Presented/published at the "CIDESA - Conferência Internacional - Desenvolvimento Sustentável e a Agroindústria", Lajeado, Rio Grande do Sul, Brazil, *5/17/2000.*

Science and Technology: a proposal to raise the generation of technical progress

Ricardo da Costa Nunes[1]

Selene Peres Peres Nunes[2]

"Knowledge and Power meet in one, for where the Cause is not known, the Effect cannot be demonstrated." Francis Bacon, apud in Fernandes (1992).

Resumo

A proposta deste trabalho é avaliar em que medida podem ser frutíferos os esforços para aumentar o gasto em ciência e tecnologia, realizando sugestões para a dinamização do processo de inovação tecnológica.

Abstract

The proposal of this work is to measure to what degree the efforts to increase the expenditures in science and technology can be advantageous, making suggestions to accelerate the process of technological innovation.

1. INTRODUCTION

The objective of this paper is to evaluate to what degree the strive to increase expenditures in science and technology can be beneficial and to make suggestions to accelerate the process of technological innovation in the country. This action is important since the resources for all public investments have been decreasing due to the

---

[1] from the National Treasury Secretariat/Ministry of Finance, working at the International Affairs Secretariat/Ministry of Planning, Budget and Management, and getting a PhD in economics from Universidade Nacional de Brasília-UNB.

[2] from the National Treasury Secretariat/Ministry of Finance, working at the Ministry of Planning, Budget and Management as Economic Adviser to the Minister, and getting a PhD in economics from Universidade Nacional de Brasília-UNB.

governmental preoccupation with obtaining a primary surplus to contain growing public indebtedness.

In view of this objective, this paper is divided into three chapters. In the first chapter, one discusses the belief, prevailing among policy-makers and in the academic ambient, that state intervention should not occur neither in the production nor in the generation of technology. This argument gains importance due to the necessity to cut governmental expenditures to balance the public accounts.

In the second chapter, one recognizes that although the generation of technology is desirable, its creation is very difficult because it mainly depends on the degree of economic development. Finally, in the third chapter, suggestions are presented for the increment of technological diffusion.

2. STATE INTERVENTION AND CREATION OF TECHNOLOGY

Various authors have highlighted the role of State action in the promotion of economic development, especially by people from CEPAL and structuralists. Moreira (1995) and Bresser Pereira (1997) present the success of the Southeast Asian countries as a very successful example of the joint action between government and private initiative. Moreira proposes an interventionist state concerned with market and product failures, and Bresser Pereira (1997,p.18) affirms: "Very successful economic systems are those that combine (...) State and market participation in the coordination of the economy. Some social-democratic countries, on one side, and Japan and the Eastern Asian countries, on the other side, are good examples of this."

For Nogueira Batista (1994), the liberal proposition for the end of the interventionist State is defended by developed countries, without them applying it. In the countries from the OCDE, the State undertakes an appreciable volume of research in the public laboratories and finances an important part of the enterprises' research effort, according to Nunes (1992). In a general manner, Germany, Belgium, France and Italy are the countries where the government interferes objecting to the generation of technology. In Germany, the government provides resources for activities where the private sector can not or does not want to involve itself.

In the USA and in England, the State action has a minor role, possibly because it is not necessary, since the large firms are the main technology generators. Although, even in these countries, the government targets the technologic development in the less competitive sectors. In the USA, the Congress interferes directly in the program of science and technology, ensuring resources and a preferential treatment for financing of the expenditures in R&D, as Rocha Neto (1992, p.68) remembers. In the Brazilian case, the technologic development also received governmental stimulus, during the 60's and 70's. In the 60's, the Program of Economic Action of the Government - PEAG even affirmed that "technological betterment is as or more important, for the process of development, as the proper increase in the rate of formation of capital"[3]. During the Costa e Silva Government, with the Strategic Program of Development - SPD, it was affirmed that: "it would be hard to find an example of some country in which rapid and self-sustained growth had not been supported by the internal process of technological development."[4]

In the beginning of the 80's, Tigre (1985) and Erber (1983), considered that technical knowledge is the product of innovation and that this is the result of R & D. They pointed out that State intervention is capable of putting any country in the position of an industrialized one. Nunes (1992) arrived at the same conclusion. The performance of Brazilian State weapon and computer industries have apparently proved these authors' proposition.

