The political economy of innovation; an institutional analysis of industrial policy and development in Brazil

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Abstract

This dissertation examines Brazilian industrial policies during the administrations of President Lula (2003-2010) and questions if innovation has truly been the main driver of those instruments. It provides a brief overview on the intersections of politics, economics, innovation and institutions as well as the main choices, incentives and alliances of the Brazilian government, which are illustrated by the Innovation Law, PITCE, PDP and campaign financing of President Lula's 2002 and 2006 candidacies. By adding to the analysis Brazil's exports, its balance of trade and the expenditures of BNDES, this research indicates a disconnect between the intentions and the results of the industrial policy. China and “low-tech” businesses seem to have become the real drivers of the government's agenda; the first for its importance to the Brazilian economy and the latter for its influence with government. Finally, while recognizing some positive results, it presents an alternative model based on a “high-tech” natural resources vision of development which could convert the current challenges into opportunities.

Keywords: Brazil, development, institutions, innovation, industrial policy

Contents

List of Abbreviations

ABDI – Brazilian Industrial Development Agency

ANPEI – National Association of Innovative Companies

BNDES – National Bank of Economic and Social Development

CCT – National Council of Science and Technology

CEPAL – United Nations Economic Commission for Latin America and the Caribbean

CGEE – Management and Strategic Studies Center

CNDI –National Industrial Development Council

CNPq – National Council of Scientific Development

CONSECTI - Council of Science & Technology Secretaries of State

EMBRAPA – Brazilian Enterprise for Agricultural Research

FIESP – São Paulo State Federation of Industries

FINEP – Financing Agency for Studies and Projects

IDS – Institute of Development Studies

IPEA – Institute of Applied Economics Research

MCT – Ministry of Science and Technology

MDIC – Ministry of Development, Industry and Foreign Trade

PACTI – Science, Technology and Innovation Action Plan

PDP – Productive Development Policy

PITCE – Industrial, Technological and Foreign Trade Policy

RFID – Radio-Frequency Identification

SPRU – Science Policy Research Unit, University of Sussex

TSE – Superior Electoral Court of Brazil

UNCTAD – United Nations Conference on Trade and Development

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Preface

The motivation for this dissertation comes from the author's background in economics and political science and in promoting partnerships in developing countries for a global and innovative corporation. The legacy of Douglass North, Christopher Freeman and Carlota Perez were of great influence in shaping this secondary research on Brazil's industrial policy, which was approached with an institutional angle to the debate on the political economy of development.

I am very grateful to my supervisor Dr. Lizbeth Navas-Alemán for challenging important paradigms and for all her dedication in this process; to Professors Jing Gu and Hubert Schmitz for sharing their research perspectives on China and innovation strategies; and to Professor Ben Martin of the Science Policy Research Unit (SPRU) for the spring course 'The Political Economy of Science Policy'. A final word of gratitude goes to my former supervisor at the University of Brasília Professor Paulo Calmon, who recommended me to this unique institution which is IDS.

Introduction

This dissertation attempts to identify the main drivers of the recent Brazilian industrial policy and contrast those findings with the challenges and opportunities to prepare Brazil for global competition and for development. As the starting point, chapter one presents a brief literature review on the intersections of political economy and science and technology while arguing about the relevance of institutions as incentives for innovation and development. Chapter two describes the structure of the Brazilian national innovation system and the main characteristics of the Innovation Law (10.973/04), the Industrial, Technological and Foreign Trade Policy (PITCE), the Productive Development Policy (PDP), as well as other key instruments and policies. It also indicates some of the "alliances" of the current administration by crossing President Lula's 2002 and 2006 campaign financing with private sector appointments - and the innovative nature of those companies - to the National Council of Economic and Social Development (CDES). Chapter three contrasts the "neoschumpeterian" (Dosi, 1982, Nelson and Winter, 1982) discourse of the industrial policy with its initial results and trends in terms of shaping a knowledge economy. In that context, the role of large natural resource exporters and that of China - now Brazil's number one trading partner (MDIC, 2010) - is analysed in regards to Brazil's exports, its balance of trade and the expenditures of the National Bank of Economic and Social Development (BNDES). Finally, chapter four identifies some positive results in recent years and presents an alternative model based on a "high-tech" natural resources vision of development, one which could convert the current drivers of the industrial policy from challenges into opportunities.

