL BANK**

The PCAM430 is almost the same transaction of PCAM450, but it is to be used by the Central Bank of Brazil and, of course, it permits the consult of any operation registered in the system. The Central

Bank can see all information about the contracts between the financial institutions and its clients. There are internal restrictions and controls in the Central Bank.

### **PCAM460 – EXCHANGE POSITION / INSTITUTION'S BRANCH**

All exchange operations and its occurrences have specific values, are in specific currencies, have specific contract and settlement dates, etc. Many values are aggregated, in different ways, to permit the evaluation of the flows of the branch of the financial institution, the flows of the whole financial institution in the country, the flows in the whole city where the exchange operation occurred and the flows in the whole country. There is also aggregated information as well about the stock variables of the market within the same levels. The PCAM460 permits the branch of the institution, responsible for the registrations, knows its own flows, and its own stocks, in different currencies and all the values converted to US dollars.

### **PCAM410 – EXCHANGE POSITION / INSTITUTION'S HEADQUARTER**

The PCAM410 is almost the same of the PCAM460. The difference is that this transaction is used by the headquarters of the financial institution and it permits access to the flows and stocks of all branches of the institution separately, and it also permits the consulting of aggregate information about the flows and stocks of the institution as a whole.

### **PCAM440 – EXCHANGE POSITION / CENTRAL BANK**

The PCAM440 is one of the most important transactions available to the Central Bank. It is about the same of PCAM460 and PCAM410, but it permits consults of all different aggregations: flows or stocks of any specific branch, flows or stocks of any institution, flows or stocks of any city and flows or stocks of the country. It has more functions than the PCAM460 and PCAM410 that allows the Central Bank monitors the limits of stocks in foreign currencies, the tendencies in the market, the concentration of specific type of operation by cities or regions, etc.

### **PCAM100/PCAM120/PCAM140 – CONSULT OF NON SETTLED CONTRACTS**

Just like described for the PCAM460, PCAM410 and PCAM440 we have three transactions available to monitor all the situations of the contracts registered in the system. The PCAM100 permits consults only of the contracts of the branch of the institution, the PCAM120 permits consults of the contracts of any of the institution's branches and the PCAM140, that is used by the Central Bank, permits consults of all the contracts in the system. These transactions are used to list contracts that are not settled yet. There is option to list contracts by its maturity dates; to list contracts with expired maturity dates; to list export contracts with some kind of irregularities; etc. Most of the functions available in these transactions are used to query about long periods that implies in working with large amount of data. Usually, the answers of the system in these cases are returned by printed reports.

### **PCAM380 – INTERBANK EXCHANGE OPERATIONS WITH AUTOMATIC SETTLEMENT – REGISTRATION AND CONFIRMATION**

It is available in PCAM300 transaction a function to register the interbank operations, which are operations that occur between two financial institutions: one institution sells foreign currency and receives domestic currency and, at the other side, the other institution buys foreign currency and pays it with domestic currency. There are also some operations that involves two foreign currencies, i.e., an institution buys a foreign currency and pays it with a different foreign currency. These operations are done, in a very simple analysis, to control the stocks of different currencies of the institutions; many times the institution has excess of a specific foreign currency and, many others, the institution needs a specific foreign currency to settle an operation. Besides it, the institutions have limits to its stocks and they need to work on the stock during the whole day to keep it at the levels that they want. Of course, this market is also used as a speculative market, just to make money; buy cheap and then sell it more

expensive in the same day. Since 1990, the CAMBIO subsystem offered a new transaction, the PCAM380, that brought very new, and well accepted by the financial market, features. This transaction is used only to do operations with a foreign currency against domestic currency. The PCAM380 works considering the two parts involved in the operation at the same time: 1) after the negotiation of the operation between the two institutions, the buyer of the foreign currency input the characteristics of the operation in the system using PCAM380; 2) immediately after it, the operation will be shown through the same PCAM380 to the seller of the foreign currency, only to the seller, as an operation waiting for confirmation of the seller; 3) the seller has one hour to confirm the operation, and, if the seller does not confirm it, the system will automatically exclude the operation, logically, and it will have no further effect for any of the parts; 4) if the seller confirms the operation, the exchange contracts of the two parts will be automatically generated by the system, the flows and the stocks will be automatically affected, the transfer of the values in the domestic currency are automatically made through the reserve accounts of the banks and, in the case that the Central Bank is one of the parts involved in the operation, the SWIFT message, ordering the payment in the foreign currency or just noticing the expectation of the credit in foreign currency, is automatically issued. The main point of this evolution is that it brought much confidence to the interbank operations because the system takes care of the payment in the domestic currency and the system has the validation of the two parts registered. Besides, it brought a large reduction in the operational costs of this kind of contracts. As will be shown further, this market is really considerable, it has about 1000 contracts every day and it negotiates over four billion dollars almost every day. All the operations registered through this transaction are considered to build an average of the exchange rates that is used as a parameter by the financial market. There is a specific transaction of another subsystem that is very used by the financial market, in fact, it is used during the whole day, that shows the characteristics of the market considering only US dollar operations. This transaction is called PCOT700 – INTERBANK EXCHANGE OPERATIONS, and it offers information about all operations in US dollars registered through PCAM380 at the moment; it makes an automatic refresh every two seconds. Of course the average exchange rate shown by the PCOT700 pass through some statistics process to eliminate the effects of some mistakes done by the market and also some suspect operations with too low or too high exchange rates. It is made an analysis of the frequency curve eliminating the extremes depending on the symmetry of the curve. The PCOT700 is a transaction of just one function and just one screen. As an example we have below the situation of the financial market in Brazil, on March 15 of 1999.

```

SISBACEN DEINF/ORNELAS      DIVULGACAO DE TAXAS E INDICES      15/03/99 16:57:23
TRANSAÇÃO PCOT700      INTERBANCÁRIO                      VCOT7001
----- P/MOEDA US$ -----
                                  MOVIMENTO DE: 15/03/99
PRAZO TAXA MEDIA ULT. TAXA TAXA MEDIA ULT. TAXA ---VOLUME NEGOCIADO---
DIAS DIA ANT. DIA ANT. NO DIA NO DIA DIA ANTERIOR NO DIA
-----
1 1,89276 1,93000 1,90025 1,90000 1.109,7 1.207,6
2 1,90474 1,90500 1,88419 1,88500 1.545,9 716,2

----- VOLUME NEGOCIADO EM OPERACOES FUTURAS (DIAS) -----
                                  TOTAL
                                  30 DIAS 60 DIAS 90 DIAS 120 DIAS 150 DIAS 180 DIAS PRE/POS
-----
PRE (US$) 0,0 0,0 0,0 0,0 0,0 0,0 0,0
TAXA 0,00000 0,00000 0,00000 0,00000 0,00000 0,00000
POS (US$) 0,0 0,0 0,0 0,0 0,0 0,0 483,8

TOT. NEGOCIADO NO INTERBANCARIO (US$) : DIA ANT. = 3.292,3 NO DIA = 2.443,1

----- UNIDADES : TAXA SEM R$ 1,00 - VOLUMES EM US$ 1,000,000.00 -----
                                  PF3/15=RETORNAR

