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Minerva Program

Theory and Operation of a Modern Economy

Information Technology and Its Social-Economic Impact in a Modern Society

By Luciano Couto Rosa Guimarães

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List of Acronyms and Abbreviations

ATM' Asynchronous Transmission Mode

ATM Automated Teller Machine

ASDL Asymmetric Digital Subscriber Line

BC Before Christ

CAD Computer Aided Design

CAE Computer Aided Engineering

CAM Computer Aided Manufacturing

CEO Chief Executive Office

CNC Computer Numeric Control

DM Deutschemark

EEC European Economic Community

EU European Union

ERM European Exchange Rate Mechanism

G-7 The Group of Seven (Germany, Canada, U.S., France, GB, Italy and Japan)

GATT General Agreement on Tariffs and Trade

GDP Gross Domestic Product

GNP Gross National Product

IBRD International Bank for Reconstruction and Development

IMF International Monetary Fund

ISDN Integrated Services Digital Network

IT Information Technology

ITU International Telecommunication Union

LEO Low Earth Orbit

MEO Medium Earth Orbit

MERCOSUL Mercado Comum do Cone Sul (Common Market of the Southern Cone)

MIPS Millions Of Instructions Per Seconds

MODEM Modulator and Demodulator

NYSE New York Stock Exchange

OECD Organization for Economic Cooperation and Development

OM Ostmark

PASTE Programa de Recuperação e Ampliação do Sistema de Telecomunicação e do Sistema Postal (Recovery and Expansion Program for Telecommunication and Postal Systems)

PBX Private Branch Exchange

SDR Special Drawing Rights

SMDS Switched Multimegabit Data Service

UNCTAD United Nations Conference on Trade and Development

Introduction

We are living in an unprecedented period in history. The rate of change in today's world has been astonishingly fast. All doubts that the world is changing vanished recently with the collapse of communism, the liberation of Eastern Europe, and the rapid unification of the European Economic Community (EEC), now called European Union (EU). These events were so revolutionary that most of us never hoped to see them in our lifetime. Some of us are just watching what is happening and realizing that the world is getting too complex and chaotic. Others are trying to understand, observing the big picture, connecting things that seem to be unconnected.

One driving force behind all this change is the advance of Information Technology (IT), a technological revolution that should alter our present world deeper and faster than the Industrial Revolution.

As an IT promoter (I work in the Telecommunication Industry in Brazil, doing R & D on new products), I think it is a great time to be living and to be one of those responsible for this change.

The population of the earth is divided not only by race, nation, religion and ideology, but also by position in time. There is a tiny group who still live, hunt and store food, as men did thousands of years ago. Others, the vast majority, still depend on agriculture. These two groups, taken together, compose perhaps 70 percent of all living human beings. They are people of the past. Somewhat more than 25 percent of the earth's population can be found in the industrialized and modern societies. They are products of the first half of the twentieth century, molded by mechanization and mass education. They are the people of the present. The remaining 2 or 3 percent of the world's population, however, are no longer people of the past or present. They are millions of men and women who can already be said to be living the way of life of the future. They are the advance agents of the world-wide information society now in the throes of birth.

This picture will change fast, as it has been changing in the U.S. When this nation was born, more than 95 % of the population worked on farms. With the Industrial Age, the agrarian work force dropped to 50 % (around 1850). Today all agricultural products are produced by less than 3 % of the work force. Even the U.S. industrial sector's peak (as a percentage of the total workforce) was already reached during the 1960s. Manufacturing employment has declined to about 20%, and soon less than 10% of all workers should operate the industrial system. Industrial capacity will always remain essential, of course, just as agriculture continues to be important even now. However, today more and more of the U.S. workforce is in the production, transformation or storage of information (clerical workers, services agents, data-entry jobs, software programmers, investment brokers, etc.).

The objective of this paper is to stress the role of Information Technology in a modern society. The effects of this technological revolution we are now living will be deeper than any social-economic change we have experienced before.

Throughout this paper I will use the expression "Information Technology" (IT) to describe a combination of new technology developments in microprocessors, opto-electronics devices and telecommunications systems.

These specific IT advances in a short explanation are:

- i) Miniaturization in microprocessors, and memories, and rapid advances in technical performance in opto-electronics (including advances in laser techniques and glass fiber as transmission media). Information processing costs, expressed in millions of instructions per seconds (MIPS), are decreasing sharply.
- ii) An increasing trend toward integrating and interconnecting computer and other microprocessor controlled equipment with telecommunications (copper cables, fiber optical cables, radio, cellular, satellites) to build IT networks. In the office, telephones, fax machines, and PCs are being integrated into network systems with image, text and data processing equipment. In the factory, the integration and interconnection of robots, computer-aided-design (CAD), computer-aided-manufacturing (CAM), machine tools, and IT related equipment are advancing rapidly to computer integrated manufacturing.

iii) Innovative computer supported switching facilities and protocol communication techniques and new services such as high speed modems, data over voice, packet switching, integrated services digital network (ISDN), frame relay, switched multimegabit data service (SMDS), asymmetric digital subscriber line (ADSL) and asynchronous transmission mode (ATM) promise to change profoundly the current technical limits.

It is on these new IT developments and their impact on the economic and social institutions that this paper concentrates. In section 1, I briefly describe the evolution of money and the new concepts of electronic money (cybercash), and electronic commerce and the importance of a telecommunication infrastructure. In section 2, I write some economic impact of IT, as it provides fundamentally new means of design, production and organization and thus represents a new paradigm which is leading and increasing economic efficiency and transforming traditional means of bringing products to markets.

In section 3, I show the dramatic change in the nature of work. Telecommuting, telework, electronic foreign workers and other concepts are presented.

The IT and the impact on social institutions is the focus of section 4. Telecommunications are revolutionizing education, training systems, health care and social services.

In the last section, I explain what Brazil is doing to improve its telecommunication infrastructure for the new millennium. A brief description of PASTE (Recovery and Expansion Program for Telecommunication and Postal Systems) is presented.

Section 1

Information Technology and the evolution of money

"I insert my ATM card from my bank in Washington, DC, and punch in my identification number and the amount of 1,500 francs, roughly equivalent to \$ 300. The French bank's computers detect that it's not their card, so my request goes to the CIRRUS system's inter-European switching center in Belgium, which detects that it's not a European card. The electronic message is then transmitted to the global switching center in Detroit, which recognizes that it's from my bank in Washington. The request goes there, and my bank verifies that there's more than \$ 300 in my account and deducts \$ 300 plus a fee of \$ 1.50. Then it's back to Detroit, to Belgium, and to the Paris bank and its ATM - and out comes \$ 300 in French francs.

Total elapsed time: 16 seconds."

This excerpt, written by Peter T. White in the January 1993 edition of National Geographic magazine, gives us a personal illustration of how telecommunication and computers have evolved to ease our lives. It also describes the common global currency: "bits" - the digital signs that are transmitted through the telecommunication network.

How was the long evolution of money and banking? How are the perspectives for the near future? Try to imagine a modern society without Information Technology.

I will start from the beginning and show the evolution of money from its creation to the current Automatic Teller Machine (ATM) card and cybercash, banking and financial systems. The 11000 year history of money will be briefly described in this section:

Money was conceived thousands of years ago. There is naturally some uncertainty about the earliest dates of money. Probably it occurred simultaneously with the domestication of cattle and the cultivation of crops, which was between circa 9,000 and 6,000 BC. As individuals, households or tribes had an excess of animals or crops, they started exchanging with each other. Subsequently both livestock, particularly cattle, and plant products such as grain came to be used as money in many different societies.

Circa 3,000 BC, banking was created in Babylonia, originally based in temples and palaces which provided safe places for the storage of valuables. Initially deposits of grain were accepted and later other crops, cattle, agricultural implements, and precious metals.