Chapter I

Innovation, institutions and development

The reason for this dissertation to research on political and economic aspects of the national innovation system of Brazil comes from the relations between technology, institutions and development. Rather than presenting a review of the remarkable theories of economic development all the way back to authors such as Adam Smith or David Ricardo and the ones who gave a closer look at technology and development such as Bernal (1939) or Schumpeter (1961), it seems to be more effective to draw upon a United Nations report on the subject:

> "The development of innovative capabilities lies at the heart of economic growth and development. While the precise interrelationship between technology and economic growth is open to debate, few, if any countries have succeeded in achieving and sustaining high growth levels without investing in and exploiting technology. The promotion of innovation is consequently becoming a policy priority in countries at all levels of development" (UNCTAD, 2005: 233).

What is now a growing literature on technology, innovation and development (Amsden (2001), Bell and Pavitt (1993), Chang and Cheema (2002), Cimoli and Dosi (1995), Dosi et al (1990), Mytelka (2007), Nelson (1982, 2004) and Reinert (2007), among others) may be interpreted as a positive sign of the increasing relevance of this area for economics, political science and development studies in general. Christopher Freeman, from the Science Policy Research Unit (SPRU) of the University of

Sussex, was one of the first to explore in depth these intersections. According to him:

“As three major new 'generic' technologies - information technology, biotechnology and new materials technologies - diffused through the world economy in the 1970's and 1980's, systemic aspects of innovation assumed greater and greater importance” (Freeman 1995: 11).

There are other perspectives which provide an even more relevant and structural role for knowledge as the key long term driver of development. Along UNCTAD's and Freeman's rationales, economics Nobel laureate Douglass North added an institutional angle to the challenge of understanding and shaping the political economy of development:

“The stock of knowledge individuals in a society possess is the deep underlying determinant of the performance of economies and societies and changes in that stock of knowledge is the key to the evolution of economies; we still have a very incomplete understanding of the complex institutional and technologically interdependent structure of political economies which is necessary to improving their performance” (North, 2005: 63).

The changing structure of global trade is also a good indicator of the relevance of innovation. The World Bank, in its recent publication “Knowledge and Innovation for Competitiveness in Brazil”, demonstrates that from 1985 to 2004 the share of primary products in global trade decreased from 23.2% to 14.7%, while high-technology products went from 11.6% to 22.4% (World Bank, 2008: 20). An interesting local angle to it: a survey in 2007 with 14,000 companies throughout Brazil showed that even though innovative firms in the country represent only 1.7% of total industries, these few hundred companies are responsible for nothing less than 26% of the Brazilian industrial gross domestic product (GDP). Moreover, they also pay salaries which are on average 23% greater than the competition (ANPEI, 2009).

Any observer who analyses the period after 1995 (the advent of the internet) would be easily overwhelmed with the incredible transformations which have taken place since then. These are “new-to-the-world” innovations; not only innovations in the technological sense but also in how business is done and on the role of developing countries. Who could imagine Land Rover and Jaguar being bought by Indian Tata? What about Chinese Lenovo acquiring IBM's computers division? Or even foresee Brazilian-Belgian Inbev taking over Budweiser (Anheuser-Busch) for U$52 billion (Accenture, 2008)?