```

## PCAM870/PCAM871 – PARAMETERS TABLES FOR MONITOR ACTIVITIES

These two transactions are used to help monitoring the exchange market. The PCAM870 is used by the Exchange Department of the Central Bank to define parameters that are used by the CAMBIO subsystem to identify suspect operations. The parameters that the Exchange Department defines can consider almost all characteristics of the exchange operations: the client, the financial institution, the city of the operation, the currency, the objective of the operation (a table defines it), the value of the operation, the exchange rate, etc. The Exchange Department can define parameters to be considered in the whole country or it can define parameters to a specific city or region. All exchange operations of the day are analyzed by the system considering all active parameters. The parameters can change any time that the Exchange Department wants to. The operations that match with the parameters are automatically marked by the system to be investigated by the Central Bank, by the respective representation that is responsible for that region. In fact, with the parameters the Exchange Department also indicates the minimum procedures that have to be followed in each situation. The PCAM871 is almost the same of PCAM870, but it is used by regional representations of the Central Bank to define local parameters that have to be applied only to operations of its responsibility. These transactions are a powerful instrument to the Central Bank because they are a sort of data mining, they work on a large amount of data and they identify suspect operations. It is a dynamic process which means that the parameters can change every day, they can become more sophisticated with time. Another important point is that with these instruments the Exchange Department can have, somehow, a standard level of monitoring in the whole country, with a standard level of intervention and standard procedures everywhere.

The main transactions were described above, it would take too long to describe it with many details. Many other transactions are available, some of them to support specific kind of operations or provide specific consult or operational routines. The number of transactions changes because there are always new implementations in the system, but, as a reference, the number of transactions of the CAMBIO subsystem by this time is 67. It is important to keep in mind that the CAMBIO subsystem is not isolated, it works integrated with many others subsystems, many others transactions.

To have an idea of the size and use of the CAMBIO subsystem it is interesting to have some numbers about it. The two tables below show it.

<b>SIZE OF THE CAMBIO SUBSYSTEM</b>	
Number of programs	over 2,000 programs and over 900 maps
Number of code lines	over 1,000,000
Number of batch routines	49
number of data base files	66
data base size (used area)	100 gigabytes
number of registers in the data base	over 240,000,000

<b>USE OF THE CAMBIO SUBSYSTEM</b>	
number of working stations	over 20,000
number of registered users	over 60,000
number of exchange operations	over 12,000 / day
number of occurrences registered by PCAM300/PCAM500	over 50,000 / day
number of occurrences registered by pcam380	over 1,000 / day
volume negotiated through PCAM380	over US\$4,000,000,000 / day
number of accesses to PCAM300	over 12,000 / day

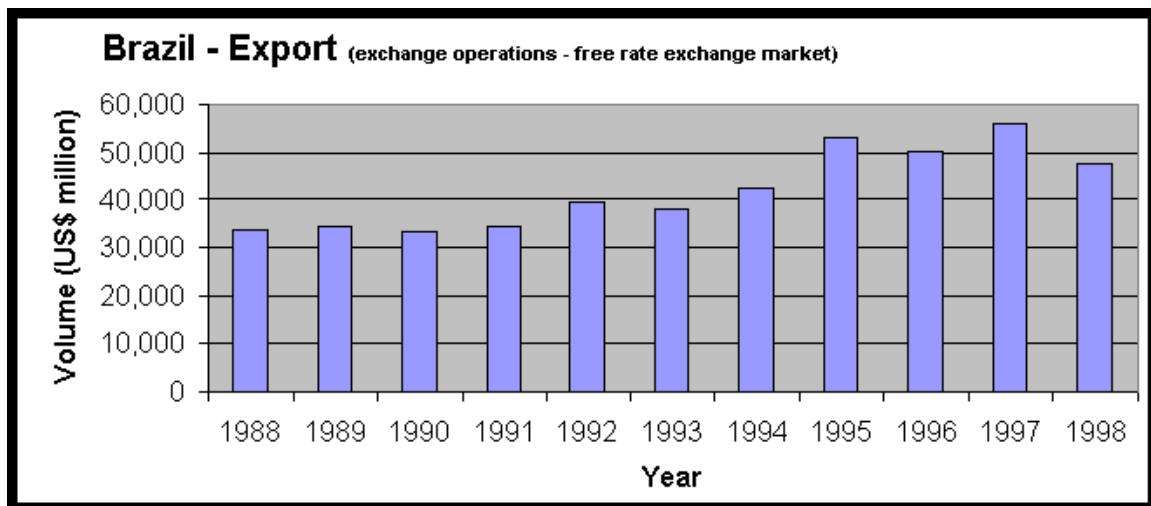


The numbers about the use of the system change depending on the situation of the economy. The numbers above can be considered as a reference of 1998.