It is remarkable that c. 1,200 BC, cowries were used as money in China, where character for money ('cai'), originally represents a cowrie shell. Cowries have been used as money in many different places. In fact, in parts of Africa they were used for this purpose as recently as the middle of the 20th century.

According to Herodotus, in the year 687 BC, crude "coins" were invented in Lydia, Asia Minor. These earliest coins consisted of electrum, a naturally occurring amalgam of gold and silver. After that the use of coins spread rapidly from Lydia to Greece. Other places started to mint their own coins like Aegina (c. 595 BC), Athens (c. 575 BC) and Corinth (c. 570 BC). Because of the enormous demand for coins to pay the troops during the second Punic War (218 -201 BC), between Rome and Carthage, the Roman rulers debased their coinage, causing inflation.

In the year 118 BC leather money was issued in China. This consisted of pieces of white deerskin, about one foot square, with a value of 40,000 base metal coin.

When Rome fell to the Visigoths in 410, banking was abandoned in what is now western Europe and did not developed again until the time of the Crusades.

During the Reign of Emperor Hien Tsung (806-821), in China, a severe shortage of copper for making coins caused the emperor to issue paper money notes.

England contributed substantially to the development of money. In 928, the provisions of the Statute of Greatley, provided that England should have a single national currency. During the Reign of Edgar the Pacific (959-975), the English coinage was regulated to ensure uniformity and standardization.

The need to transfer large sums of money to finance the Crusades provided a stimulus to the re-emergence of banking in western Europe between 1095 to 1270.

In 1156 the earliest known Foreign Exchange Contract was issued when two brothers borrowed 115 Genoese pounds and agreed to reimburse the bank's agents in Constantinople the sum of 460 bezants one month after their arrival in that city.

In 1355, Nicole Oresme's *De Origine Natura Jura et Mutationibus Monetarum* was published. Oresme, the greatest economic thinker of the Middle Ages, argued that the quantity of precious metal in circulation determines the value of the currency. Later, in 1370, he became chaplain and adviser to King Charles V of France.

In 1440 Gutenberg invented the modern Printing Press. Although Europe already knew of the use of paper money in China, the printing press design was subsequently modified, by Leonardo da Vinci among others, for use in minting coins nearly two centuries before printed banknotes were produced in the West. Leonardo da Vinci used a water driven mill to produce more uniform coins quickly. This innovation was widely adopted and the new money was termed "milled money".

In 1521 Cortés conquered Mexico. Before the arrival of the Spaniards, the Aztecs and Mayans used gold dust (kept in transparent quills) and cocoa beans (kept for large payments in sacks of 24,000) as money.

In 1526 Nicholas Copernicus wrote his Treatise on Debasement. As many provinces of his native Poland, and other parts of Europe, had suffered from debasement, the great astronomer argued that it was the total number of coins in circulation, rather than the weight of metal they contained, that determined the level of prices and the buying power of the currency.

In 1532 Pizarro landed in Peru and began the conquest of the Incas. The Incas were unique in having reached a high degree of civilization without the use of money even though they possessed huge amounts of gold and silver. The more efficient the Inca's planning system, the less the need they had for money.

In 1599, the Dutch attempted to monopolize the pepper market. Pepper had a high value-to-weight ratio, especially at times of real or artificial scarcity. On some rare occasions it was worth even more than its weight in gold. The Dutch action prompted the formation of the London East India Company the following year. In 1600, the London East India Company was founded. Imports from India subsequently caused a drain of precious metals from England to India.

In 1619, tobacco began to be used as currency in Virginia. Barely a dozen years after its introduction to Virginia, tobacco started being used as currency and this use continued for nearly 200 years.

In 1637, wampum became legal tender in Massachusetts. It was used only for sums up to one shilling.

In 1661 the Bank of Sweden issued notes. It became the first chartered bank in Europe to do so.

In 1681, the first public note-issuing "bank" was founded in Massachusetts. In this context the term "bank" means simply a batch of bills of credit issued for a temporary period. This example was followed subsequently in other British colonies in North America.

In 1695, the Bank of Scotland was founded. The first joint-stock bank in Europe solely dependent on private capital and unconnected with the state.

In 1698, coins formed less than half the English money supply. Davenant, a contemporary writer, estimated that the total value of coins in circulation was less than that of tallies, bills, banknotes etc. Increasingly the power of money creation was passing from the King, in charge of the mint, to the London money market and provincial banks. Political power was also affected by this transfer of financial power.

In 1705, after traveling widely in Europe, John Law returned to his native Scotland and published *Money and Trade Considered: With a Proposal for Supplying the Nation with Money*. He argued that metallic money is unreliable in quality and quantity. Bank notes issued and managed by a public bank would remove the brakes on the economy.

In 1707, The Act of Union of England and Scotland stipulated that the United Kingdom should have a uniform coinage - a single currency symbolizing and cementing a united kingdom. During the 3 years of recoinage in Scotland the shortfall in currency was made up by the issue of notes by the Bank of Scotland.

In 1715, North Carolina recognized 17 different forms of money legal tender. All the British colonies in North America tended to suffer from a scarce supply of the official British coinage. Consequently they used a variety of substitutes, including wampum, copied from the native inhabitants, tobacco and other natural commodities, and Spanish and Portuguese coins. The importance of these substitutes varied according to location.

In the mid-eighteenth century, at the start of the Industrial Revolution, there were barely a dozen banking houses in England and Wales outside the London area.

In 1760, a wampum factory was opened in New Jersey. Demand for wampum as currency, and later ornament, remained strong. In the factory, steel drills made the holes that were used for stringing the shells together. This process increased output of wampum enormously, causing inflation. The factory remained in production for 100 years.

In 1776, Adam Smith defended paper money. In his *Wealth of Nations*, he drew attention to the benefits of paper money in stimulating business, both in Scotland and in the American colonies.

Between 1787-1817, privately-issued tokens became common in Britain. By the end of the 18th century there was such a severe shortage of copper and silver coins in Britain that many firms had difficulty obtaining enough

currency to pay wages. This shortage led to a growth in payments in kind, as well as the use of foreign coins and unofficial tokens. The token manufactures greatly expand the amount of currency available.

In 1792, the Dollar (the word 'dollar' came from an old Austrian coin, called 'taler', because of its high silver content) was adopted as the unit of account, based on a bimetallic standard, subdivided into 100 cents. Foreign coins were supposed to lose their status as legal tender within 3 years of the US coins coming into circulation

For hundreds of years before the creation of the first formal, western-style banks, financial services had been provided in India by castes such as the Multanis, Marwari and Pathans. They provided credit, collected deposits and arranged trading deals through bills of exchange or "hundi." In 1906, The Bank of Bengal was founded. It was the first of the so-called "presidential banks" established during British rule to supplement the internal money supply of India.

In 1816, Privy Council recommended establishment of the gold standard. This proposal was accepted and, in accordance with a related proposal, a new British one pound coin made of gold, the sovereign, was produced.

In 1824, the Suffolk Bank of Boston, in co-operation with 6 other local banks, began the development of a system of clearing inter-bank accounts.

At that time, with hundreds of banks issuing notes in Britain in uncoordinated fashion, the value of the currency was difficult to control. A controversy arose between the "currency school", which believed that gold and Bank of England notes were the only real money, and the "banking school", which believed that notes were just one among many forms of money.

The Credit Mobilier, founded in 1852, was the first effective major French bank to be established specifically for providing funds for industry and infrastructure. It was followed by many other new banks in the next two decades. Despite the failure of the Credit Mobilier in 1867, these banks channeled savings into essential investments in transport, communications, agriculture and industry.