Many of the paradigms that until recently dominated the debate of innovation and economic development are now subject to a new global order, with a considerable shift in power in international relations. Political economist Albert Hirschman, in one of his many contributions to the understanding of the challenge of development in Latin America, had described one of the old cycles:

> “New products would be invented, manufactured and perfected first in the most advanced industrial countries, whence they would be exported. Eventually, however, the technology for any given new product settled down and the new products became standardized, at which point the industry became footloose and could often be started in new industrializing countries with cheap labor. They were now entitled to industrialize, but were once again assigned to a somewhat lowly role, as they were supposed to follow at a respectful distance behind advanced countries” (Hirschman, 1961: 24)

Now, at least for some countries, things seem to have changed. Take global research & development (R&D). Expenditure of R&D grew rapidly over the 1990's and reached U$677 billion in 2002. In 2008, the figure was U$1.055 trillion. In that same year, Italy, Canada and the United Kingdom (all G7 members) invested altogether U$82.2 billion; China alone committed U$102.3 billion. Connecting the dots is not that difficult. The fact is that countries are more and more interconnected and unlike what used to happen in the past strategic innovation is also being sent to developing countries, specially the ones with large and growing markets such as China, India and Brazil. Increasing competition, rising

costs and scarcity of skills in developed countries are the main drivers of this process (OECD, 2009).

This is just one angle of the opportunity of development that a country like Brazil now has. What was once denounced by the Singer-Prebisch thesis (Prebisch, 1950) - with its implications for dependency given the nature of terms of trade - may now be fundamentally changed if innovation is positioned as the key driver of the transformation and “upgrade” of Brazil. The world itself has changed.

Celso Furtado, a Brazilian development economist who shared many of the perspectives of Hans Singer (Institute of Development Studies - IDS) and Raúl Prebisch (UN Economic Commission for Latin America and the Caribbean - CEPAL), indicated how Brazil, through its industrial development in basic iron and steel, petroleum and capital goods had “conquered decision centers” that previously were located abroad. According to him, the Brazilian economy had started a process of shedding its “peripheral” character and had a good chance of becoming a “center in its own right” (Furtado, 1959). As Freeman also noticed, “nations should not only acquire the achievements of more advanced countries but should increase them by their own efforts” (Freeman, 1995: 6).

Dependency and development (and now, more than ever, interdependency) are a result of the interaction of many factors such as population, resources of all kinds, location, political leadership and many others. However, it is hard to argue that without progressing from “problem-solving” to “problem framing” innovation - as utilized by Schmitz (2008) - a country can truly achieve global competitiveness and sustainable development for its people (Cardoso, 1972 and Seers, 1981: 17).

With all that in perspective one question arises. If Furtado and others saw that coming in the 1960's why does almost 50 years later Latin America still faces poverty, inequality, unemployment and several

other unacceptable social conditions? As with almost anything in political economy, there could be many answers. Although none of them could by itself respond to the whole question, this dissertation will argue that institutions (interpreted here as incentives) are the main hypothesis. According to Harvard political economist Robert Bates:

> "The heart of the problem lies in the political origins of economic development. If development is a public good - social conditions that an individual can enjoy for free - what, then, makes it in the private interests of those in power to implement public policies to secure them? What makes it in the political interests of the holders of power to adopt policies that promote development?" (Bates, 1988: 243).

That has always been and will continue to be the core of the problem of development. Max Weber, in one of his many works on the public and private boundaries, made a very clear distinction between the old, crypto-plutocratic economic elites, and the new, entrepreneur capitalists. When describing the economic and social changes in eighteenth century England, Weber emphasized:

> "... irrational and rational capitalism faced each other in conflict. That is, capitalism sustained by fiscal and colonial privileges and public monopolies against capitalism oriented to market opportunities" (Andreski, 1983: 156-157).

This is of fundamental importance. Weber did indeed have a strong position on separating the public from the private, but capitalism - the rational one - should not be interpreted as an enemy of society. On the contrary. Within reasonable rules of the game, who would argue against the simple rationale that a proper business environment stimulates entrepreneurship, which stimulates investment, which in turn generates jobs? This is also the type of capitalism that Joseph Schumpeter talks about. The one that implies innovation and the creative destruction cycles that come with it (Schumpeter, 1961). People who are simply willing to compete in the global economy.