One should highlight, however, that this belief never achieved unanimity. Link (1977) carry out a study to verify if federal research was linked to industrial growth and innovation and concluded that there was no relationship between these variables. Also for Friedman (1984) and Coase(1960), State action is not capable of proportioning economic development: "(...)forget about the law: look at costs and benefits to see how economic life is conducted."

For some authors, however, the problem is that priority has been given to technology only in periods of economic growth, since crises enhance the redefinition of public expenditures. In this sense, an option that presented itself to the allocation of resources to science and technology, would be the economic openness, proposed by the World Bank (1997), or the external indebtedness, suggested by Oliveira (1993). This proposition was recognized by PEAG: "greater technological knowledge saves us a substantial outlay in

[3] See Ministry of Planning and General Coordination (1968).

research, (...). Capital supply represents an easier way for Brazil to have technological progress, a basic requisite of economic development"[5]. According to IMF (2000), Canada is active in trade liberalization initiatives, especially in agriculture, textiles, and clothing.

The advantage of this alternative would be the fact that the country can obtain primary innovations through the importation of technology, while the secondary innovations happen with the use of new technologies from other sectors. The acquisition of new techniques and of new products from modern industries as well as the installation of these industries in the developing countries would contribute to increasing local competition and to reducing consumer price levels.

This action would contribute to modernization of the industrial park of the country with absorption of foreign technologies, reinforcing the entrepreneurial capacity in diverse economic sectors and enlarging its competitiveness in the international market. With the liberalization of exterior trade and hence importation of lower priced products, the firms could enhance their efficiency by utilizing the available resources better.

Although the reduction of production costs of electronic and computation products in the countries from Southeastern Asia and Japan seems to explain their exportation performance, as pointed out by the IMF (1996), Nemoto et alli (1996) and the Nomura Research Institute (1996); for Guimarães (1993, p.20): "The economic openness corresponds to a rupture with the ideal of sustainable technology that oriented the scientific and technological policies formulated in the 60's and its version, limited and radical, in the 80's - the computation policy."

Thus, for some authors, foreign technology importation is not able to generate technological power to importing countries since the developed countries transfer to the developing ones only part of their technology, transferring the know how production but not the specific activities of innovation and R&D. Besides that, the foreign industries can come bringing own technology can go out taking their technology. This took place in many countries.

In general terms, there would be at least three important explanations for this dependency situation in the Third World. First, the subsidiaries of multinationals train

---

[4] See Ministry of Planning and General Coordination (1968).

technicians from their countries but do not utilize local labor, which would be cheaper and more intensive, for R&D activity. Second, technological importation can inhibit the local efforts in R&D, because the subsidiary multinationals impede links between local industries and research institutes, utilizing restrictive clauses in the licensing contracts of technology and limiting the process of "learning by doing". Third, many times the imported technology is not appropriate for local necessities. These conclusions support the Dependency School in stating that sustainable development is very difficult for poor countries.