In 1865, French businesses tended to prefer notes to bank deposits and cheques so a law was issued to simplify and encourage greater use of cheques.

By the end of the 1870s the gold standard had become an international standard with London as the world's main financial center.

In 1890, cheques accounted for 90%, by value of financial transactions in the US.

From 1850 to 1914 huge amounts of capital were exported from Britain. British capital was heavily invested abroad, especially after 1890, in the United States, parts of the British Empire, and Argentina. The total reached billions of pounds.

From 1860 to 1921 the number of banks in the US increased by over 19 times. During the same period, bank numbers fell in other advanced countries, but in the US a peak of nearly 30,000 was reached in 1921.

In 1900, Currency Act or US Gold Standard was approved. The great increase in America's stock of gold helped to end the reliance on bimetalism. The act also halved the minimum capital requirement for the smallest national banks, thus stimulating an increase in their numbers, and raised the limitations on the issuance of notes.

In 1910, the Kirghiz people in central Asia still used horses as their main monetary unit and store of value. Sheep were used as subsidiary units and small change was given in lambskin.

In 1913, the US Federal Reserve System was established. All national banks had to become members of the system and the state banks were given conditional permission to join.

In 1914, New British one pound and 10 shilling notes were issued by the Treasury. The success of the new notes allowed banks to withdraw gold gradually from internal circulation, thus putting a quiet end to the gold standard.

Between 1922 and 1923 Germany suffered from hyperinflation. The situation got so bad that wages were paid as frequently as twice a day to give people a chance to spend them before the notes lost their value. Other countries agreed to ease the burden of war reparations. A new, interim currency, the Rentenmark, secured on mortgages, on land and industrial property, restored stability.

In 1924, Germany adopted the Reichsmark and returned to the gold standard. The Reichsmark, which replaced the Rentenmark, had a value equivalent to the pre-war gold mark.

In 1931, the US and France held 75% of the world's gold stock. This figure was reached by September. During the previous 6 weeks, over £200 million worth of gold was withdrawn from London. Britain abandoned the gold standard. This decision marked the beginning of the move from Classical to Keynesian economics. Then the Commonwealth (except Canada), Ireland, Scandinavia, Iraq, Portugal, Thailand, Japan and some South American countries followed Britain off the gold standard.

In 1938 cattle were still used as money in parts of Africa. Even scrawny cattle were highly valued because of their monetary function. Overgrazing resulting from attachment to cattle as a store of value continued to cause environmental problems as late as the 1980s.

In 1944, the Bretton Woods agreement in New Hampshire, USA, envisaged a system of convertible currencies, fixed exchange rates, and free trade.

In 1947 new financial institutions were established; the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IBRD). Plans for an International Trade Organization failed as they were not ratified by the US Congress but they paved the way for the General Agreement on Tariffs and Trade (GATT).

After the Second World War, Germany suffered from hyperinflation. Owing to the devastation of the war, Germany experienced hyperinflation for the second time in a generation. In the official markets, ration cards and permits were more important than currency while on the black market cigarettes, soap, tinned beef and chocolate served as currency.

In 1949 Britain devalued and started an international realignment of exchange rates. Britain devalued the pound from \$4.30 to \$2.80 i.e. by about 30% against the dollar. This sparked a major realignment of exchange rates in which most other countries also devalued their currencies against the dollar. Britain's action reduced the value of sterling assets held by other Commonwealth countries and stimulated moves towards financial and political independence in the colonies.

In 1950, The European Coal and Steel Community was established. This was the first step towards the creation of the European Economic Community (EEC).

In 1951, bank rate was restored as a policy instrument in Britain. During the era of the gold standard, the Bank of England could successfully control the monetary system by varying the bank rate. However, the policy was much less successful in the 1950s.

In 1956, Milton Friedman's *Restatement of the Quantity Theory* was published. This triggered the development of modern monetarism theory.

By the 1960s, primitive forms of money, e.g. cowrie shells and manillas, that were still in widely used only a few decades earlier had virtually disappeared from circulation, with a few minor exceptions (e.g. the use of fei stones in the Central Pacific island of Yap). The replacement of primitive by modern money, together with the move from subsistence to market economies, means that the lives of more people are directly affected by monetary policy.

In 1969, the International Monetary Fund (IMF) created Special Drawing Rights (SDR). These were to assist countries with balance of payments difficulties. By this time all countries had dispensed with the internal

circulation of gold and, in most cases, did without gold backing for their currencies. The creation of SDRs made international trade less dependent on the constraints of an almost fixed supply of gold or the vagaries of favorite currencies.

In 1971, the Bretton Woods agreement broke down, after a big drop in US gold reserves and a large increase in foreigners' claims on US dollars. In 1973 the US suspended the convertibility of the dollar to gold. Although the IMF had been set up to promote exchange rate stability it adapted quickly to a world of floating exchange rates.

In 1976, Maine legalized entry of banks from other states. This decision started a widespread move in other states to legalize interstate banking. In most cases entry was restricted to banks from neighboring states, but some states allowed entry from any part of the US.

In 1976, after a financial crisis, the socialist government in Britain abandoned Keynesian policies when inflation surpassed 25% and adopted monetarism instead. Friedrich Hayek called for choice in currency and the denationalization of money. He argued that the freedom of consumers to use whatever currency they choose would be a better guarantor of the value of money than government monopoly.

In 1979 the European Monetary System was created. This system included an exchange rate mechanism allowing fluctuations of 2.25% (6% in the case of certain weak currencies), on either side of an agreed central rate; a strengthening of the European Monetary Cooperation Fund, founded in 1973, by the deposit of 20% of each member's gold and dollar reserves; and the creation of the new European Currency Unit or Ecu, based on the weighted average of 10 European currencies.

In 1984, the US Federal Appeals Court legalized nationwide ATM networks. It had been argued that ATMs were branches and, therefore, subject to laws restricting branch banking, but the Court rejected this argument.

In 1985, the EEC agreed to a Single European Act. The aim was to create, by the end of 1992, a unified economic area in which goods, services, people and capital would be able to move freely.

In 1986, the London Stock Exchange was opened to new competitors and, at the same time, a new system of automated operations was introduced. After these changes there was a great boom.

In 1989, communism collapsed in Eastern Europe. Eastern Europe faced the challenge of restructuring centralized economies along market lines, similar in some respects to the problems successfully tackled by West Germany in its reforms of 1948. The scale of the investment needed raised fears in developing countries that the needs of the Third World would be ignored.

In 1990, East and West Germany were reunited. The East German Ostmark was replaced by the Deutschemmark in the ratio of 1 DM for 2 OM for business and large personal holdings, and 1:1 for small personal holdings.

In 1991, the USSR dissolved. The former republics of the Soviet Union faced similar challenges of reconstruction to those of the eastern European countries following the collapse of communism. Many subsequently introduced new currencies in the early years of independence.

In 1992, the Maastricht Treaty on European Union was signed. The treaty set the end of 1999 as a target date for the creation of a single currency. By the end of 1992, the European Union officially had a single market with no barriers to capital, labor, goods or services. The inclusion of banking and financial services in the single market increased the pressure for a single currency.

In 1993, the European Exchange Rate Mechanism was reorganized. Because a number of currencies, especially the French franc, were the target of speculation, the width of the official currency bands was increased greatly in order to preserve the system.

In 1995, the Common Market of the Southern Cone (MERCOSUL) was created. Brazil, Argentina, Paraguay and Uruguay are the founding members and Bolivia and Chile are associated members.

In 1995, over 90% of all transactions in the US, by value, were made electronically. The high cost of cheque and coin payments was a strong motivating factor in the development of electronic payment systems. More than 150 million ATM cards are now in use in the U.S., not only for cash withdraw but also for make payments at gas stations, supermarkets and stores.