The question being asked here is about institutions, or simply put, incentives. The mechanisms of productivity are by now pretty much understood. The growing literature on innovation and development is also progressively reaching the desks of policymakers. But the issue - especially in a country like Brazil, being 35 times the size of the United Kingdom (IBGE, 2010) - is one of dynamic incentives and incentives in a very diverse environment. As per North:

> “While the sources of productivity growth are well known, the process of economic growth is going to vary with every society, reflecting the diverse cultural heritages and the equally diverse geographic, physical and economic settings... different experiences of societies through time will produce different perceptions of the way the world works and therefore require different institutions to provide the same incentives” (North, 2005: 66, 165).

What Brazil now has is a special configuration of its opportunities, both in the internal and external fronts. Much is said about China and India - for good economic reasons - but it seems that if a more ambitious innovation agenda was put in place by business, government and academia, Brazil could take the emerging markets leadership in many areas and promote a new development cycle based at the same time on natural resources and on innovation. It is a matter of how much Brazil's policies and institutions will gear the country to that future. Economists Joseph Stiglitz and Giovanni Dosi echo Bates' considerations and suggest one way to go about it:

> “Those supposedly in charge of leading development strategies are the very groups which have huge vested interests in it and huge rents from the status quo. Hence the need to engineer systems of institutional compulsion lending momentum to imitation, productivity growth, production expansion and eventually innovation. In turn, this involves the political ability to directly or indirectly allocate developmental rents to the actors of the 'great transformation' (Polany, 1944) - and also withdraw them according to performance” (Stiglitz and Dosi, 2008: 9).

Some developing countries will have a greater capacity to steer their future than others. Given its growing market and growing middle class - which just surpassed 100 million people, out of 192 million (IBGE, 2010) - and the reasonable assumption that R&D tends to follow mass markets, it seems that Brazil has a promising chance ahead. By now, the general scenario starts to indicate that it would be to the best interest of local elites to make Brazil itself part of the elite. After all, the forecast is that in a few years it will become the world's fifth largest economy (The Economist, 2009).

Chapter II will now analyse what are the choices, incentives and alliances that Brazilian government is promoting, while Chapter III will map the main pressures being exerted on the industrial policy and how successful Brazilian government has been in shaping a knowledge economy.

Chapter II

Industrial policy in Brazil; choices, incentives and alliances

In the literature of modern political economy there is a divide between a view advocating strategic focus on the comparative advantages one country inherits from its past and another view arguing that the productive forces of a nation should actually be constructed. Whatever side of the debate one may be, it is hard to argue against the understanding that industrial policies played a fundamental role in the process of every experience of industrialization, from Germany to the United States - long before 1900's - all the way to Korea, Taiwan, China, India and also Brazil.

Given the variety of instruments used to shape these policies and how their incentives and disincentives influence each economy, inputs will often be translated into different outputs. Shaping institutions is the common denominator. According to Stiglitz and Dosi:

> "The notion of 'industrial policy' comprises trade policies, science and technology policies, public procurement, policies affecting foreign direct investments, intellectual property rights and the allocation of financial resources. Industrial policies, in this broad sense, come together with processes of 'institutional engineering', shaping the very nature of the economic actors and the boundaries between what is governed by market interactions and what is not" (Stiglitz and Dosi, 2008: 2).

Within this diverse "portfolio", there is a set of policies which is identified in the literature as the

“neoschumpeterian synthesis” (Dosi, 1982, Nelson and Winter, 1982). This perspective emphasizes the strategic role of innovation in economic development and positions knowledge as dependent on a favourable institutional environment for innovation. According to this vision - shared by many of the authors referenced here - the market does not necessarily always guarantee that there will be resource allocation in knowledge intensive areas. Thus, government should utilize a series of incentives to modify relative prices and make investments in knowledge intensive sectors more attractive. Furthermore, this approach recognizes the need to create a national innovation system, one in which public and private actors continuously interact and invest in innovation (Almeida, 2009: 13-14).

Carlota Perez, a Venezuelan honorary research fellow at the University of Sussex, has been studying for decades the social and economic impacts of technical change and the historically changing conditions for growth, development and competitiveness. Although it may seem that globalisation can be progressively reducing the policy space available for countries to manoeuvre, Perez brings a new perspective to this and to other debates of institutional economics. In her view:

“It may be considered that the Schumpeterian description of technological revolutions as processes of creative destruction is applicable not only to the economy but also to policies and institutions” (Perez, 2001: 117).