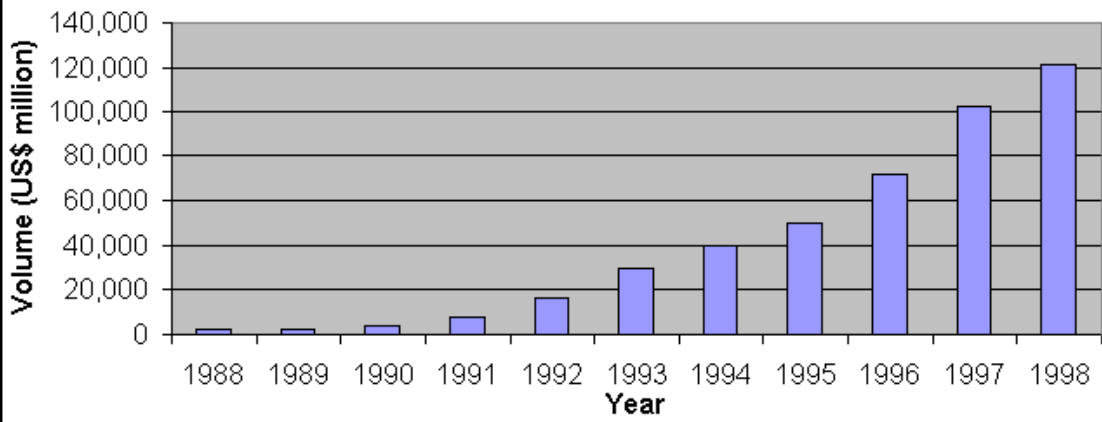
The results obtained with the CAMBIO subsystem are considerable. There are much more to be done but, just through an overview, it is clear that the system is an important instrument to monitor the market and to implement changes in the exchange policies of the country. The table and the charts bellow give an idea of the size and the evolution of the exchange market in Brazil (source: SISBACEN):

Year	Export	Import	Financial Inflow	Financial Outflow	Interbank
1988	33,465	14,527	2,585	15,536	
1989	34,295	17,286	2,314	16,899	15,122
1990	33,421	19,491	3,746	14,178	80,917
1991	34,504	19,757	7,700	15,500	137,966
1992	39,559	18,832	16,351	16,507	392,918
1993	37,807	21,298	29,756	28,348	545,884
1994	42,561	25,838	39,919	40,149	762,016
1995	53,146	41,549	49,806	47,749	812,088
1996	50,228	41,479	71,826	55,352	1,069,242
1997	55,900	58,582	102,715	82,976	1,248,054
1998	47,745	43,938	121,322	107,814	1,368,964

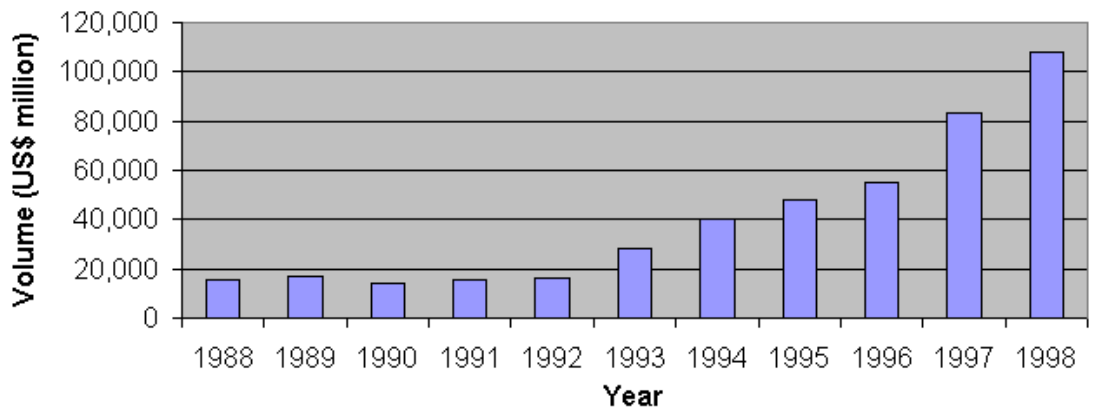
BRAZIL – Exchange Operations – Free Rate Exchange Market – US\$ million



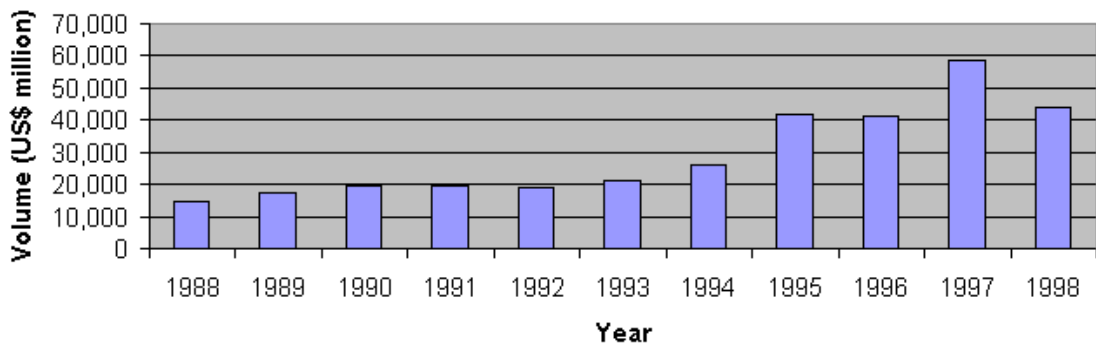
### Brazil - Financial Inflow (exchange operations - free rate exchange market)