Money does not change hands, it changes screens in the world of stock specialists and brokers at the New York Stock Exchange (NYSE). Four to six billion dollars' worth of securities are bought and sold each day.

In 1995 the first trials of electronic cash were introduced by Mondex in Swindon, UK.

The potential use of electronic cash is so huge, that I will point out some important issues. Electronic cash is a payment system that combines the best features of traditional cash with the advantages of electronic payment. Due to the astonishing miniaturization of microprocessors and their sharply-reduced cost , they could be embedded in a plastic card. This microprocessed card digitally stores the electronic equivalent of cash.

Cardholders can easily get electronic cash at home by using telephones and/or personal computers, and can quickly transfer cash to one another. Unlike debit, credit or other stored value cards, which require purchases to be cleared and settled, users of this type of intelligent card can pay and receive e-cash (electronic cash) at the time of transaction. It can be used at point-of-sales retail stores as well as at the virtual shopping malls and e-commerce (electronic commerce) of the information superhighway.

There are advantages from both for the consumers and the retailer point-of-view. I will list just some of them:

- i) It reduces the risk of storing cash and transporting it to the bank.
- ii) Sales are faster because the processing is not centralized but local.
- iii) It reduces checkout time and shortens customer lines.
- iv) It provides self-service opportunities and, as a result, reduces labor requirements.
- v) No telephone line is required to authorize purchases.
- vi) Gives merchants a secure, cost effective method for accepting small cash purchases via the Internet.

In the United States, according to Computer Industry Forecast (1996), catalog home shopping is decreasing 2.7% a year whereas on-line transactions are increasing 49.4% a year.

Security has been a primary concern for and a big constraint on the expansion of electronic commerce. But according to the Gartner Group, next year (1998) the overall performance and security in the Internet will be good. By the year 2000 a good management of transaction will be available. The Forrester Research Inc. of Cambridge, Mass., says consumers spent \$ 530 million in on-line transaction in 1996 and will drive that up to \$ 7.2 billion by the year 2000. Bussiness-to-bussiness e-commerce was \$ 600 million in 1996 and will reach \$ 66.47 billion by the turn of the century.

All these numbers and forecasts may sound optimistic or unreal, but 30 years ago when credit cards were introduced in the United Sates, the public was shocked at the idea of 'instant credit'. Today, we don't leave home without it. Currently some 250 million MasterCard and Visa cards have been issued in the U.S. alone. According to David Chaum, the cost of paper cash systems range from 2 to 3 percent of GDP, making electronic cash appear a most cost-effective alternative.

Even though a world-wide currency seems to be a logical step as the global marketplace continues to grow, the political barriers are tremendous.

"No nation wishes to give up monetary and fiscal sovereignty", says Professor Paul S. Nadler, Professor of finance, Graduate School of Management, Rutgers University. On the other hand, a standard electronic cash

system may be a step in this direction. And indeed it is already a reality because information technology is able to make an electronic transaction and to convert any exchange rate of any country in seconds, as described in the beginning of this section.

The economic impact of information technology will be reviewed in the next section.

Section 3

The economic impact of information technology

As we learned from macroeconomics theory, there are two sources of economic growth. The first is extensive growth which is the growth in the factors of production: Land (all natural resources), labor (human efforts) and capital (investment in product and equipment). The second one is intensive growth which is the growth in output given the factors of production due to technological improvements, improved methods of production and high quality factors. The big difference is that the former is finite whereas the latter is infinite.

Technology is one of the greatest engines of economic growth and change in society, and its role has been increasing. We can imagine the huge impact on civilization when men managed to control the use of fire thousands of years ago, invented the horse collar that led to major changes in agricultural methods in the middle ages, or produced the steam machine which led to the Industrial Revolution and transformed the way goods were produced, distributed, and consumed.

But now, IT not only is transforming the way information is produced, distributed, and consumed, but also it requires a new fundamental form of economics. A young generation of economists, such as Paul Romer of the University of California at Berkeley, is trying to rethink macroeconomics theory. Paul Romer is attempting to get away from the focus on fiscal policies and short-term economic cycles and instead look at the role of technology in long-term economic growth. Information Technology deals with bits. Bits are radically different than atoms. They can be reproduced without cost and distributed around the world at the speed of light, and they never deteriorate. Material goods, made of atoms, have none of these properties. Therefore, on the microeconomics level, we also need a new business model. For example, in the modern technological economy, you give away your product, such as a software program on a disk, in the hope of making money later on tailoring the product or providing ongoing services. The software firm Netscape, among others, has already used that tactic with great success. In December 1994, Netscape was just an ordinary Silicon Valley start up company, making no money and with its \$ 12 million in seed funding almost gone. With its Navigator program for browsing the Internet available, sales took off and for the first full year of operation, ended on December 31, hit \$ 81 million. Netscape's August 1995 initial stock offering set off an investor frenzy, turning a company with just \$ 20 million in sales and no profit into a Wall Street phenomenon with a \$ 2 billion market cap. On January 28, 1997, Netscape announced that it had earned \$ 21 million on sales of \$ 346 million, a 305% gain. For 1997, analysts expect sales to jump 45%, to more than \$ 500 million. In the IT hardware segment, the rate of speed and improvements is astonishing as well. Since the microprocessor was invented 25 years ago, its performance has improved 25,000 fold. Every 18 months microprocessors double in speed. The same way the cost of a telecommunication trunk line, which was US\$ 60,000 in 1960 dropped to US\$ 5,000 in 1994. If the auto industry could have experienced the same improvements and cost reduction in the last 25 years, today it would be possible to buy a Rolls-Royce with US\$ 0.30 (thirty cents of a dollar)!

It is possible that IT, as other technologies, not only induces incremental innovations, radical innovations or changes of technology systems but also causes changes in techno-economic paradigm:

"Some changes in a technology system are so far-reaching in their effects that they have a major influence on the behavior of the entire economy. A change of this kind carries with it many clusters of radical and incremental innovations, and may eventually embody a number of new technology systems.

A vital characteristic of this fourth type of technical change is that it has pervasive effects throughout the economy, i.e. it not only leads to the emergence of a new range of products, services, systems and industries in its own right; it also affects directly or indirectly almost every other branch of the economy, i.e. it is a 'meta-

paradigm'. We use the expression 'techno-economic' rather than 'technological paradigm' because the changes involved go beyond engineering trajectories for specific product or process technologies and affect the input cost structure and conditions of production and distribution throughout the system..... From this it is evident that we view Shumpeter's long cycle and 'creative gales of destruction' as a succession of 'techno-economic paradigms' associated with a characteristic institutional framework, which, however, only emerges after a painful process of structural change."

Freeman and Perez described 3 key factors that should be fulfilled in order to justify the expression 'techno-economic paradigm'.

(i) Clearly perceived low and rapidly falling relative cost.

(ii) Apparently almost unlimited availability of supply over long periods. Temporary shortages may of course occur in a period of rapid buildup in demand for the new key factor, but the prospect must be clear that there are no major barriers to an enormous long-term increase in supply. This is an essential condition for the confidence needed to take major investment decisions which depend on this long-term availability.

(iii) Clear potential for the use or incorporation of the new factors in many products and processes throughout the economic system; either directly or (more commonly) through a set of related innovations, which both reduce the cost and change the quality of capital equipment, labor input, and other inputs to the system.

Needless to say IT fulfills all these conditions. Nowadays we see computers, telecommunications systems and microprocessor applied to almost everything (cash registers, cars, medical equipment, household appliances, etc).

But why did it take so long to merge of telecommunications (more than 100 years old) and computers (50 years old)?

