National Innovation Systems:
A case study of South Korea and Brazil

Kate Ho and Katharina Luban
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1. The National Innovation System – An Overview

Efficiency and intensity of innovative activity in an economic area does not only depend on entrepreneurial decisions. It also replies on institutional setting, the public research activities as well as access to capital and a skilled work force. The National Innovation Systems (NIS) approach analyses innovative activity in this broad sense. The focus is not solely on the number of introduced process and product innovations in a country, but the research and development efforts by business firms and public actors are under consideration as well. In addition, the determinants of innovation - for example - incentive mechanisms or the availability of skilled labor are also important.

Lundvall (Lundvall 1992, p.16) names Friedrich List (1841-1959) as the first person to oppose Adam Smith's (1723-1790) approach which favoured a cosmopolitan model of economics, whereby the acting of participants and the functioning of the markets are dependent only on generally accepted laws. List pointed out the revenues of the nations depended mainly on the "accumulation of all discoveries, inventions, improvements, perfections and exertions of all generations which have lived before us" (in: Freeman 1995, p. 6). List stresses the interdependence of intangible and tangible investments and the importance of stately interventions.

While List's publications attempted to explain Germany's dominance over England in the 3rd Kondratieff wave in the late 19th century (Freeman 1988), the amazing development of the post-war Japanese economic growth and policy encouraged Freeman (Freeman 1987) to do a thorough analysis of its NIS.

Since then, there has been a growing interest in this kind of approach to innovative success. It maybe a result of economic trends such as enhanced technical sophistication of Korea, Taiwan and other Newly Industrialised Countries. The studies have certain commonalities in structure and content. They all define a proposed framework which influences a nation's ability to create and apply new technological knowledge for economic advantage. While disagreeing the importance of competitive economic factors, most authors strongly agree that an educated workforce is a necessary though not sufficient condition for an effective NIS.

Most approaches differ in other important aspects. Authors such as Freeman and Lundvall lay an emphasis upon organisational matters related to learning, the interaction between the production system and the process of innovation. A narrow view only considers organisations and institutions involved in searching and exploring – such as universities, technological institutes and R&D departments. The broad definition includes "all parts and aspects of the economic structure and set-up affecting learning as well as searching and exploring" (Lundvall 1992, p. 12)

Other authors, like Nelson (Nelson 1988), focus on the production of knowledge and innovation, mostly related to law and economics and thereby stressing institutional factors. In his opinion a NIS should consider how well institutional set-ups take into account and solve the private / public dilemma of information and technical innovation.

After all, since Lundvall's (Lundvall 1992) and Nelson's (Nelson 1988) contributions, the NIS approach has gained even more in popularity, amongst politicians as well as amongst innovation researchers.

2. From Systemic Examination to System-Level Comparison

When first developed, the NIS approach was applied to regions, sectors or nations to describe and explain the structure of the main actors involved in innovation processes. Through understanding these factors, governments could accelerate economic productivity and increase the national rate of growth in wealth and personal income. It was common to put nation-specific innovation patterns into a cultural, political and/or historical context. However, the attention moved to performance comparisons across systems later on.

One of the first comparative NIS studies was conducted by Porter (Porter 1990). This and his other early comparative studies did not follow a formalised structure and only involved two or three countries. None of the authors of early comparisons took into account that the respective countries' social, economic and political environment. This had as much an influence on their ability to develop and use technological knowledge as systemic, i.e. tangible characteristics have. It is therefore arguable whether a nation's NIS, in isolation of other national influences, can be used as a tool for governing the competitive environment of another nation.

Still, a way of benefiting from these comparative studies is the deduction of political implications. Institutions like the OECD or the EU encourage policy-oriented studies that frequently combine the NIS approach with the idea of benchmarking. The OECD Working Group on Technology and Innovation Policy (TIP) for example conducted a four-year study on the policy relevance of the systemic approach to innovation activities (OECD 1999). Some of the findings in that report stem from earlier OECD studies, such as the 1998 publication "Technology, Productivity and Job Creation: Best Policy Practices" (OECD 1998). The EU decided in 2000 to "develop indicators and a methodology for the benchmarking of national research policies" (European Commission, 2000, p.3). Studies of this kind aim at identifying "best practice policies" and "best behavior" among the countries under study by surveying various indicators of innovative outcomes or efforts. Grounded on the results of the search for best practice policy, recommendations are derived.