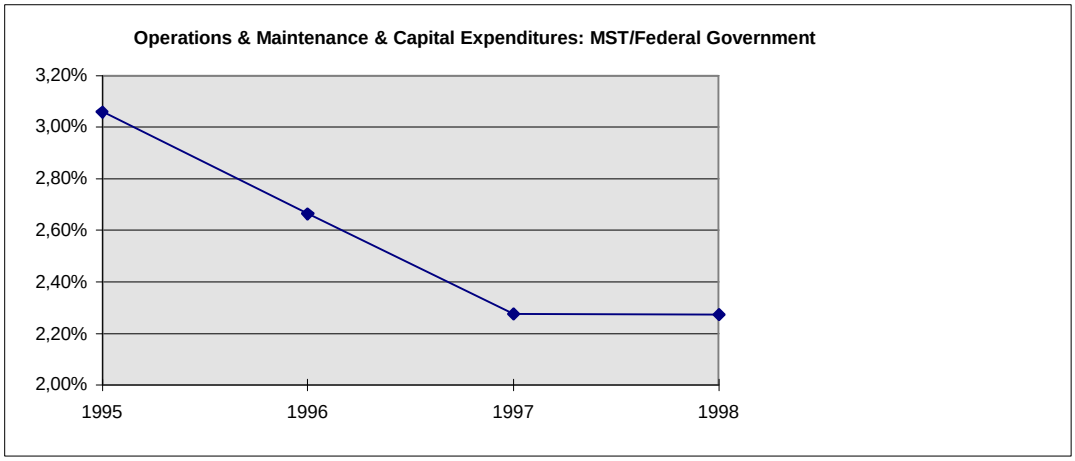
Despite the belief of some authors in the necessity of the State's investment in technology production, the various aspects of international competition (distributive equity, social cohesion, elevation of the educational level, infrastructure, among others) stopped being politically prioritized in the beginning of the 90's in favor of fiscal equilibrium and of the adequacy of industrial structure for neoliberalism. The governmental orientation of seeking technological development has lost emphasis since the III National Development Plan in 1980.

This preoccupation with fiscal adjustment of the federal government supported by the liberal theoretical framework has explained successive budgetary resource cuts in the Ministry of Science and Technology. This fact, pointed out by Oliveira (1993), can be observed in Graph 1. The cuts in science and technology became larger than in the social programs since they do not damage re-election politics, as exposed by Nunes (1992,p.w4): "the appeal of compensatory social programs has much more political impact than the investments in science and technology, typical of the long term and, therefore, with little weight in the political market".

---

[5] See Ministry of Planning and Economic Coordination (1965, p.143).

Graph 1



Source: SOF 1998.

3. OUTCOME OF THE EXPENDITURES IN SCIENCE AND TECHNOLOGY

It is a fact that Latin America and the Caribbean need to equip and structure their economies with advanced technological processes to have success in the new global environment. The technological and scientific productivity in this region, in terms of publication in specialized academic reviews, as well as in patents, is lower than other concurrent regions. While the USA spends from 2 to 3 per cent of the GDP in Research and Development, Brazil and other countries in development disburse less than 1%. The authors call attention to the fact that the public sector in many countries from the region is responsible for about 70% of the financing of R&D, in comparison to 25% in some countries of Southeast Asia, and less than the 50% in the countries from the OCDE.

However, Latin America has made advanced technological progress. In this process, the State performed a relevant role, although, in a general manner, society has not been recompensed by the investment in the sector. A first explanation comes from the fact of making efforts in areas that do not result in the growth of productivity and, secondly, because the link between enterprises and universities is little developed. In Brazil, the proper academic community -(the well-known judgment by peers) - supported in the elite conception of science, where society is not able to evaluate the work of scientists makes the judgment of the research processes in accordance with definite criterion. This ends up helping the emphasis in scientific questions in detriment to the technologies inside national public institutions that lean more towards the relationship of the scientist with the State. Different from what happens in Australia which privileges research about industrial

necessities and the economy in general, at the same time in which they introduce deep reforms in the academic system, such as, in the main public organisms of research to induce fulfillment of their work linked with industry, see Nunes (1992).

Without a doubt, the quest for sustainable technological growth is as desirable as it is difficult to achieve. Firstly, big enterprise, in larger number in developed economies, are the great technology producers, especially, some sectors from the more modern industries. Theses industries are capable of producing and consuming technological innovations in an enduring manner, reserving their share of the market. These sectors are composed of military, aerospace, computation, and biotechnology industries, among others. In these sectors, modern technology has been developed denominated by "primary innovation" that radically alters the conception of technical basis, creating transformations in the productive processes ("creative destruction"). When these productive alterations are passed to other process of the economy there is a "secondary innovation". These are due to "primary innovations" and also contribute to productivity increases and economic growth. The industry that consumes innovations produced by other branches of the economy (such as the textile industry that utilizes equipment from the chemistry industry) does not have the power to influence the path of technological process.