Even though every one of these inputs identified as a key factor existed long before the new paradigm developed in the 80s, strong economic and social factors served first as constraints and later as unleashing forces. The massive externalities created to favor the diffusion and generalization of the prevailing paradigm acted as a powerful impediment to change for a prolonged period. Only when production along the old trajectories showed persistent limits to growth and to future profits did the high risks and costs of trying the new technologies appear to be justified. (The structural crisis of the 1980s seems to have triggered the general use of IT). Now that IT has been widely adopted, the change is generally irreversible.

The previous (and still in use) technological regime was based on low-cost oil and energy-intensive materials (especially petrochemicals and synthetics), and was led by giant oil, chemical, automobile and other mass durable goods producers. Its ideal type of productive organization at the plant level was the continuous-flow assembly-line turning out massive quantities of identical units. The ideal type of firm was the corporation with a separated complex hierarchical managerial and administrative structure, including in-house research and development (R & D). It ought to operate in oligopolistic markets in which advertising and marketing activities played a major role. It required large numbers of middle-range skills in both the blue and white-collar areas, leading to a characteristic pattern of occupations and income distribution. The massive expansion of the market for consumer durables was facilitated by this pattern, as well as by social changes and by the increasing availability of consumer credit. In this paradigm, production required a big network of highways, railroads, service stations, airports, and oil distribution systems. At various times in different countries, both civil and military expenditures of governments played a very important part in stimulating aggregate demand, and a specific pattern of demand for automobiles, weapons, consumer durables, synthetic materials and oil derivatives.

Now, IT has changed everything upside-down. The new paradigm of an ideal information-intensive productive organization increasingly links design, management, production and marketing into one integrated system. Firm organized on this new basis, whether in the computer industry such as IBM, or in the clothing industry such as Benneton. They can produce a flexible and rapidly changing mix of products and services. Growth tends increasingly to be led by the electronics and information sectors, taking advantage of the growing externalities

provided by an all-encompassing telecommunications infrastructure, which will ultimately depress sharply the costs of access to the system for both producers and users of information.

The IT skill profile appears to change from the concentration on middle-range craft and supervisory skills to increasingly high-range qualification, and from narrow specialization to broader, multi-purpose basic skills for information handling. Diversity and flexibility at all levels substitute for homogeneity and dedicated systems.

The IT profile of capital equipment is no less radical. Computers are increasingly associated with all types of productive equipment, as in Computer Numeric Control (CNC) machine tools, robotics, and process control instruments; through Computer Aided Design (CAD); Computer Aided Engineering (CAE); Computer Aided Manufacturing (CAM); and with administrative functions through data processing system all linked by data transmission equipment. According to some estimates, computer-based capital equipment already accounts for more than half of all new fixed investment in plant and equipment in the United States.

The annual rate of spending on IT in the U.S. was \$ 251 billion, or 3.6 % of the GDP as of 1996's third quarter compared with only \$ 47 billion, or 1 % of GDP, in the third quarter of 1980. Louis Gerstner, IBM's CEO recently predicted that the global IT industry would grow to \$ 1.3 trillion in annual revenue by 2000 from \$ 800 billion today.

In order to illustrate the use of IT, I will give some examples of how big companies are using technology to boost their business:

- Wal-Mart Stores Inc., U.S.' largest retailer began in 1995 to record every sale in every one of its 2,268 stores in a giant 'data warehouse'; The company uses the data to fashion targeted marketing strategies while distributing products to the stores where the most people are likely to buy them.

- The German software company SAP AG has grown rapidly by selling sophisticated programs that automate and seamlessly link together all aspects of a company's operations. The system processes orders; schedules and tracks manufacturing; dispatches and tracks goods, and makes sure they are invoiced properly so that the bills sent to customers match the orders that were taken.

- Dell Computer doubled in size to \$ 8 billion in annual revenue in the last two years, using a vast network of resellers and the system registers the order of a customer before it begins to build a machine The new plant in Austin, Texas, will have no storage space.

- General Electric's lighting division has already begun using the Internet to solicit bids for spare parts for its factories overnight instead of over two weeks. The solicitations go out over the global network to a preselected group of suppliers, who reply with their bids the following day. It will save hundreds of millions of dollars a year.

Michael Hammer, the management guru and co-author of "Re-engineering the Corporation" said:

"Such efficiency has helped insulate the national economy from the waxing and waning of the business cycle. If businesses no longer overproduce during booms, they won't be forced to cut production and lay off workers when demand slackens"

I have stressed the role of IT in creating widening investment opportunities and creating the potential for big increases in productivity and profits. But deep structural problems linked to this change of paradigm are now evident in all parts of the world. Among other manifestation are a shortage of the high-level skills associated with the new paradigm, even in countries with high-levels of general unemployment, and a persistent surplus capacity in the old paradigm, energy-intensive industries such as steel, oil and petrochemicals.

I turn, in the next section, to consider the impact of IT in the workplace and other related changes.

Information Technology and work

For more than 10,000 years people had labored in their own houses and the nearby land. But 300 hundred years ago, with the Industrial Revolution, workers had to move out of the home and field to work in factories. But men are economic beings and once again they are going back to home due to IT and to advances in the production system. As Alvin Toffler wrote:

"Watching masses of peasants scything a field three hundred years ago, only a madman would have dreamed that the time would soon come when the fields would be depopulated, when people would crowd into urban factories to earn their daily bread. And only a madman would have been right. Today it takes an act of courage to suggest that our biggest factories and office towers may, within our lifetimes, stand half empty, reduced to use as ghostly warehouses or converted into living space. Yet this is precisely what the new mode of production makes possible: a return to cottage industry on a new, higher, electronic basis, and with it a new emphasis on the home as the center of society".

He called this improved home 'the electronic cottage'.

It may sound absurd and lots of objections may arise. Some may say that women are struggling to get out of the home. Others may ask how you can get any work done with kids running around. So it seems that there is no motivation to work at home but according to the Bureau of Labor Statistics, in 1993 more than 20 million workers across America actually worked at home. That number is growing by as much as 13 percent annually, as sophisticated desktop computers, modem lines, and fax machines change the nature of the traditional office. Many of these workers are self-employed, but this is a trend also for organization men and women. According to LINK Resources, a research and consulting firm in Manhattan, "7.6 million company employees work at home at least part-time". There is also the concept of a 'Virtual Office', which means that for most of the people their work space is wherever their cellular phone and notebook computer happens to be.

'Teleworking' or 'telecommuting' are new terms coined in the recent past to refer to the ability of workers to either work out of their homes or to only drive a few minutes and reach a complex in their immediate neighborhood where, through advanced communication and computing support, they can access their corporate computing resources and undertake work. Other words such as 'homeworking' and 'networking' were also coined to describe it.

The interest in the concept of teleworking started in the early seventies because of the first oil crisis. At that time some scientists suggested that the then infant IT had the potential to substitute electronic communication for physical travel.

A much more recent upsurge in one facet of teleworking occurred during the Gulf War. During that period, there was a dramatic growth in video-conferencing facilities. This demand was created not from need to save jet fuel, but from the widely perceived belief that civil aviation was going to be subjected to a wave of terrorist attacks. The funny thing about this experience was that the attacks fortunately did not happen, but many companies learned that with video-conferencing they could make substantial savings in travel costs without sacrificing their operating efficiency.

Later in this chapter we will present some real examples of cost savings for companies. But what are the advantages and disadvantages of the home-based workers.

The disadvantages include:

- a. Feeling of being 'cut off' from the main office activities.
- b. Feeling of isolation.
- c. Constant temptation (food, TV, etc.)

- d. Need for self-discipline.
- e. Out of 'fast track' for promotions.
- f. Tendency to become a 'workaholic'.
- g. Bothered by distractions (i.e. kids).
- h. Sometimes can add the 'work stress' to the 'home stress'.