Nelson (Nelson 1993) responded to the absence of a well-articulated analytical framework. He conducted a fifteen-country study that was designed to illuminate institutional arrangements which supported technical innovation in these countries. He highlighted the similarities and differences, and initiated an at least preliminary discussion of how the differences came to be and seem to matter (Nelson 1993b).

Many comparative studies on the system-level have been conducted and are utilised as a preliminary step to generate rankings of NISs. System-level approaches usually try to bridge two aspects; the systemic analysis of innovation processes with emphasis on country-specific elements/structures and comparisons across systems that abstract from systemic idiosyncrasy.

Many attempts to formalise the concept of NISs have been published since Nelson's initiative. To capture the structure and performance of an NIS, descriptive models of NISs have been employed to provide a conceptual framework. Liu and White (Liu 2001) for example built their framework on five different activities of innovation processes, namely "R&D", "implementation", "end-use", "linkage" and "education".

Another model to study the composition and strength of a country's innovation system has been introduced by Chang and Shih (Chang 2003). Based on previous work by the OECD (OECD 1999), the model is made up of six major functions of generic types of institutions that are involved in the innovation process: "policy formulation", "performing R&D", "financing R&D", "promotion of human resource development", "technology bridging" and "promotion of technological entrepreneurship". These basic criteria are meant to analyse the structural specifics of a NIS by describing the role and performance of particular institutions. To capture the abstract performance of a system and to consider the participation of different actors in an innovation system, its dynamics and its efficiency, another four fundamental groups of indicators have been employed: “R&D collaboration”, “informal interaction”, “technology diffusion”, and “personnel mobility”.

A recent trend in the literature on NISs regards studies of countries outside the group of highly industrialised nations, focusing on transformation economies in Eastern Europe, developing countries as well as newly industrialised countries in Asia and Latin America.

In the following we will have a closer look at the NISs of South Korea and Brazil. We will study the composition and strength of these systems by looking at them on the system-level in a formalised manner rather than only comparing systemic characteristics. We will do so by employing the model of Chang and Shih (Chang 2000) that was introduced earlier on. The approach of Chang and Shih is the system-level approach that proved to be the most comprehensive because of its clear division of the structural specifics and the abstract performance of a system.

3. Comparison of South Korea and Brazil

3.1 Institutional Functions

3.1.1 Technology and innovation policy formulation

In Korea, various independent ministries and agencies carry out Science and Technology (S&T) activities, which could include Research and Development activities (R&D). Duplication and conflict between individual policies create inefficiencies within the system. To minimise such inefficiencies, a process of policy co-ordination and budgetary co-ordination is carried out (Chung 2001).

For policy co-ordination, the Ministry of Science and Technology (MOST) is legally the central point of S&T policy. Eventually long term technological forecasting was added to MOST’s role. Every five years, MOST uses the Delphi method and feeds the results back into R&D policies and directions (Chung 2001).

Largely ineffective due to the lack of political power and financial resources, MOST actually functions as the secretariat for the National Science and Technology Council (NSTC) instead. NSTC was created under the Special Law for Scientific and Technological Innovation in 1997 and chaired by the President of Korea. NSTC decides policy agenda, policy directions, priorities for R&D allocation and evaluation of national R&D programmes. The Ministry of Planning and Budget (MPB) performs the budgetary co-ordination, which includes producing the annual budget guidelines and allocation of the budgets. Previously, the MPB had the most power in the S&T policies; however, it is likely that the balance of power will shift towards NSTC in the future (Chung 2001).

In Brazil, S&T policies have been hindered by periods of military and civilian control with conflicting interests. Shortly after Brazil returned to civilian ruling, the Ministry of Science and Technology (MCT) was formed in 1985 to take direct responsibility of:

- CNPq – National Research Council
- FINEP – Agency for financing studies and projects
- SEI - Special Informatics Secretariat

The MCT’s role was to take explicit control of the “expansion of infrastructure in science and technology, principally related to human resource development”. Also, attempts were made at identifying important strategic sectors and provide funding to ensure growth. Previous allocations were ineffective since they were awarded on academic criteria rather than application to commercial opportunities (Dahlman and Frischtak 1993).