Choosing and implementing an industrial policy is no easy task for any government. As previously stated, the political and economic restrictions of the status-quo will always present challenges to any reformer and it will never be possible to please everyone. There is a dilemma which must be faced: what one wants to be - a country with a high-technological productive structure - and what one already is - in the case of Brazil a nation with a fairly diversified productive structure but with competitive advantages in agriculture and other commodities.

Moreover, the structural changes which policymakers usually aim for will almost always produce results in the long-term, whereas their mandates (at least in democracies like Brazil), are short-term. Let us now take a picture of the principal characteristics of the Brazilian experiment and its challenges.

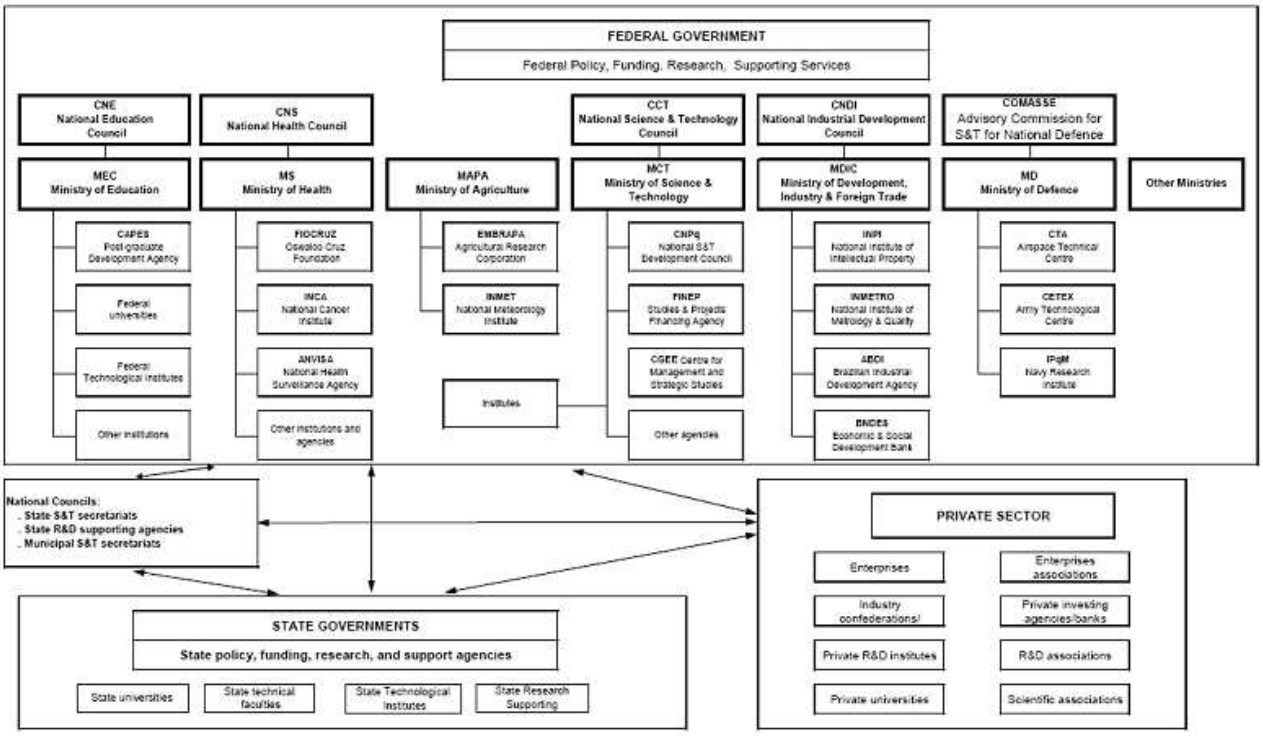
Choices and Incentives; the System and its Policies

The national innovation system of Brazil is a quite complex one and given the purposes of this research its description will be restricted to the main institutions which compose it and will focus on a governmental point of view.