But there are clearly some strong advantages to telecommuting, including:

- a. More control over your life - greater flexibility of your time.
- b. A saving of the money normally spent on cars, gas, clothing, etc.
- c. Little or no commute time.
- d. Greater productivity due to less distractions.
- e. Environmental responsibility - you are not adding to the pollution if you drive less.
- f. Higher level of personal satisfaction with work and life.
- g. Leisurely dress code.
- h. Often more "peace and quiet" in work setting.
- i. Often better communication with colleagues (i.e. e-mail).
- j. More time for personal life and family.

From an economic point of view, items 'd' and 'f' seem to be very important, particularly in the U.S. Despite official encouragement of carpooling, a 1994 study by the U.S. Federal Highway Administration found that more people now commute alone. This mass commuting is a ticking time bomb. Traffic delays caused by inadequate roads are expected to cost the United States \$ 50 billion by the year 2005 in wasted wages and gasoline. In California, traffic congestion is estimated to cost employers \$ 2.4 million a day in productivity losses. Air pollution, health losses from both accident and disease, waste of time, employee frustration, and stress are toxic byproducts of mass commuting.

In the past, alternatives were unavailable or ineffective; now IT can provide relief from the burdens of physically commuting to work.

A variant of telecommuting is what has been called 'hoteling', a concept that has emerged in the recent past. In short, hoteling implies asking workers to work outside the office, visiting clients, working at home, or otherwise being in the field, and reducing the office space so that at any one time only 30% to 50% of the workforce can be present and seated in the office. No permanent offices are assigned, and all offices are stark and identical; when a worker needs to come to the office to accomplish a task that cannot be done on the road or to attend some meeting, the worker is assigned a cubicle from a pool of available seating positions, much the same as a person is assigned a room he/she goes to a hotel. Each cubicle has voice and data jacks so that workers can plug in their laptops and be connected with the company file, application and e-mail server.

Some of the companies that have implemented this concept include IBM, Ernest & Young, Arthur Anderson, Miliken, and Chiat/Day.

Ernest & Young reduced its space needs by about 20%, while IBM reduced its needs by 75% in the offices where hoteling has been used. Again a compound of computers, software and intelligent PBX (in short IT) gives the support for this system to work well.

There have been human-factor challenges to this nonterritorial office concept. However employee-to-employee interactions are supported via e-mail, file sharing and innovative workgroup software that realistically reflect the virtual elements of an office.

Employers are developing and implementing this system for the following reasons:

- a. As a means of saving money and, therefore, of becoming more competitive.
- b. A response to a lack of available employees. The number of available new employees is down from the 1960s as the "baby boomers" move toward retirement.
- c. A response to employees who demand more balance between their work and their personal lives. Therefore, companies must find solutions to keep employees happy or lose them to the competition.
- d. To reduce wasted time and frazzled nerves caused by long commuting by car! Some employees spend 2-3 hours per day driving to and from work and arrive exhausted and mentally unprepared for work.
- e. To avoid lengthy work disruptions in case of a natural disaster such as recent Los Angeles and San Francisco earthquakes, the Southeast hurricanes, blizzards last year (1996) in the Northeast of the United States.

This approach is not applied only within a company or a country. If there is a global economy, it should be a global labor market and a global labor force. While capital flows relatively free in the telecommunication system of global financial networks, governments, institutions and labor unions keep foreign workers out of their nation's boundaries. But because of IT, the world is becoming borderless.

Even though in 1993 only 1.5% of the global labor force (about 80 million workers) worked outside their country, this figure is changing because of the electronic immigrants.

Electronic immigrants are just foreign information or professional workers who provide their services via telecommunications. There are thousands of examples not only of big companies, but also small enterprises. Some examples:

For a decade, Boeing Aircraft has directed the manufacture of commercial jetliners by engineers in Seattle, WA, linked by telephones, computer communications, video, and fax machines to fabricators in Japan.

American Airlines has located its entire world ticketing operation in Barbados.

A joint venture of AT&T, Cable and Wireless (UK), and Telecommunications of Jamaica sells advanced telecommunications data-entry services in Jamaica.

Similarly, remote data-entry and administrative operations have opened in China, India, Ireland, Israel, Korea, Mexico, Singapore, and Taiwan because of the lower wages paid in these countries compared to the U.S.

Even small firms and individuals (Architects, lawyers, engineers, consultants) can provide worldwide services wherever they are for utilization at another place.

Information Technology allows for accelerated spatial and temporal dispersion of work (to homes, to flexible work hours, to remote work centers, and to travel and travel destinations). Work can now be distributed geographically, and to people working at different times. More importantly perhaps, tasks can be accomplished interdependently rather than dependently. Data entry can be organized at one remote work center, whereas financial analyses may be provided to data consumers in headquarters and homes all at once. Management

conferences become low-cost audio (and now with video, depending where you are) conferences regardless of individual travel schedule or worksite.

In large organization telephone contact is preferred even among people physically close to one another. Eventually face-to-face communication has its rewards, especially in negotiations, but it also has limitations. For a great deal of work, especially the exchange of information, telecommunications is preferable. Telephone calls, voice mail, and electronic mail are spontaneous (no advance scheduling necessary) , are pithy, can be declined, can be switched (call transfer) to another party, can be stored for future use (voice mail), as a rule do not require knowledge of the other party's location, and allow parties simultaneous access to their computers, notes, and other resources they might not have in a conference room.

Remote work exploits these advantages. The more you look at the available, affordable technology of remote work, the less remote it seems.

Section 4

IT and its impact on social institutions

Information Technology is having a dramatic impact on social institutions, in its own right and as a consequence of the economic changes just described in the previous section. For one thing, these developments directly challenge education and training systems. There will be an increasing need to tailor education and training to individual needs, both inside and outside of the classroom.

IT will obviously affect the delivery of a wide range of other social services. For example, there is great interest in IT application to health care in order to deliver services more efficiently and effectively, to encourage preventive medicine, and to provide in-home alternatives to hospital care. Dr. Pekka Tarjanne, Secretary-General of the International Telecommunication Union (ITU) addressed this issue at the opening of the Kyoto International Plenipotentiary Conference in 1994. He stated that he is personally fascinated by the possibilities of using communications technology to serve the needs of the handicapped and elderly so that they may lead more normal lives for as long as possible, and participate in the affairs of society instead of having to remain on the margins.

It is also becoming clear that the networks of the future will pose significant questions insofar as human rights and freedoms are concerned. In many countries since the late nineteenth century, "universal access to basic communications services at affordable rates" has been a foundation of communications policy - broadly understood to include content as well as carriage services. In such countries, the application of this principle has resulted in very high penetration levels for basic telephone and off-air television services.

Beyond the issue of the meaning of universal access to basic services in the information age, IT will raise a number of other very significant questions that will likely touch each of us personally in our daily lives.

In a number of countries, concerns have been expressed regarding the impact of telecommunications on privacy. We need to know and agree if the principles of freedom of information and expression developed for the media of the past can be applied to the network of the future. Can the laws, codes and regulations pertaining to such matters as pornography, slander, defamation, and hate literature, as developed for the print and broadcasting media, be applied to the electronic services offered on the networks of the future? How can the principles of copyright law be applied to multi-media services which may combine diverse sources of information from different media to create new products? How can we cope with information overflow?

The rate at which man has been storing information has been spiraling upward. It began with the innovation of writing (at a slow rate during centuries) and accelerated with the invention of printing in the fifteenth century. At that time, it took a century to produce a library of 100,000 titles. By 1950, Europe alone was producing 120,000 titles a year. In 1970 the U.S. government alone generated 100,000 reports, plus 450,000 articles, books and papers. On a worldwide basis, scientific and technical literature mounted at a rate of 60,000,000 pages a year. By the year 2025 the volume of information produced in one day will be equivalent of all information known today.