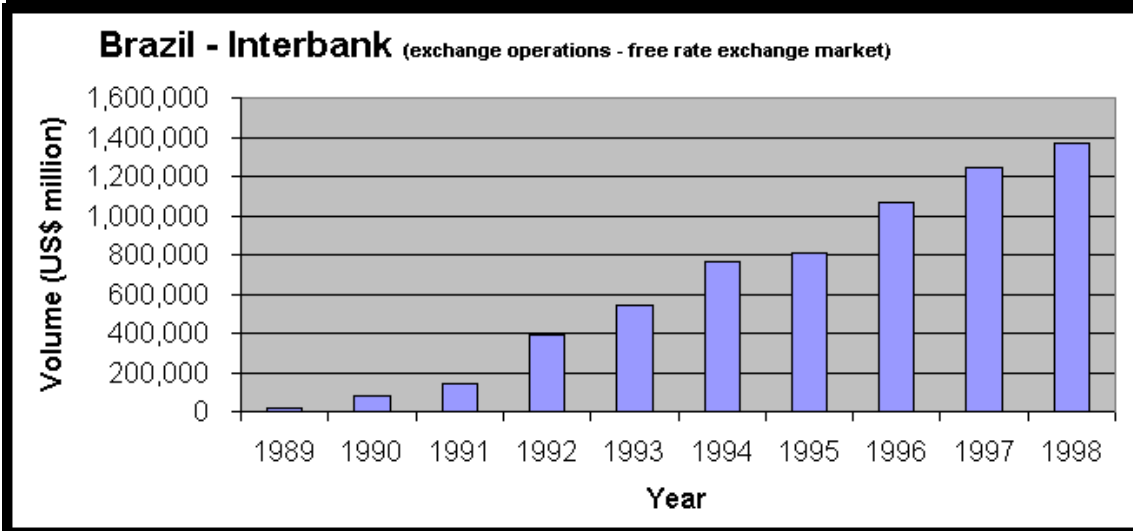
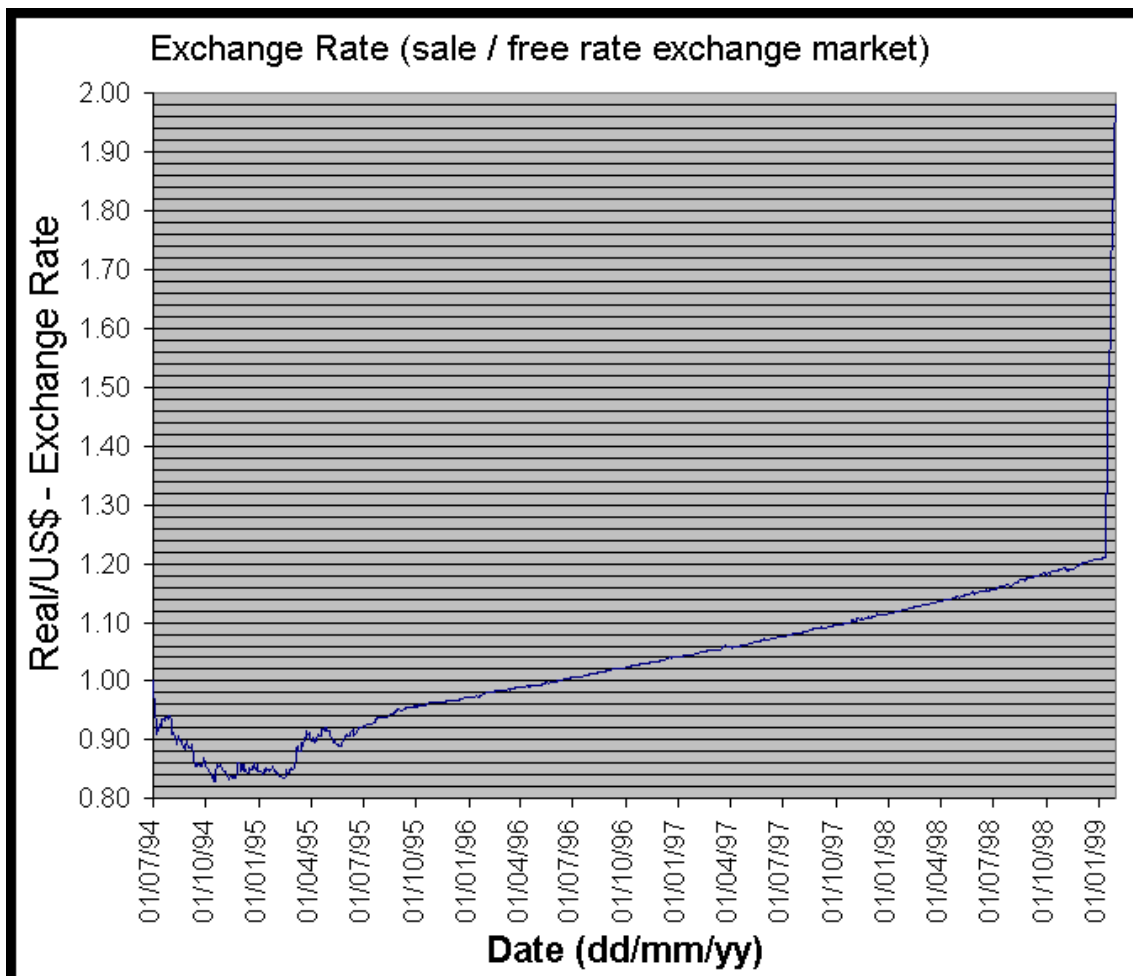


### Brazil - Financial Outflow (exchange operations - free rate exchange market)



### Brazil - Import (exchange operations - free rate exchange market)





#### 4.2 SISCOMEX – Foreign Trade Integrated System

The SISCOMEX, Foreign Trade Integrated System, was created by the federal government of Brazil via the Decree N° 660 on September 25th, 1992. It is a computer network system that manages all Brazilian foreign trade information. The project was conducted by three government entities that are somehow most involved in the foreign trade process: the Central Bank of Brazil, the Foreign Trade Secretariat and the Federal Revenue Bureau.