On a general perspective, the outcomes of the system are usually a result of the interactions of the National Council of Science and Technology (CCT), an advisory body to the Presidency, which is entrusted with a policy coordination role, the Ministry of Science and Technology (MCT), which acts as an executive body with the assistance of FINEP (MCT's financial support agency), the National Council of Scientific Development (CNPq) and the Management and Strategic Studies Center (CGEE).

Additionally, industrial policy is formulated by the Ministry of Development, Industry and Foreign Trade (MDIC), mainly through its Innovation Secretariat, but also via the National Industrial Development Council (CNDI) and the Brazilian Industrial Development Agency (ABDI). Coordination among these agencies is promoted by representation of MCT and MDIC in both CCT and CNDI. Regional governments also interact through the Council of Science & Technology Secretaries of State (CONSECTI). Figure I summarizes the system and its interaction with other institutions as well as the private sector (Brito Cruz, 2006).

Figure I – National Innovation System of Brazil



Source: Ministry of Science and Technology, 2006

With that in mind, it is important to recognize that in recent years many improvements in the Brazilian innovation system have taken place. Since 2004 no less than 4 laws and 7 decrees have been enacted by the central government, whereas in the regional level 10 states of the federation already approved complementary innovation laws focusing on their local realities (MCT, 2010). Achievements were also promoted by FINEP, CNPq and other institutions. Nevertheless, for the purposes of this research some specific developments will be analysed: Innovation Law 10.973/04, Incentives Law 11.196/05, Decree 5.798/06, the Industrial, Technological and Foreign Trade Policy (PITCE), the Science, Technology and Innovation Action Plan (PACTI) and, finally, the Productive Development Policy (PDP).

Innovation Law

First drafted during President Cardoso's administration (1995-2002), the Innovation Law was sent to Congress and sanctioned by President Lula in 2004. The main improvements brought by this new legislation may be summarized as follows (Casa Civil, 2004):

- Stimulates the participation of science and technology institutions in the innovation process;
- Establishes of a legal environment for strategic partnerships between universities, institutes and private enterprises;
- Provides authorization for public institutions to support starting companies and the possibility of these sharing infra-structure, equipments and human resources for the technological development and the generation of innovative processes and products in private enterprises;
- Authorizes direct government budget allocation to companies with innovation projects; and
- Approves funding from the National Scientific and Technological Development Fund (FNDCT).

Incentives Law

On the following year, 2005, a new incentives legislation (“Lei do Bem”) was enacted to further improve the national innovation system. Its main provisions were (Casa Civil, 2005):

- Exemption from federal indirect taxes of sales of selected products and purchases of capital goods and inputs;
- Corporate income tax deductibility for R&D expenses and for payments of royalties for the use of trademarks/patents and technical/scientific assistance; and
- Accelerated depreciation and amortisation provisions.

Decree 5.798/06

Since 2006, when Decree 5.798 was published, purchases of many capital goods and intermediate inputs have been exempted from IPI (excise tax). These measures were later updated (Decree 6.909/09) as part of a broad package to ease the tax burden on businesses. Benefits included (MCT, 2010):

- An increase in deductibility from the corporate income tax of spending on R&D of up to 200%;
- Federal taxes on value added exemption on purchases of capital goods and intermediate inputs by exporters (defined as enterprises that export at least 80% of their output, including ICT);
- Federal taxes on value added exemption on retail sales of lower-cost personal computers;
- An allowance for remittances for the payment of technical/scientific assistance fees;
- Exemption from corporate income taxation of remittances for intellectual property rights; and
- Deductibility of corporate income tax for up to 50% of the salaries paid to scientists working in the private sector.

Industrial, Technological and Foreign Trade Policy (PITCE)

Announced in 2003 and published officially in 2004, the Industrial, Technological and Foreign Trade Policy (PITCE) was conceived with the following objectives:

"To increase economic efficiency and the development and diffusion of technologies with potential to improve international trade competitiveness. It is focused on the increase of efficiency of the productive structure, in the increase of innovation capacity of Brazilian firms and exports expansion. It is the base for a greater insertion of the country in international trade, stimulating the sectors in which Brazil has or should have greater competitive advantage" (Casa Civil, 2004: 2).