The capacity of the economies to generate technological innovations is deeply linked to their degree of development: the richer they are the larger their potential to generate technology. The seven big countries from the OCDE are responsible for more than 90% of the total investment in R&D. In fact, Research and Development is the variable with which there is stronger economic concentration, compared to, for example, GDP, exportation and direct foreign investment. This is because productivity of labor and capital is larger in developed countries, which engenders more resources for investment in R&D.

Being thus, the firms are principal technology generators, as one regard in the following Table 1. Conca (1998, p.499) calls attention to the existence of other obstacles for sustainable technological development: "The collapse of Brazil defense sector in the early 1990s illustrates that the largest barriers to Third World military industrialization are not financial or technological but rather institutional. Simultaneous domestic-political and global-market changes destabilized the institutional foundation of Brazilian military-industrial growth".

Table 1

Production of Technology

Country	Sector	1990	1991	1992	1993	1994	1995
Brazil	Government	-	-	-	74,9	74,3	68,3
	Enterprises	-	-	-	25,1	25,7	31,7
	Sup. Educ.	-	-	-	-	-	-
	N. O.	-	-	-	-	-	-
	Foreign	-	-	-	-	-	-
Canada	Government	36,5	35,9	34,5	33,5	-	31,6
	Enterprises	41,5	41,3	43,8	44,8	-	46,7
	Sup. Educ.	9,9	10,2	9,8	9,0	-	8,6
	N. O.	2,5	2,7	2,4	2,6	-	2,7
	Foreign	9,7	9,9	10,1	10,1	-	10,5
Chile	Government	72,6	73,5	71,1	75,5	61,9	61,1
	Enterprises	20,6	17,2	18,2	15,4	29,5	29,4
	Sup. Educ.	0,0	0,0	0,0	0,0	0,0	0,0
	N. O.	0,0	0,0	0,0	0,0	0,0	0,0
	Foreign	6,8	9,3	10,7	9,1	8,6	9,5
USA	Government	40,5	37,6	36,6	36,5	35,8	35,0
	Enterprises	55,1	57,8	58,6	58,6	59,1	60,1
	Sup. Educ.	2,9	3,0	3,1	3,1	3,2	3,1
	N. O.	1,5	1,6	1,7	1,7	1,8	1,8
	Foreign	-	-	-	-	-	-
Mexico	Government	-	-	-	73,4	63,6	66,2
	Enterprises	-	-	-	14,3	19,0	17,6
	Sup. Educ.	-	-	-	8,9	7,7	8,4
	N. O.	-	-	-	1,2	0,6	1,1
	Foreign	-	-	-	2,3	9,1	6,7
Portugal	Government	62,0	-	59,0	-	-	65,0
	Enterprises	27,0	-	20,0	-	-	19,0
	Sup. Educ.	1,0	-	1,0	-	-	1,0
	N. O.	6,0	-	5,0	-	-	3,0
	Foreign	5,0	-	15,0	-	-	12,0

Source:Castro, Wolff, & Alic (1999).
N.O= Nonprofit Organitazation

Therefore, as the big multinational enterprises are the principal sources of technology generation, one can not wait for State financing of technological research to deeply modify the Brazilian position. Principally, when one knows that the government does not have resources due to its agreement to execute fiscal adjustment.

4. SUGGESTIONS FOR GOVERNMENTAL ACTION

4.1 Stimulus for technological research in the agriculture sector

We suggest seeking the increase of diffusion of technical progress through the enlargement, or at least the conservation, of the budgetary resources in the Center of Excellency, in particular those destined for formation of technical progress in rural areas as

with EMBRAPA. Rich nations distinguish themselves more by production of industrialized goods than agricultural, because, although their productivity is larger in both sectors, the differential relative to the poorest countries is larger in the former, as pointed out by Smith (1985, p.24):"Consequently, the wheat of a richer country, of the same quality, does not always arrive at market with lower prices than a poorer country. (...) Although, a poor country, despite the inferiority in cultivating the land, can, up to a certain point, rival the rich countries on the low prices and the quality of wheat, can never face the competition confronting their industries". It is exactly, in the agricultural sector, that the country has been presented expressive technological progress and where there is more space for new technological advances. In addition is a sector that employs much, as pointed out by Kumar (1992,p.6): "primary sector (...) provides significant employment opportunities and generates substantial income, but at far lower productivity than other sectors". Besides that, the agriculture production can help industrial development. First, the agriculture firms generates industrial machinery and the agriculture works demand industrial goods. Second, the increase of agriculture technology reduces the good prices, contributing to fall of work wages (as pointed out by David Ricardo), what also contributes to industrial development.