The goals of the SISCOMEX considered a new managerial approach, via the total integration of all governmental agencies activities as to guidance, follow-up and control of the different stages of the export and import operations. The main goals of SISCOMEX project are:

- elimination of all double-check controls and data collection systems since an integrated information flow would be available;
- adjustment of concepts, uniformity of codes and nomenclature, simplification and standardization of foreign trade operations;
- supply the government with reliable and timely data so that it can continuously appraise and improve its foreign trade policy;
- cutting down on fraud attempts through the use of unified and automatic check-outs;
- to induce more businesses to open up to foreign trade transactions by making it easier to operate from any place inside the domestic borders;
- record every single export and import operation;
- make foreign trade information available to anyone who operates in the foreign trade area (enterprises, institutions, government agencies, etc);
- supply data that enable the government to foresee the trends of the market;
- automatic verification of the Brazilian trade balance;
- check automatically all operations as to conditions, restrictions, prohibitions, codes validity, minimum and maximum prices, export or import quotas controls, cross references as well as issues messages and notices that enable agencies concerned to take steps on every export or import stage;
- better integration between the exchange operation and the commercial operation (financial and commercial aspects);
- reduction of costs in the export and import process;
- simplification of the export and import process, reducing the amount of different forms involved and eliminating the bureaucracy.

The development of the system required large investments by the government, mainly to automate all customs services of the country. The SISCOMEX was implemented in two stages. On January of 1993 was implemented the SISCOMEX considering only the export operations, and then, on January of 1997 was implemented the part of the system that considers the import operations. Considering the long period between the two parts of the system, newer technology was used to take care of the import operations. The technical development of the whole system, considering export and import operations, was done basically by the Information Technology Department of the Central Bank and by the Data Processing Federal Agency, SERPRO. The development of the SISCOMEX took such a long time mainly because of three factors: 1) it was an ambitious and very large project using new technology; 2) it involved three different government entities that had to discuss the whole process and had to consider technical and political aspects between them; and 3) it required very large investments.

To access the SISCOMEX system the exporters, importers or their agents must get a government authorization and supply information regarding who is entitled to enter the system; a code and password are then assigned. The management of these authorizations is not done by the Central Bank as it is to access the SISBACEN, this management is done by the Federal Revenue Bureau, using specific routines developed by SERPRO. After exporters and importers have access to SISCOMEX they are able to connect to SISBACEN and use functions of SISBACEN automatically. Many times the users of the SISCOMEX or the SISBACEN/CAMBIO do not know in which computer

the application is running; both computer networks are interlinked and the functions of the systems are divided between two networks.

The SISCOMEX system is active and all export and import operations have to be registered in it. Brazilian government has information about foreign trade very detailed and with no delay. It is very important to have aggregated information, in many different levels and views, about foreign trade to conduct the foreign trade policies. An operational overview of the SISCOMEX system has to be done dividing the system into two modules: export operations and import operations.

## **SISCOMEX – EXPORT OPERATIONS**

Once the exporter or his agent has the authorization to access the system and has the necessary infra-structure (It can be a microcomputer with a modem or a mainframe computer connection.) to access it, all export operations that the exporter wants to do can be done anytime, from his own office. The process is very simple. The exporter, or his agent, has to use a transaction to input the characteristics of the export: exported product, quantity, price, destination's country, total value, payment's conditions, transportation's type, date of shipping, etc. The transaction used to do this is PCEX300 or PCEX500 depending on who is inputting the data. If a financial institution, that already has access to the SISBACEN, is feeding the system, it will use PCEX500.

The SISCOMEX system analyzes all the characteristics of the export and decides if the export is automatically authorized, what occurs most of the time, or if the export needs any complementary procedure. The validation analysis uses a very complex table of parameters to lead the export operation. This table of parameters brought to government a very agile and precise instrument to act in the foreign trade process. Using this table, all government consenting agencies, that includes the Central Bank, the Foreign Trade Secretariat, the Federal Revenue Bureau, the Health Ministry, the Army Ministry, the Environment Agencies, and many others, can decide to have a new restriction for export, can decide to change an old restriction, can decide to have new procedures in the export of a specific product, or can decide many other changes in the export process. The decisions can be informed to the system in real time by the agency. As soon as the system's tables are changed all new operations will be analyzed considering new restrictions and procedures. This is a very powerful instrument because anytime a government agency decides to do something it can be done immediately, with no lag of implementation and with immediate reaction of the market. These implementations do not demand any change in the system's programs.

If the export operation is automatically authorized, the exporter can go to the shipping defined place and continue the operation. At the shipping place customs service has access to the system and executes the necessary functions to take care of the export. The other part of the export process is to sell the foreign currency that the exporter would receive as payment of the export. This is done using the CAMBIO subsystem as explained before. If the export operation is not automatically approved the system will notify the user the next procedures, that can be: 1) wait for the analyzes of a specific government consenting agency to decide about the export; 2) present some necessary documentation to some government consenting agency to continue the export; or 3) some other specific procedures. The participation of the government consenting agencies is done using SISCOMEX system in real time; all of them are connected to the system.

The description above is just about the main functions of the SISCOMEX, module of export operations. There many functions to take care of specific types of operations, involving commodities, credit operations, drawback operations, etc. The system is integrated with the SISBACEN/CAMBIO, so the monitoring of the market can be done. Using the SISBACEN/CAMBIO the Exchange Department of the Central Bank can, for example, identify all export operations occurred, with expired date of payment, that do not have the corresponding exchange operation; this identifies export of products that were not paid. In this case the foreign currency was not added to the international reserves of the country.

## **SISCOMEX – IMPORT OPERATIONS**

The technology used in the development of the module of import operations permitted to have more user-friendly solutions. This module works differently than the module of export. The importer uses a program running locally in his microcomputer, with *WINDOWS* technology and graphic resolution, to input the information about the import operation; the information is locally analyzed and validated. After the document is ready, the importer has to do a connection to the central computer system, the mainframe computer, and submit the document to a new analysis and new validation. The main differences are that the import procedures initially works off-line the main system, with no connection costs, and second, the system uses graphic interfaces that are more user-friendly.