But fortunately, information is going digital. By the year 2000, half the material accessed in major libraries will be digital. IT is given the qualities to arrange the information. With navigating systems and intelligent agents, information access will be improved. Information will be available at any time and place. With the Internet, information is already at your fingertips.

How will the networks of the future impact on cultural identity? The broadcasting system, the principal means of distributing cultural products in many countries, already feels threatened by direct broadcasting satellite systems. On the other hand, the dramatically lower communications costs that should be made possible by these networks, their greater flexibility and their multi-media capacity could create new opportunities for cultural expression at the local, regional, national, and international level. Will the networks of the future open up new ways of cultural expression? Or will they be dominated by homogenized content?

It seems that there is a global paradox. As the world economy grows, the component parts are becoming more numerous and smaller and more important. There is a new tribalism balancing globalization. For example, as English becomes everyone's second language, the mother tongues become more important and more passionately held. Most reference books report that there are 4,000 to 5,000 languages spoken in the world today.

The more people dress with T-shirts, blue jeans, and tennis-shoes, looking like a southern Californian teenager, the more we appreciate a "Bahiana" dress or an Indonesian sarong.

It is also becoming clear that IT will raise questions about the conduct of politics and government in the information society. We have already witnessed the impact of TV on public opinion about the Vietnam War, Watergate and, recently in Brazil, the election and impeachment of Fernando Collor de Mello. The same technology (TV) that helped him to speak directly to the people of Brazil and to be elected, magnified his inappropriate conduct and led to his resignation and impeachment.

Even the VCR was used to undermine the Shah Reza Pahlavi regime and spark the Islam Revolution by the Ayatollah Khomeini in Iran.

These technologies are easy to manipulate and they are one-way broadcasting. Usually, political staffs manage the information fed to the news networks by packaging it in such a way that a producer has difficulty, altering the spin already put on it. By changing the rules of the game, those in office can supply news items made to fit the networks' formulas, and gain considerable influence over the public's political agenda.

However with fragmentation, scattered TV channels and satellite dishes, political manipulation of these media is rather difficult. This is especially true because of the Internet. This system was built without a central command authority, which means that nobody owns it, nobody runs it, nobody has the power to prohibit anybody from hooking into it.

Right now we are observing "The Internet Revolution" in what is left of Yugoslavia. The Serbian students and protesters are using the Internet to organize the protest against the authoritarian president Slobodan Milosevic. For the first time, the Internet is playing a crucial role in a popular uprising against an authoritarian regime. The implications are enormously important for the future. The events in Serbia are being closely watched by governments around the world, especially the Chinese government, which is concerned about the role an expanded Internet could play in that country.

One very important question is: how will IT impact on the political process itself? Are electronic referenda the logical successor to opinion polls in shaping government policy? How will the network of the future affect the conduct of election campaigns? Will they enable political parties to identify and influence voter preferences even more effectively than current technologies? How will the personalization of communication networks affect the presentation of candidates and issues? Could the networks of the future provide more democratic access to government institutions?

Perhaps the most fundamental political question to be faced concerns the role of the nation state in the 'borderless world' created by the information society.

In February 1995 the G-7 club held a special meeting in Brussels to address jointly the issues involved in the transition to the information society. During that meeting, G-7 country ministers identified a number of projects in which international cooperation might be advantageous. These projects aim at demonstrating the full potential of an information society and at encouraging its implementation.

In early 1995, Brazilian president Fernando Henrique Cardoso decided, as one of the key measures of his new administration, to overhaul Brazil's telecommunication system, in order to link up with the emerging global superhighway.

The telecommunication measures and programs adopted by President Cardoso's administration will be presented in the next section.

Section 5

Brazil's 'quantum-leap'

For all that has been written in the previous sections, and because of political and economic stability, Brazil and other developing countries have a window of opportunity to solve some of their worst problems, e.g. poverty, health care and education. For the rest of the 90's and beyond, the new areas of great economic advantage are in Latin America and Asia. Places like, Indonesia, Malaysia, Thailand and the "Four Tigers" -- Hong Kong, Republic of Korea, Singapore, and Taiwan in Asia -- and Chile, Venezuela, Peru, Argentina and Brazil (in Latin America) will increase their net receipt private investment inflows. All these countries have in common a new and unwavering commitment to the principles and practices of a free-market economy. Each has demonstrated the political will to implement structural reforms necessary to promote free markets, such as privatization, trade liberalization, tax reform, and to create capital markets and the necessary financial intermediation systems.

Brazil has a leading position in direct investment inflows. As of 1995 it was the fourth largest destination for US investment, ahead of Japan, France and Italy (see chart 1) and the largest among the developing countries (see chart 2).

US Investment in Industrial Countries 1995

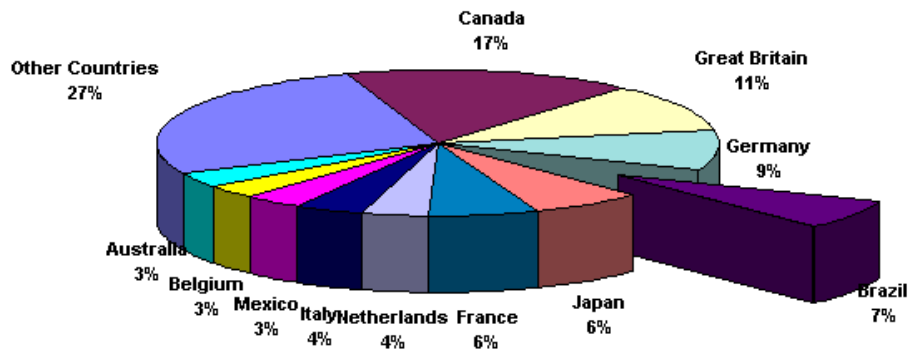


Chart 1

Source: U.S. Department of Commerce

Adaptation: Luciano Guimarães

US Investment in Developing Countries 1995 Stocks - US\$ billions - all sectors

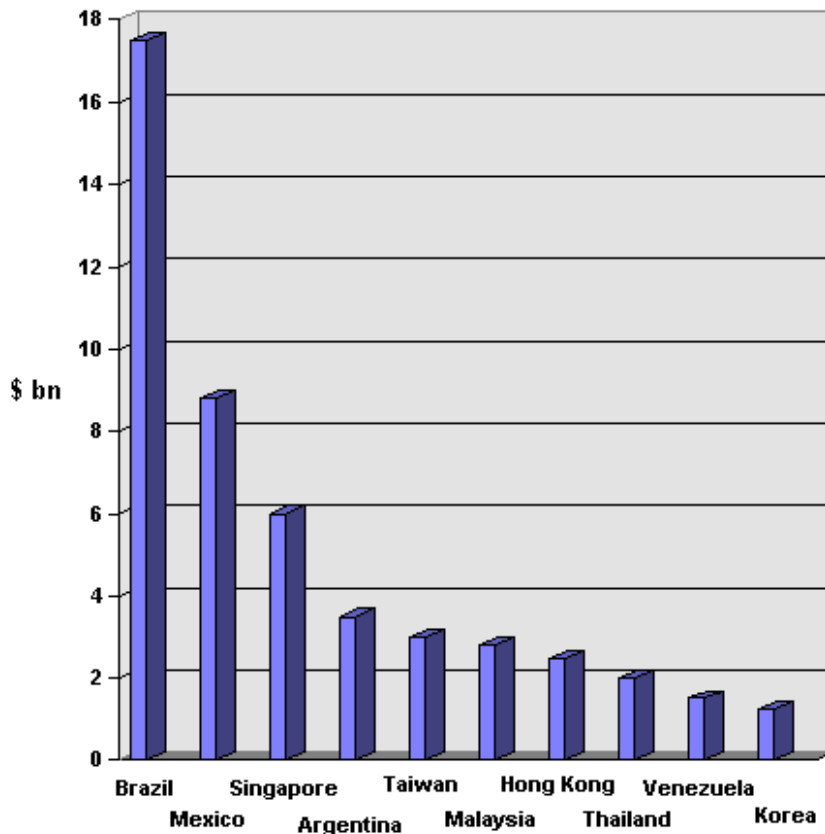


Chart 2

Source: International Direct Investment Statistics Yearbook 1995 OCDE

U.S. Department of Commerce

In the information era, countries will probably not be divided into industrialized and non-industrialized nations but into those that have an adequate telecommunication infrastructure and those that do not.