Besides that, the agricultural investment could stop the work exit from the countryside in direction to largest cities. Those people go to the cities looking for jobs, but there are no works for all, the result is a social economic problem that request social transference for those workers. On the other hand, if there is agricultural investment in the countryside, one can avoid large governmental expenditure.

Employing the theoretical framework of David Ricardo who has as a result that development in society conduces an increase in the cost of food and hence in the salary and that the utilization of new technologies in agricultural production could compensate this action, in a way such that the employment of machinery in agricultural production could even result in a fall of production costs and consequently in the increase of real wages. Thus, having as a base David Ricardo's theory, the introduction of machinery can contain the increase in the cost of living. Recognizing that the salary level is an important component in the evolution of inflation, which is a large concern to emergent economies, and that inflation is influenced by food costs, the investments in agricultural production can

help in the stabilization of these economies. Besides this, the encouragement for technological production of the modern manufacturing sectors requires large assistance through governmental investment and protection against foreign competition to assimilate imported technology.

In the last 30 years in Brazil, a real agricultural revolution has occurred with the incorporation of new agricultural land and significant increases in productivity. In accordance with the Center for Agricultural Studies of the Getúlio Vargas Foundation -GVF, the productivity has grown 69% in the last 20 years and, in particular, soy has increased 107%, with the production per hectare changing from 11,2 thousand tons per hectare, in 1980, to 23.2 tons in 1997. Brazil could stop being a soy importer to become a big exporter and still cater to a relevant part of the internal demand for wheat. Besides this, techniques and strategies were developed for the rational exploration of the principal animal species of economic importance, determining that the country could achieve the position of the second largest cattle producer.

Part of this technological progress was explained by the action of EMBRAPA with public resources. The tasks developed by the firm resulted in the expansion of domestic agriculture and ranching production, which prompted the reduction of importation and exportation. Its participation in the mentioned changes can be regarded with expressive events:

a) developing of bacterium strains for the elimination of the utilization of nitrogenous manure in the cultivation of soy, representing an annual savings of US$ 1.5 billion;

b) increase of productivity of wheat by 72%, allowing a reduction in importation of US$ 900 million in 1980, and US$ 97 million in 1988;

c) employ a variety of technologies to incorporate the Cerrados, which makes it possible for the region to become responsible for 40% of the production of grains.

d) discovery of a bacteria that fixes the nitrogen on the sugarcane, which can represent a savings of US$ 155 million annually.

Such facts permit-us to put the enterprise's value, while it is a public patrimony, on the same level as other important State-owned firms, such as Petrobrás and Banco do Brazil.

However, in the mid 90's, EMBRAPA suffered budgetary cuts due to the governmental goal of lowering public expenditures. The Union does not receive resources with dividends from EMBRAPA, on other side, the country is benefited by the transference of technological progress from the firm.

In this manner, the carrying out of the projects mentioned were made with scarce financial resources, having the National Treasury as a principal financier. The enterprise's own revenue originates from the commercialization of agricultural products and from raising livestock, alienation of assets and from the execution of technical services, such as analyses made in laboratories, product test, training courses while working, advising and technical assessment, as well as requested research projects. However, the generation of resources has been small, as one can observe in the following table that represents the budgetary structure with average figures from the period 1986/91:

Table 2

EMBRAPA: BUDGETARY RESOURCES	
- Resources from the special of Federal Government.	81.10%
- Borrow	5.65%
- Own revenue	7.90%
- Agreements with National and Foreign Institutes	1.47%

Source: EMBRAPA/DOF. 1993.