As a broad rule, the Brazilian import licenses are issued automatically by the system. The import operation has to be declared to the system just at the time of the customs process. The import operation, as a commercial approach, is a declaration process. The importer has to use the SISCOMEX, import module, to input the declaration of import and then go through the customs service and get the imported products. The customs service is connected to the system and executes the necessary functions to continue the import operation.

However, there are situations that the legislation requires an expected authorization of some government agency to import specific products, or, when some specific conditions have to be considered. These situations need specific procedures by the importers, they have to get a non automatic license and then, after the import operation is authorized, they have to complement the license at the moment of the conclusion of the operation, going through the customs services. Like the export process, the government agencies are connected to the system to analyze the requested licenses and decide about them.

The import module of the SISCOMEX is very flexible just like the export module; any change that government wants to do about the import parameters can be done with no lag of implementation and immediate reaction of the market. The import declaration has information about the conditions of payment of the import and these information are validated by the computer of the Central Bank ; the SISBACEN is automatically activated by the SISCOMEX. After the declaration of import is accepted by the SISCOMEX all information about the import is transferred to SISBACEN and, just like in the export process, the monitoring of the market is done analyzing and controlling the payments that must be done, the conditions the payments must be done and avoiding payments that cannot be done.

### **4.3 LEILAO – System of Electronic Auction of Foreign Currencies**

The Central Bank of Brazil, as the sole depository of the country's official reserves in gold and in foreign currencies, is responsible for guaranteeing the regular functioning of the foreign exchange market, the relative stability of exchange rates, and equilibrium in the balance of payments. To guarantee the regular functioning of the foreign exchange market the Central Bank has to observe the demand and the supply of foreign currencies and has to operate in the exchange market when necessary. The objective of this overview of the LEILAO subsystem is not to discuss if the Central Bank has to intervene in the market or not, or when the Central Bank has to intervene in the market. The objective is to describe one specific instrument that the Central Bank has to operate in the exchange market buying or selling foreign currency. The LEILAO subsystem is used just to negotiate US dollars.

The exchange desk of the International Reserves Operations Department of the Central Bank of Brazil interact with the exchange market of the country and identifies if the market is equilibrated, if the market has excess of US dollars or if the market has shortage of US dollars. There are many different reasons that lead the Central Bank to sell or to buy US dollars in the exchange market, this is just a simple situation to explain the subsystem. Using the LEILAO subsystem the Central Bank can intervene in the market buying or selling US dollars and getting the best exchange rates offered by the market and having total transparency. To operate using this system the Central Bank has elected a

number of dealers that are obligated to participate of the auctions that are done. The dealers are obligated to present bids for every auction even if they do not want to buy or sell US dollars. These dealers then negotiate in the exchange market guaranteeing the supply or the demand of US dollars.

This is an instrument used to conduct the exchange policies of the country. Using this system the Central Bank could guarantee the band system of exchange rates of last years. During the crisis of Mexico in 1995 the Central Bank did many auctions in the same day to avoid the devaluation of the national currency. The system was used again very intensively in 1997 when the Asia crisis started. During 1998 and January of 1999 the Central Bank had to sell many US dollars to guarantee the band system of exchange rates. Then, in January of 1999 the exchange rates system changed in Brazil, and now we have a floating exchange rates system. Since the change of the exchange rate system the Central Bank has not done anymore auctions because there is no intention to spend international reserves to lead the exchange rate to a specific value. The last electronic auction of US dollars was made on January 14. As the market says, the Central Bank may be selling US dollars some days, to avoid speculative movements, but is not using electronic auctions to do it. After the end of the current crisis, the Central Bank will certainly continue to use this instrument because it is very efficient and, that is very important, it is very transparent.

There are three types of electronic auction that the Central Bank can do using LEILAO subsystem:

- purchase auction – the dealers have to make at least one bid interested in buying US dollars, with the minimum amount specified by the rules of the auction;
- sale auction – the dealers have to make at least one bid interested in selling US dollars, with the minimum amount specified by the rules of the auction;
- spread auction - this auction is normally used to indicate to the market the exchange rate that the Central Bank considers adequate, or, it is used to avoid speculative movements of the market. In this auction the dealer has to make at least one bid informing the number of lots of the bid, an exchange rate to buy the lots and another exchange rate to sell the lots. The system analyses the difference between the two exchange rates, one is to buy the lots and the other is to sell the lots, and registers the bid only if the difference is lower or equal to the spread specified in the auction rules. If the difference is higher than the spread the dealer will not be allowed to input the bid because of the validation process. The auction rules define a maximum spread in this case. If the bid of the dealer has a low exchange rate to sell the lots, the Central Bank will call him to sell the US dollars. If the bid of the dealer has a high exchange rate to buy the lots, the Central Bank will call him to buy US dollars. Considering that the spread has a limited value the dealer cannot offer a high exchange rate to sell the lots and a low exchange rate to buy the lots. The Central Bank can decide to sell US dollars accepting every purchase bid with a minimum exchange rate; and, in the same auction, the Central Bank can decide to buy US dollars accepting every sale bid with a maximum exchange rate. The dealer has to make reasonable bids otherwise they will loose money. This instrument, with the floating exchange rate market, will not be very useful to indicate exchange rates to the market, but it continues to be useful to avoid speculative movements in the exchange market.