Note the relative lateness of consideration of technology policy at the ministerial level compared to Korea. The formation of the MCT levitated the status of technology policy, which was once performed by the Secretariat for Industrial Technology (SIT) within the Ministry of Industry and Commerce (Alcorta and Peres 1998). It is noticeable that whilst MOST’s role is concentrated on long-term technological goals, MCT was actually more concerned with infrastructure building. In addition, the priority of technology policy is so high that the President takes a direct control in the shaping of such policies, however, in Brazil, no such direct involvement is documented.

3.1.2 Performing R&D

In the past two decades, the Korean government has shifted its stance from having a leading hand in R&D activities from the 1960s and 1970s to the encouragement of private firms to perform R&D. In 1980, 62% of R&D were performed by public institutes, along with 9.2% by Universities and only 28.8% by private firms. By 1990, this had dramatically shifted to 74% of research performed by private firms (an increase of 45.2%) whilst the public sector only performed 18.5% (drop of 43.5%) (Chung 2001).

The same situation existed in the 1970s in Brazil – i.e. public R&D dominating private R&D – however, the trend remained. Brazilian firms have showed little interest in performing R&D. The number of firms that declared R&D in their tax returns totalled 1,050 in 1976/77, dipped in 780 in 1981/83 and recovered 1,090 in 1985 (Dahlman and Frischtak 1993). Dahlman and Frischtak (1993) state that the Electronics sector was the most active at 34.9% and the Vehicles sector second with 24.3%.

The type of R&D performed in Korea has shifted towards technology development over basic. Basic research declined from 22.9% in 1970 to 13.2% in 1996. In addition, the Korean state founded companies, the chaebols, had reached the technological frontier from reverse engineering and efforts were poured into R&D to gain international competitiveness. This was a key strategic move for Korean firms since they had a small domestic economy compared to Brazil's (and most industrialised countries that they were competing against) and therefore had to compete in foreign markets.

In contrast, the most common type of innovations in Brazil is incremental. Alcorta and Peres (1998) state three reasons for this behavior:

- **Larger managerial capacity.** Brazilian managers tend to "react by emphasising commercial and financial solutions, not technological ones". Therefore, when troubles arise, they seek solutions in relation to reduction of overheads rather than product improvements.
- **Lack of knowledge in innovation**. Firms still treat human capital as a cost rather than as a resource.
- **Lack of medium/long term vision**. Firms lack the vision for long-term competitiveness.

3.1.3 Financing R&D

In comparison to other Industrialising countries, Brazil has quite substantial R&D expenditures in absolute terms. However, upon closer examination, their R&D to GDP ratio has remained constant during the 1980s (Dahlman and Frischtak 1993). In contrast, Korea's ratio rose from 0.77 to 1.95 in the same period. Also, whilst Brazil's economy is twice the size of Korea's, in absolute terms, the R&D expenditure is almost the same and in recent years, Korea's is doubled that of Brazil's. The trend continues into the twenty-first century; Etzkowitz and Brisolla (1999) state that whilst the Korean target is to spend 5% of its GDP on R&D, Brazil's aim never rose above 1.5-2% - even during its most prosperous years.

The Government performs the majority of Brazilian R&D. In 1982, the Government funded 67% of the R&D, 22% by private firms, 5% from foreign investment and 8% by others. The trend remained in Brazil: in 1995, 69% of R&D was funded by the Government, 22% by private firms and 9% by other firms which includes state owned firms (Alcorta and Peres 1998). Whilst Korea was at first in a similar position, it managed to shift towards private funding. .

One of the main failings of the financing of R&D in Brazil has been the lack of direction and specialization in research. As Alcorta and Peres (1998) state, "this diversity and fragmentation did not allow firms to concentrate their limited technological, marketing and financial resources in a smaller set of key products that could have been competitive in international markets … the lack of firm, industry and intra-industry specialisation seems to be one of the major limitations to Brazil's industrial development."

3.1.4 Promotion of Human Resource Development

From an illiterate workforce in the 1950s (22.0% in 1953) to nearly 90% literacy rate within two decades demonstrates the high priority that Korea has for education. The spending in education compared to total government spending has increased from 2.5% (1951) to 22% (1980). Despite the high expenditure, this is still only one third of the total expenditure on education; the rest is made up through private firms and parental contribution. This rapid increase has created a highly skilled workforce. Overseas training has also been a major factor – a hangover from the days of U.S. aid to Korea after the colonisation (Kim 1993).

Brazil has seen a substantial increase of students in their education system during the same period. In primary education, the percentage of children within that age group attending school has increased from 58% (1960) to 88% (1990). In secondary education, percentages rose from 15% to 56% within the same period. Higher education saw the biggest increase, from 3% to 19% during three decades (Alcorta and Peres 1998).