The financial deterioration of EMBRAPA can be explained by the low prices charged to its clients that have low acquisitive power. The elevation of the tariffs could leave many producers without technical attendance from EMBRAPA and, in this case, important technological innovations would not take place in the countryside, damaging the rural productivity with consequences for Brazilian inflation. Thus, the tariff policy does not contribute to increase the level of EMBRAPA's revenue since the clients have low acquisitive power.

The clearest consequence of the rupture of the auto-financing mentioned is the narrowing of the possibility of increasing the agricultural and ranching production due to obsolescence of the infrastructure accumulated by EMBRAPA. This fact put in risk the proper future of the agricultural and ranching research due to a loss of genetic resources that can, though of the mating between relative species, proportion a more productive species, as well as the continuity of research due to the impossibility of the acquisition of

materials, obsolescence of machinery and of equipment and the flight of qualified workers.

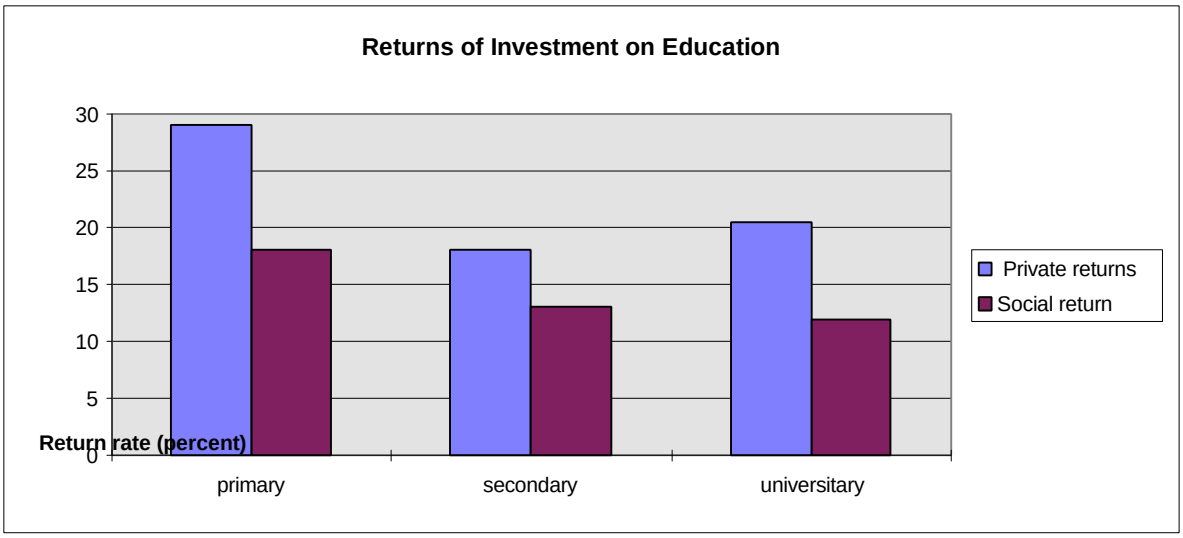
Concluding, in view of the above, one can not hope that the increase of expenditure in science and technology could propitiate an expressive gain of productivity in the economy. This is because, the new technologies are generated mainly in the administrative center of the greater multinational enterprises situated in the developed countries. Although, the country has EMBRAPA which is an internationally competitive enterprise in biotechnology. Thus, one can encourage technological research in agriculture, a sector in which the differential of productivity between rich and poor countries is minor**.**

4.2. Increase of expenditure with basic education

Investments in social areas can enhance work productivity, as pointed out by the World Bank (1994). Barro (1990) also affirms that expenditure with education makes labor more productive, accelerating the accumulative rate of human capital and, hence, economic growth. Thus, expressive efforts were made in England to improve teaching in professional, primary, and high schools. In this educational segment, according to Rocha Neto (1992, p.41), one finds Brazil's principal factor of technological delay. The explanation of this diagnostic is given by Fogaça, Salm & Eicheberg (1992, p.4) who affirm: "the laborer is responsible for the major impacts of technological alterations ". This is possible because those workers make suggestions in the productive process.