The sequence of an electronic auction of foreign currency is the following steps:

- the Central Bank decides to issue an electronic auction of US dollars. The auctions can, normally, be done between 9:00 AM and 7:00 PM. The first step is to use the transaction PLEI600 and input the characteristics of the auction. Using the PLEI600 the auction is issued; an automatic message is issued through the communication system of the Central Bank informing to the market all the characteristics of the auction; and, a one line message is shown at the top of the PCOT700 transaction informing about the auction. All institutions that operate in this market keep the PCOT700 active during the whole day with somebody looking at it. The characteristics of the auction that are informed are: the type of auction (purchase, sale or

spread); the start-time and the end-time to input the bids by the dealers; the minimum lot of the bid; the maximum number of bids by participant; the settlement day of the operation; the maximum spread to be used in the spread auction; and, until January of 1999 another characteristic was the market of the auction (as explained before we used to have two different exchange rate markets between 1988 and January of 1999).

- all the exchange market will know that an auction is going to happen. The dealers must input their bids for the auction using the transaction PLEI650. The system validates all information of the bids and controls the start-time and the end-time of the auction.
- just after the end-time to input the bids the Central Bank can use again the transaction PLEI600, another function, to analyze the bids and decides about the auction. To get to the results of the auction the Central Bank has a powerful function to make different simulations and then decide the amount that will be sold and the amount that will be bought. Of course that only in the spread auction the Central Bank can sell and buy in the same auction. During the analysis process the Central Bank does not know the responsible for each bid; the Central Bank can see the information about the bids but not the identification of the proposers. The Central Bank is not obligated to sell or to buy any amount, regardless of the exchange rates offered.
- finished the analyses process, the Central Bank decides about the auction and then the results are immediately available. The dealers can see their own bids but they cannot see the results of the others. The result of the auction, as a whole, is public and everybody can see it using the public access of the SISBACEN, using the transaction PLEI655. The public information about the auction are: the characteristics of the auction, the minimum exchange rate sold and the maximum exchange rate bought.

As we can see, the process is very simple. The important point is that using this system the Central Bank can buy and sell US dollars reaching better results. The tool used to analyze the bids is powerful and flexible, allows the Central Bank analyzes the market and makes decisions based on information. It is a transparent process and permits the Central Bank to act very fast in the market leading to the desired equilibrium of the exchange market. The table below offers a good view of the flow of an auction; it shows the participation of the financial institutions and the participation of the Central Bank.

FINANCIAL INSTITUTIONS	CENTRAL BANK OF BRAZIL
1. Access the SISBACEN (Information Access Security System)	1. Access the SISBACEN (Information Access Security System)
<ul style="list-style-type: none"> <li>• PCOT700</li> </ul> Monitoring of the Exchange Market (information on rates utilized in the market and on the volume traded, until the moment, considering all financial institutions)	1. PCOT700  Monitoring of the Exchange Market (information on rates utilized in the market and on the volume traded, until the moment, considering all financial institutions)
	<ul style="list-style-type: none"> <li>• PLEI600 (Issue the Electronic Auction)</li> </ul> Notice in 2 (informs that bids will begin to be received in 2 minutes). Informs the characteristics of the auction: <ul style="list-style-type: none"> <li>a) time-limit for receiving bids defined;</li> <li>b) maximum spread defined, in case of "spread auction";</li> <li>c) minimum lot;</li> <li>d) maximum number of bids defined;</li> </ul> All participants are informed about the auction simultaneously.
<ul style="list-style-type: none"> <li>• PCOT700</li> </ul>	



Notice in 2 (shown on the top of the screen and indicates that the Central Bank will be receiving bids within 2 minutes)	
<ul style="list-style-type: none"> <li>• PMSG800</li> </ul> <p>Auction Report (automatic message issued to all users of SISBACEN with detailed information about the electronic auction)</p>	<p>5. PMSG800</p> <p>Auction Report (automatic message issued to all users of SISBACEN with detailed information about the electronic auction)</p>
2 minutes interval	
<ul style="list-style-type: none"> <li>• PLEI650</li> </ul> <p>Registration of bids (dealers file their own bids as well as those of other non-dealer financial institutions)</p>	
<ul style="list-style-type: none"> <li>• PCOT700</li> </ul> <p>Notice of completion of auction (no more bids accepted)</p>	
	<ul style="list-style-type: none"> <li>• PLEI600</li> </ul> <p>Processes selection of bids and announces results</p> <p>a) auction bidders not known;</p> <p>b) dealers who do not file any bid are included at mandatory participation levels;</p> <p>c) Central Bank may reject all bids presented.</p>
<ul style="list-style-type: none"> <li>• PCOT700</li> </ul> <p>Notice of completion of selection of bids. Information about minimum/maximum rate accepted.</p>	
<ul style="list-style-type: none"> <li>• PLEI650</li> </ul> <p>Auction results available for the bidders.</p>	
	<ul style="list-style-type: none"> <li>• PLEI600</li> </ul> <p>Information about all bids, accepted and rejected. The bidders are now identified.</p>
PLEI655	
Auction results available to all SISBACEN users and to the public access of the system.	

#### 4.4 Other Systems of the International Area

There are many others systems to support the international area of the Central Bank. The list below considers some of these systems; it has just a brief description of them:

- **GEINTER** – International Reserves Management System – This systems is composed by different modules that allows the Central Bank, through its International Reserves Operations Department, manages the international reserves of the country. There is a module to manage the international deposits desk, a module to manage gold operations desk, a module to manage securities desk, a module to manage cash flow, etc. Once the operation is informed to the system, then the system has standard procedures of security, confirmation, accounting, issuing of SWIFT messages, etc. It is an integrated system that takes care of the front-office, middle-office and back-office activities. The financial market is very complex and everyday there are new types of operations that the Central Bank wants to do and that has to be accepted by the system. The system is constantly being improved to achieve total transparency, security and better results managing the international reserves. There is a new local area network installed in the International Reserves Operations Department with the best technology available, integrating information of the national and international financial market provided by the most important providers of these kind of information, like Reuters, Bloomberg, etc.