Although the quantity of students has risen dramatically, the quality has decreased in both countries. In Korea, the student to professor ratio has dropped from 22.6 to 35.8 from 1966 to 1985. The number of universities has increased from 69 to 100 within the same period of time. Kim (1993) argues that Korea suffered a drop in competitiveness during the early 1990s due to this. MOST founded more research-orientated S&T schools to reinstall the research foundation needed for innovation to counter the teaching-orientated method at undergraduate level. Within Brazil, the state has had to invest heavily in technical and vocational training to compensate for the poor formal education system at primary and secondary levels. At university, CAPES, the higher education authority, estimates only one quarter of new graduates programs are decreed academically satisfactory. Postgraduate programmes are used to compensate the quality variance within universities. Other parts of the problem included the low status of undergraduate teaching staff which has led to falling living standards and the increased bureaucratisation of universities (Alcorta and Peres 1998; Dahlman and Frischtak 1993).

Brazil has a very low percentage of scientists and engineers compared with Korea and indeed, other industrializing countries. Only 0.13% of its population are trained as engineers – Korea has four times this amount. There exists a shift and concentration towards commercial science over engineering. Also, Brazilian research has tended to concentrate in medical sciences, art and social science (Alcorta and Peres 1998; Dahlman and Frischtak 1993).

	South Korea	Brazil
Percent age group enrolled in:		
Primary education		
(1965)	101	108
(1985)	96	104
Secondary education		
(1965)	35	16
(1985)	94	35
Tertiary education		
(1965)	6	2
(1985)	32	11
No of tertiary students per 100,000 population (latest year)	3606	1140
Nº of tertiary students in General science and engineering fields (1,000)	585	535
(Year)	(1987)	(1983)
Total (As % of population)	1.39	0.40

Urban (As % of population)	2.02	0.58
Nº of students in Natural science, mathematics and computer science, engineering (1,000)	320.6	323.3
Total (As % of population)	0.76	0.24
Urban (As % of population)	1.10	0.34
Nº of students in engineering only (1,000)	227.6	164.6
Total (As % of population)	0.54	0.13
Urban (As % of population)	0.78	0.17
No of students enrolled in vocational training (1,000)	814.5	1481.0
(Year)	(1986)	(1985)
As % of population of working age	3.06	1.83

Source: Dahlman and Frischtak (1993) quoted from Lall (1992)

3.1.5 Technology Bridging

There is no mention of any technology bridging institutions within Korea. Either none exists or they play a relatively minor role.

Arocena and Sutz (2001) note that the Brazilian university accountancy systems was a hindrance to creating links with industry because it prevented the on-time spending of private investment. Organisations were created to attempt to bridge the gap – some located within the university itself and some outwith. Theses acted as consultancy firms. But success was limited due to the institutes' failure to promote the "effectiveness of the universities' capabilities" (Arocena and Sutz 2001). Instead, they waited on industry approaching them which led to under-utilization of these institutions.

3.1.6 Promotion of Technological Entrepreneurship

Despite their importance, during the 1980s, chaebols began abusing their economic power and stifling entrepreneurship within small and medium firms (SMEs) (Kim 1993). To reply, the Korean Government took two actions - they created sanctuaries and the venture capital industry. Sanctuaries are 205 business terrorities which chaebols and their related subsidies cannot enter - this allowed SMEs to flourish in high technology sectors (Kim 1993). Secondly, the first Venture Capital company was formed in a special partnership between the state and private firms. The subsequent Small and Medium Enterprises Formation Act in 1986 lead to another 12 Venture Capital firms being formed, funded by a combination of state and private sector (Kim 1993). In addition, the New Technology Commercialization Financing Promotion Act set up in 1986 promoted the formation of financial institutions that only financed the high technology sector (Kim and Dahlman 1991).

Whilst entrepreneurs in Korea have a steady supply of capital, their Brazilian counterparts do not have the same luxury. There is little venture capital in Brazil and it is debatable whether there exist the entrepreneurial opportunities. No literature can be found on this, but it seems the lack of innovation within industry, applied research within university and capital would result in a stagnated supply of entrepreneurs.