Also for Pscharopoulos (1993) one should prioritize the basic teaching that yields a large economic return for the society, as one can observe in the following graph. This position is strengthened by Castro, Wolff & Alic (1999, p.27) who affirm: "Among the elements of IDB's strategy for strengthening of the quality and relevance of pre-university (grades 1-12) which are particularly relevant to science and technology(...)".

Graph 2



Source: Psacharopoulos (1993).

5. CONCLUSION

Concluding, one can not hope for expressive growth of technology in Brazil since the country does not have modern industry that is capable of encouraging self-sustained growth in technology. Besides this, State intervention quit being politically prioritized in the beginning of the 90's in favor of economic neo-liberalism. This fact and the deficit in the fiscal situation of the country have implicated successive budgetary cuts that restricted the efforts of technological development. There is still the belief that the public investment in different areas does not result in an expressive increase of productivity.

In view of these facts, one suggests seeking the increase of the diffusion of the technical progress through the increase of budgetary resources of EMBRAPA and other excellent centers of R & D in the rural area. Those Institutes have been yielding series of primary and secondary technological innovations. The raising of resources for those Institutes could be a way of intensifying the relationship between the financed study with the purpose of generating new technologies since those Institutes have had success in the production of new technologies. While other research centers do not contribute to technological diffusion, thus, only a part of society's knowledge is incorporated in productive techniques.

One also points out the necessity of encouraging the production of small and medium sized enterprises; continuation of agrarian reform that is made with training and vocational assistance; and increasing budgetary resources for basic teaching. The education of the workers yields larger external economies than the formation of superior level specialists.

6. REFERENCES

ARAÚJO J.R. J. TAVARES (1984). *Mercados Contestáveis e Concorrência Schumpeteriana nas Economias de Industrialização Recente*. Rio de Janeiro.

BARRO, R. (1990). "Government Spending in a Simple Model of Endogenous Growth", *Journal of Political Economy*, 98: s103-s125.

BARRO, R. (1991). Economic growth in a cross section of countries*. Quarterly Journal of Economics*, 106.

BAUMOL, W. (1982) "*Contestable Markets: an Uprising in the Theory of Industry Structure"*. The American Economic Review",72:1-15.

CASTRO, C. M., WOLFF, L.& ALIC, J. (1999). *Science and Technology in Today's World*. Inter-American Development Bank.

COASE, R. H. (1960) "*The Problem of Social Cost"*. The Journal of Law and Economics, v.3, p.1-44.

CONCA, Ken (1998). "Between global markets and domestic politics: Brazil's military-industrial collapse". *Review of International Studies*, vol. 24, p. 499-513.

ERBER, F. S. (1983). "*A Intervenção do Estado e o Desenvolvimento Tecnológico - O Padrão dos Países Capitalistas Centrais"*. Texto para Discussão n. 31 do Instituto de Economia Industrial - IEI da UFRJ.

FERNANDES, A. M. (1992). *"Métodos de Acompanhamento e Avaliação Institucional e de Realimentação do Sistema de C&T no Brasil*". Ministério da Ciência e Tecnologia.

FOGAÇA A., SALM, C. & EICHEBERG, L., C(1992). " Universidade e Modernização". Ministério de Ciência e Tecnologia.

FRIEDMAN, M. (1984) *Capitalismo e Liberdade*. Abril Cultural.

GUIMARÃES E. A. (1992). "A Experiência Brasileira de Política Científica e Tecnológica e o Novo Padrão de Crescimento Industrial. Ministério da Ciência e Tecnologia.

HAYEK, F. A. (1950) *"The Meaning of Competition. Individualism and Economic Order"*, Routledge, London.

INTERNATIONAL MONETARY FUND. (1996) *Japão - Recent Economic Developments- Staff Report for the 1996 Article IV Consultation*, SM/96/171.

KUMAR, P.C. (1992). "Supply-side Tax Policies for Developing Countries: A Survey and Synthesis". Development Policy Review, v. 10, p. 5-13.

LINK, Albert N.(1977) "*On The Efficiency of Federal R&D Spending": A public Choice Approach*. *Public Choice,* 31: 129-134.