- FOREX – Foreign Exchange System – This is a subsystem that runs integrated with the GEINTER subsystem. The FOREX is used to manage the foreign exchange operations done by the Central Bank with international banks. The Central Bank has to manage the international reserves keeping stocks of strong currencies. Like the GEINTER subsystem the back-office, middle-office and front-office activities are considered by this subsystem.
- RDE – Electronic Declaratory Registration – This system manages information about the inflow and outflow of foreign capital for different destinations. In the recent past, all foreign capital inflow, and consequently capital outflow, had to be previously authorized by the Foreign Capital Registration Department of the Central Bank; this process used to take a long time. Depending on the destination of the foreign capital inflow, it is not, anymore, necessary a previous authorization by the Central Bank; the interested part has just to register the declaration of the foreign capital inflow using the RDE subsystem, it is automatically validated and authorized. The foreign capital taken to Brazil to participate in privatization or investment funds is already managed by this system. It is being implemented, in the first semester of 1999, the management of the foreign capital taken to Brazil for direct investments. To have an idea of the importance of this system, just in 1998, the foreign capital taken to Brazil for direct investment was over 25 billion US dollars.

## 5. Conclusion

Time has shown that technology changes fast but humans and their organizations change slowly. Organizational inertia is one of the greatest problems that business organizations and humans are currently facing in terms of catching up to the potential strategic value of Information Technology. Information Technology area is becoming a very important strategic area in the organizations. The role of Information Technology has moved beyond building applications portfolios of systems that automate business transactions. The evolution of technology brought powerful microcomputers, interconnected through the local area networks which are connected to the wide area networks, with user-oriented software that permit professionals of different areas use this technology without custom-developed systems and without intermediary programmers. The organization has to be able to assimilate new technology but has to do it with criteria. Information is considered one of the most important wealth of the organizations; organizations need the guarantee of availability, integrity and security of information.

Central Bank of Brazil, just like many other organizations, is facing the challenge of the new technology. As described in this paper, the Central Bank has large information systems that have to be accessed by financial institutions spread around the country. These are nationwide systems that work online, have to be available without undesired interruptions, have to be fast, manages huge data bases and have different solutions of connectivity. The Information Technology Department has to guarantee the availability, integrity and security of the information of these corporate systems. Many professionals of different areas are using the powerful microcomputers, with all kinds of software, to implement local solutions and to search and get information from the central data bases. The use of new technology in the Central Bank always considers the stability of it; the national financial system and the Central Bank is quite dependent of the SISBACEN and the confidence in the system is very important. The intention here is not to compare high capacity computers solutions with downsize solutions; this is a technical approach that has to be done in each project to get the right size solution for the project. The important point is that the organization has to be open to receive and use new technology and the organization has to accept the new reality of the technology that permits the professionals of different areas use powerful software without the permanent need of programmers. However, the corporate systems still need professionals of information technology to plan it, implement it and manage it.

Rapid changes in information system technology, e.g., open systems, client-server environments, interoperability, etc, that focus on empowering the user is changing the traditional role of the Information Technology Department in the organizations. There is not a defined solution for every

organization, each organization has to consider its own situation. Central Bank of Brazil decided to maintain the mainframe-based system to take care of the nationwide, corporate and large systems; local area networks, with client-server environments, interconnecting all work stations of the organization are connected to the wide area network. The users have powerful instruments to use by themselves and, parallel to it, have the mainframe system that manages the central data bases and the access of the financial market. The implemented solution has been analyzed all the time and many improvements have been constantly added to it.

To achieve better results in the supervision of the financial market and to get higher quality information about the financial market the Central Bank has analyzed a group of computer tools that is gaining recognition as part of the information empowerment movement. Many of these tools involve new technology that is not widely used yet. These tools require complex and subtle interactions between machine and humans, with each teaching and learning from each other. The theory of these tools considers: expert systems (a computerized decision-making technique that embodies knowledge got from experts); artificial intelligence (software systems that attempt to replicate aspects of human intelligence); neural network (a sophisticated system that tries to mimic human brain processes and learns from the mistakes it makes); chaos theory (a theory proposing that seemingly random events, such as stock prices, have patterns that computer programs can detect); and; fuzzy logic (a mathematical method that deals with approximations or gradations). The Central Bank is not an academic environment and has to consider the available and already used technology. The first step aiming at the use of these powerful tools will be finished this first semester of 1999. Central Bank implemented a Data Warehouse solution that gathers information about the exchange operations of the country and about domestic activities of the financial institutions. To access the data warehouse there are powerful tools that permits the Information Technology Department, or directly the users, make complex queries involving large data bases. Procedures using data mining tools will be applied to identify anomalies and preview frauds in the financial market. After the implementation of the data warehouse, many tools, using those theories listed above, will be used by the Central Bank to have higher quality information and to have better performance in the monitoring of the market. This seems to be a real tendency in the SISBACEN environment. These tools use graphics interfaces, they are user-oriented, they are very flexible and efficient. This solution required a new environment of computers to avoid the impact on the transactional environment, where the data is online updated.

The importance of the SISBACEN to conduct the monetary and exchange policies is very clear. The SISBACEN just had a very important role providing real time information during the crisis that happened during January and February of 1999, when the big devaluation of the national currency, the Real, occurred. During the crises the Central Bank needed real time information about the financial market to make the decisions that should be implemented.

As shown along this paper, the use of the SISBACEN permitted immediate implementation of government decisions with no lag in the market reaction. The solutions described incorporate expert systems that consider dynamic rules and procedures that have to be executed to a given situation. It is not reasonable to judge all the systems implemented considering the new technology available; it is important to highlight that the SISBACEN is constantly in an evolution process and it is always incorporating the new technology. The costs of the system's development were justified and new investments are done every year to improve the system. The Central Bank is considered an example of computer-based solutions supported organization. Brazilian government has information about the national financial market. Central Bank has the SISBACEN to monitor the financial market, to operate in the international financial market, to provide information that helps the strategic decisions and to implement the monetary and exchange policies. The SISBACEN is an instrument for implementing Brazil's monetary and exchange policy.

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