The Brazilian government has recognized the importance of a telecommunications sector prepared to give appropriate support to a modern economy.

In view of this situation and of the urgent need for a national development program, President Fernando Henrique Cardoso's Administration decided to promote a complete reorganization of the communication system. Future government initiatives shall preserve public telecommunication assets and comply with the following overall guidelines: stimulate private sector investments; strengthen the role of the State as the agency regulating telecommunication activities; diversify the supply private sector services in this industry; and preserve public sector presence in strategic communication and technological development areas.

The strategy, already defined, will be implemented through a long term program called 'Programa de Recuperação e Ampliação do Sistema de Telecomunicação e do Sistema Postal' - PASTE (Recovery and Expansion Program for Telecommunication and Postal Systems).

The following are among its objectives: to establish guidelines, goals, programs and projects to recover and expand telecommunication and postal services in the country; to implement an extensive investment program through 2003 with substantial private sector participation; to increase substantially the supply of telecommunication and postal services; to modernize the industry, eliminating technological backwardness in the short term so as to support national economic development effectively; to stimulate technological innovation as a tool to achieve productivity gains and competitiveness; to consolidate and expand the role of the postal service as an agency of interest to the whole society; and to integrate telecommunication and postal activities in order to optimize their potential.

The following fundamental issues are going to be pursued during this administration: - Formulation of a broad investment program, reaching up to 2003, to be carried out by public and private businesses in the communication industry, in agreement with the guidelines and goals adopted for telecommunication and postal services;

- Professional improvement of technical and managerial staff of service operators;

- Implementation of a new institutional model for the industry, encouraging competition in the exploitation of several services;

- New regulation for several services, with the adoption of competition criteria as far as the granting of concessions and authorizations are concerned, reform of the Brazilian Telecommunications Code, and updating of the Postal Law.

Investments projected by PASTE amount to R\$ 75 billion in April 1995 values, of which approximately half will be paid during the first execution period (1995/1999) and the other half in the following period (2000/2003). These investments cover five programs associated with the structure of the National Telecommunication System, as shown in the table below:

Summary of Investments per Program

(R\$ billion)

Program	1995-1999	2000-2003	TOTAL
Access networks	10.23	10.86	21.09
Interconnection networks	6.66	7.09	13.75
Basic networks	14.33	15.23	29.56
Specialized networks	4.52	2.57	7.09
Oper. & sup. systems	1.72	1.85	3.57
TOTAL	37.46	37.60	75.06

The present home telephone service is concentrated in higher income families. Over 90% of families with a monthly income of more than R\$1,000 are covered while, on the other hand, the degree of penetration among families with a monthly income of less than R\$300 is negligible.

One of PASTE's objectives is to change this picture by providing universal access to basic communication services, at the same time that it meets the demand for other services in different segments of the society.

Suggested programs and projects in PASTE presuppose the following in order to be carried out:

- transfer of technological and productivity gains to prices;
- use of appropriate technologies and adoption of creative, lower cost solutions with an adequate quality standard;
- reduction of network and access implementation costs;
- reduction of service taxes.

The meeting of telecommunication needs in Brazil demands solutions appropriate for each market segment. Among these solutions is virtual telephone, a voice message storing device having its own number that may be accessed from any telephone terminal, and card driven public telephones with inductive technology that is already installed in many localities. Thus, the objective is to make telecommunication services more readily available to the lower income population, at prices compatible with each income bracket.

In short, the Brazilian reality requires a wide range of alternative services, from the simplest and easiest to use at low prices, destined for low income families and micro-enterprises, to the most sophisticated high speed and broad-band services destined in more developed society segments and larger companies. Among the new services to be offered are those pertaining to high speed networks (high speed data, video), added value platforms, corporate networks, and so on.

As previously observed, PASTE intends to establish the basis for a new relationship between telecommunication companies and their customers. It gives the highest priority to the supply of services with desirable intrinsic quality so as to achieve universal access by all layers and segments of society, transforming the telecommunication industry into a fundamental component of national development.

The expansion proposed by PASTE will open a privileged opportunity for Brazil to make technological gains, restructure its systems and review traditional technical and operational procedures. By the year 2003, the current network will represent only about one third of the network that will exist at that time.

In this sense there are Broad Band Networks, currently called information highways or information super-networks. The basic segments of such networks will be implemented initially at local, regional, and national levels through the employment of advanced switching and transmission techniques (ATM for switching, and optic communication and SDH for transmission), that will make up their cores. Users will be connected to these networks by modern access means, such as optic accesses, wireless accesses, distributed switching, local ring networks, and so on. Without any doubt, this is one of the segments that will acquire growing importance for the implementation of future networks, especially low speed ones.

An intensive use of satellites to offer a wide range of services is also projected, besides current voice and video interconnections. One of the most notable applications is the one that will create worldwide communication facilities for users when they subscribe one of the many systems offering global coverage for mobile terminals, based on an array of satellites strategically distributed around the Earth in low (LEO - Low Earth Orbit) or medium orbits (MEO - Medium Earth Orbit). Even if the volume of these services is not as significant with respect to what may be obtained with traditional cellular systems, they will be highly relevant because they will enable quick coverage in locations where normally this would be very difficult, or would mean extremely high costs. This is the case, for instance, of a great number of rural areas and isolated localities in the country, mainly in the Northern, Mid-Western, and the Northeastern regions.

The benefits resulting from this approach are obvious, both for operators and users. They may be identified as reduction in costs and in project maturation time, systems modernization, improved service quality standards, faster access by users not presently covered, supply of services in remote locations, and access opportunity for low income users through public message services (virtual telephone).

The goals proposed in this program (PASTE) will allow for the telecommunication development process to be resumed in the country, considering that its growth has been curtailed during recent. In this way it will be

possible to meet Brazilian society needs in a qualitative and quantitative way.

It must be mentioned that, besides supplying a larger number of telecommunication services and meeting demands within shorter terms, these activities will have a very positive impact on other industries. A large number of new jobs will be generated; national manufacturers will be strengthened; there will be a significant increase in tax income; national technology will be improved: and small and medium sized companies will be encouraged to grow.

In this way Brazil will be repositioned in the world ranking of telecommunication services quality indicators, especially with respect to telephone density versus per capita income. At the same time, the Brazilian economy will be strongly influenced by the new basic infrastructure to be created. Thus, the telecommunication industry will have an increasingly more important role in the economic and social development of the country.

I close this paper with a quote from President Fernando Henrique Cardoso's telecommunications program:

"Nowadays Telecommunications are, doubtless, the most attractive and profitable business for private international investor. Telecommunications are coming to be the key factor of economic expansion, which is being transformed into the so called third industrial revolution. Certainly there are many investors interested in increasing such activity worldwide, and particularly in Brazil due its potential and dimensions..... Information Technology has become the fundamental factor for economic growth and social development. It means that the relative restraint in our country will necessarily be surpassed in order to boost the development process. It is not only a means to expand existing services because of question of justice and equality. We need to invest heavily in communications to build a strong infrastructure, which is essential to generate wealth for investment in the social area."

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