Ministério do Planejamento e Coordenação Econômica(1965), p.143.

Ministério do Planejamento e Coordenação Geral(1968), Vol.1, parte II, pp.IV-8.

MOREIRA, M. M. (1995) "*Em busca das ligações entre intervenção estatal e sucesso industrial"*. Texto para Discussão Nº 38. Banco Nacional de Desenvolvimento Econômico e Social - BNDES.

NELSON R. R. & WINTER S. (1982) "*The Schumpeterian Tradeoff Revisited".* The American Economic Review, v.72, p. 114-132.

NEMOTO, Nobuya, SASAKI, F., MORITA, K. & IKEDA, Y. (1996). *"The Japanese Economy"* . Quarterly Economic Review, May 1996, vol.26 No.2. Nomura Research Institute.

NOGUEIRA BATISTA, P. (1994). "*O Consenso de Washington: A visão neoliberal dos problemas latino-americanos"*. Caderno Dívida Externa n. 6. Publicação do Programa Educativo Dívida Externa - PEDEX. São Paulo- SP.

NOMURA RESEARCH INSTITUTE - NRI (1996). "*The Asian Economies".* Quarterly Economic Review, May 1996, vol.26 No.2. Nomura Research Institute.

NUNES, B. F. (1992). "Ciência e Tecnologia no Brasil - Sistema e Atores". Ministério de Ciência e Tecnologia.

OLIVEIRA, D. A. R. de (1993)."*A Crise Fiscal e o Financiamento à Ciência e Tecnologia no Brasil".* Ministério da Ciência e Tecnologia.

PASTORIZA, F. A. (1996) "*Privatização na Industria de Telecomunicações: antecedentes e lições para caso brasileiro"*. Texto para Discussão nº 43, BNDES.

PSACHAROPOULOS, George (1993). "Returns to Investment in Education: A Global Update" *Policy Research Working Paper nº 1067*. World Bank, Latin America and the Caribbean Region.

ROCHA NETO, Ivan (1992). Planejamento Estratégico de C & T. Ministério de Ciência e Tecnologia.

RODRIK, D. (1992) *"Political economy and development policy"*. European Economic Review, 36: 329-336.

SANTOS, E. dos & FREITAS A. G. de(1993). *"Centros de Excelência em P&D no Brasil: o caso do Centro de Pesquisa Leopoldo A. Miguez de Mello- CENPES"*. Ministério da Ciência e Tecnologia.

SCHUMPETER, J. A. (1977) *Teoría del desenvolvimento económico*, Ed. Fondo de Cultura Económica.

SCHUMPETER, J.(1950).*"Capitalismo,Socialismo e Democracia".* New York: Harper & Row.

SHEPHERD, W. G. (1984) "*Contestability" vs. Competition".* The American Economic Review, vol 74 no. 4 p. 572-587.

SMITH, Adam. (1985) *A Riqueza das Nações*. Ediouro.

TIGRE, P. B. (1985) *"Economia da informação: implicações para o Terceiro Mundo"*. Dados e Idéias. Outubro, (p.91-98).

TYLER, W. (1978) "*Technical efficiency and ownership characteristics of manufacturing firms in a developing country: a Brazilian case study"*. Weltwirstschaftliches Archives, 114.

VICKRES, J. (1995) "*Concepts Of Competition"*. Oxford Economic Papers 47: 1-23.

World Bank (1997). El estado en un mundo en transformación, Informe Anual, 1997. Washington, D.C.

FOGAÇA A., SALM, C. & EICHEBERG, L., C(1992). " Universidade e Modernização". Ministério de Ciência e Tecnologia.

SALM Cláudio & FOGAÇA A. (1992). "Modernização Tecnológica e a Questão dos Recursos Humanos" - *Revista Economia e Sociedade,* nº 1 - UNICAMP.

SALM Cláudio & FOGAÇA A. (1992). "A Nova Relação entre competitividade e Educação - Estratégias Empresariais" - IEDI, janeiro de 1992.

INTERNATIONAL MONETARY FUND (2000). Canada: Staff Report for the 2000. Article IV Consultation. IMF Staff Report nº 00/17.