3.2 Interactions of institutions

3.2.1 R&D Collaboration

Collaboration is very weak in both countries. In Korea, MOST estimates only 35% of its national R&D is undertaken by a combination of universities, research institutes and industries (Chung 2001). Collaborations between Universities and the Private sector are the weakest link in the Korean NIS. Due to the under-funding of universities as mentioned above, industry regard universities as having inadequate facilities for their purposes and hence, they attract very little funding from the private sector. Instead, more common are informal collaborations through the usage of consultancy from individual members (Kim 1993).

Between industry and public research institutes, collaborations are more frequent as the government provides subsidies and financial incentives for such collaborations. Recently, large private firms chose to keep their R&D secret to retain competitive advantage despite the short-term financial incentives. These collaborations are largely used to support SMEs instead.

There was no literature found on formal R&D collaborations between institutions in Brazil. Indeed, it is doubtable whether any exists within industry since such a small amount of firms perform R&D.

3.2.2 Informal Interactions

There has been no literature found stating informal interactions within institutions in both countries which suggests that they play a very minor role. However, it has been suggested that within Korea there is high mobility within GRIs and private firms and hence, close, undocumented personnel links between the two. In Brazil, three major universities for technology all have nearby science parks to encourage the transfer of knowledge from the universities to industry (Marcovitch 1993).

3.2.3 Technology Diffusion

The role of Foreign Direct Investments (FDIs) is very different in both countries. Brazil received US$ 27.4 billion and Korea only received US$ 3.6 until 1986 and unsurprisingly, their role in the Brazilian NIS is of paramount importance (Viotti 2002). Explicit governmental policies for attracting FDI have existed since 1960s. “This consisted not only protecting the local market but also of offering significant subsidies and special treatment for foreign investors.” (Dahlman and Frischtak 1993) However, with weak Intellectual Property Rights, foreign companies tend not to invest their most advanced technologies (Dahlman and Frischtak 1993). In Korea, however, the lack of FDIs is deliberate. Korea’s governmental policies require all foreign investment to be approved by the state – an attempt to steer Korean companies’ independence from Multinational Enterprises (Viotti 2002). This proved crucial during the 1980s: whilst Korean companies could specialise and shift towards innovation, Brazil lacked the capability to shift its stance.

The Brazilian dependence does not end with FDIs. There exists a “strong reliance” on foreign technology licensing and expertise as well (Arocena and Sutz 2001). This compensates for the lack of domestic R&D. Whereas the Korean situation is opposite. Chaebols have aggressive in-house R&D laboratories to “absorb, assimilate and adapt imported technologies” (Kim 1993).

In the 1980s, the Korean government created public research institutes with the sole purpose of diffusing technology. A lack of resources meant that they could not produce prototypes or carry out any effective R&D. Although this may seem a failure of the objectives, it actually produced the same effect as the researchers from these institutes as well as from state financed companies joined industry to head research and engineering departments, carrying with them the knowledge gained from the state institutes.

Other than that, the Korean NIS does not have any “explicit policy instruments” (Kim and Dahlman 1991) on technology diffusion. Indirect instruments such as consulting engineering firms and capital goods producers allowed the government to target these agencies to help technology diffusion. In addition, two main instruments were used in link supply and demand of technology diffusion. For SMEs, six public agencies provide various technical services which ranges from training and automation to assisting firms with product quality. Secondly, scientific and technical information are disseminated through scientific papers within technical information centers (Kim 1993).

3.2.4 Personnel Mobility

No literature has been found on the personnel mobility in either countries which points to its insignificance in both NISs. Kim (1993) notes that the Korean war, despite destroying large parts of the industrial infrastructure actually helped "… the subsequent economic development, having completely transformed a traditional rigid society into a highly mobile one by forcing geographical mobility" (Kim 1993). It is clear that mobility played an important part in the initial process and Koreans probably retained that mobility since Korea is a relatively small country compared to other industrializing countries like Brazil or China.

Within Brazil, there are no hints on the role of mobility, however, since public R&D largely dominate, the role of mobility – if it does exist – would be minor since they would only be transferring within the same type of institutions rather than from inter-institution.

4. Conclusions

In drawing conclusions out of the comparison between South Korea and Brazil it has to be repeated that there is no such thing as a fully fledged institutional framework that incorporates all possible interdependencies between the different institutions. The above approach has mainly highlighted differences in the characteristics of two countries, that in the 1980s were seen as equal in development. The systemic approach to innovation is by established as a useful framework to study technical change and its determinants, but, it is arguable whether generalisations can be drawn and whether Brazil, had it copied the Korean NIS, would have had similar success.

We recongise the weaknesses with the Chang and Shih framework. The four fundamental groups proposed by Chang and Shih to capture this abstract performance of a system, were either not to be documented in literature (personnel mobility and informal interactions) or didn't show great differences (R&D collaboration). Only the Technological Diffusion of foreign knowledge showed significant diversities of the countries' practises, but the dissemination of innovation generated in the respective countries doesn't have any significant mentionings in the literature.

Authors like Viotti (Viotti 2002), who deals with innovation patterns, refute the usefulness of the NIS concept in the case of technological laggards when he points out: "The NIS approach is not appropriate for dealing with the processes of technical change typical of industrialising economies, which are extremely different from those of industrialised countries" (p.654).

However, the fact that in low- and middle-income countries only fragmented innovation systems were empirically found does not irrevocably imply that the NIS framework is useless in these contexts. Alcorta and Peres (Alcorta 1998) do not refrain from using the NIS approach and whilst there are weaknesses within the Chang and Shih framework, it still proved a useful and insightful tool to analyse the South Korean and Brazilian NISs. Through their framework, we analytically discussed ten aspects of the NIS and we hope that through similar studies, wider public policy implications can be drawn. Hence, governments of Industrialising countries can learn and improve their economic progress.

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Appendix A – Facts and Figures for Brazil and South Korea

R&D expenditure of Brazil and South Korea

	Absolute Expenditure		R&D Intensity			
	Amount	Year	1970	1977	1982	Latest Year
Brazil	1448	1982	0.24	0.70	0.59	0.59 (1987)
South Korea	1307	1983	0.39	0.60	0.90	1.8 (1986)

Source: Dahlman and Frischtak (1993) quoted from UNESCO (1989)

Source of funding for Brazil and Korea

		Source of Funding				Source of Expenditure		
Country	Year	Government	Industry	Foreign	Other	Industry	Higher Education	Government Agencies
Brazil	1982	67	20	5	8	30	27	53
South Korea	1986	19	81	-	-	67	11	22

Source: Dahlman and Frischtak (1993) quoted from UNESCO (1989)

Number of scientists and engineers in South Korea

	Research Institute		University		Industry		Total	
1975	5,300	(na)	2,300	(na)	2,700	(na)	10,300	(na)
1980	4,600	(484)	8,700	(2,877)	5,100	56	18400	3417
1985	7,200	(1,105)	14,900	(6,640)	19,000	251	41,000	8,005
1990	10,434	(2,933)	21,332	(21,332)	38737	1,139	70,503	17,662
1995	15,007	(4,659)	44,683	(27,073)	68,625	3,373	128,315	35,105
1996	15,503	(4,938)	45,327	(27,434)	71,193	3,734	132,023	36,106

Unit: Persons (scientists and engineers only)
Source: Chung (2001) quoted from MOST (1997a) and KITA(1997)

Percentage of R&D performers in South Korea

R&D Performers	1975	1980	1985	1990	1996
Industry	28.9	28.8	65.4	74.9	73.2
University	5.1	9.2	10.3	7.6	9.4
GRI	66.0	62.0	24.3	18.5	17.4

Source: Chung (2001) quoted from MOST (1997a, 1998b) and KITA(1998)

R&D Expenditure and percentage of expenditure by institutions in South Korea

	1965	1970	1975	1980	1985	1990	1996
R&D Expenditure (billion Won)	2.1	10.5	42.7	282	1,237	3,350	10,878
Government	1.9	9.2	30.3	180	307	651	2,398
Private	0.2	1.3	12.4	103	930	2,699	8,467
Government: Private	93:3	90:10	71:29	64:36	25:75	19:81	22:78
R&D/GDP (%)	0.26	0.38	0.42	0.77	1.58	1.95	2.79

Source: Chung (2001) quoted from MOST (1997a, 1998b) and KITA (1998)

Public Expenditure and GDP within Brazil

Year	Public Expenditure	GDP
1981	966,133	253,785,250
1982	1,184,970	257,988,623
1983	938,207	247,500,345
1984	907,447	253,138,254
1985	1,242,271	282,347,174
1986	1,455,239	314,477,537
1987	1,485,365	323,573,075
1988	1,468,595	322,597,503

Source: Dahlman and Frischtak (1993) quoted from CNPq (1989)