The main lines of action of PITCE were: innovation and technological development, exports, industrial modernization and institutional environment (as horizontal lines of action), software, semiconductors,

capital goods, pharmaceuticals and medicines (as strategic sectors) and biotechnology, nanotechnology and renewable energies (as technologies of the future) (Casa Civil, 2004).

The officials that drafted the industrial policy did actually position technology and innovation as drivers of national development (the neoschumpeterian synthesis), as it can be noted from the official act of the launching of PITCE:

"The new global scenario positions innovation as a key element of competitiveness. The use of new processes pressures companies to operate with low costs and high quality. The development of new products and uses creates the potential for new markets, which marks the growing importance of innovation capabilities. Increasing public and private resources in this field is strategic, specially in the case of R&D, education and the articulation of knowledge networks" (Casa Civil, 2004: 4).

In addition, in section 4.1 of PITCE, entitled "Innovation and Technological Development", government provided a description of some of the challenges for this area and presented its intentions:

"Brazil needs to structure a national innovation system which will enable the articulation of agents that promote innovation in the productive sector. This would involve companies, public and private research centers, technological development financing institutions, intellectual property bodies, technological management, knowledge management institutions, etc. In order to organise this system it is necessary to improve the legal framework, its institutions and define its priorities"(Casa Civil, 2004: 11).

Science, Technology and Innovation Action Plan (PACTI)

In 2007, the federal government launched the 2007-2010 Science, Technology and Innovation Action Plan (PACTI), which grouped the main ongoing initiatives within MCT and its agencies and better defined its participation in PITCE's execution. The principal objectives of PACTI were (MCT, 2009):

- Expand, integrate, modernize and consolidate the innovation system, acting in partnership with state governments to increase the national scientific and technological base;
- Accelerate the establishment of a favorable environment for innovation in the private sector, strengthening the Industrial, Technological and Foreign Trade Policy; and,
- Strengthen the innovation and research initiatives in strategic areas for national sovereignty, mainly energy, aerospace, public security, defence and the Amazon.

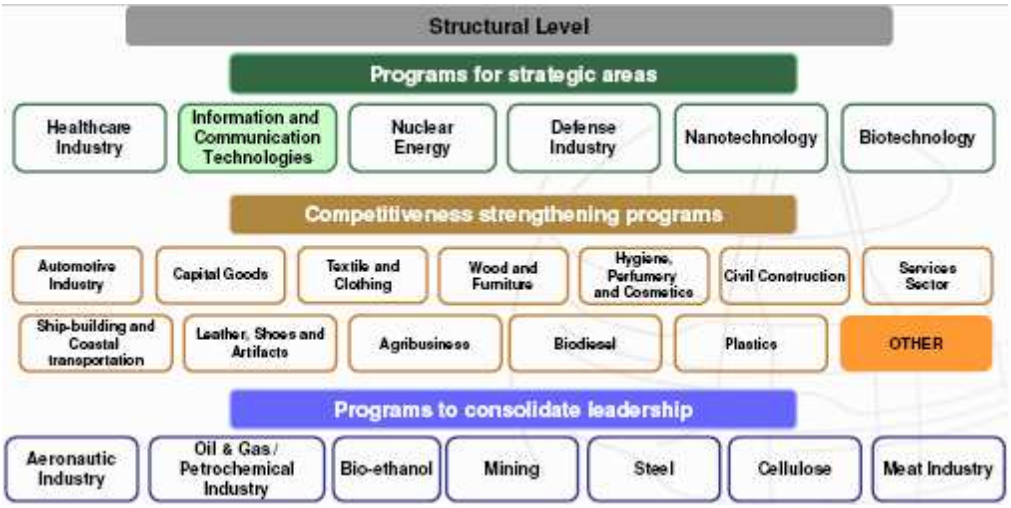
Productive Development Policy (PDP)

In May 2008, the Brazilian government announced the Productive Development Policy (PDP). Its main objective was to contribute to the sustainability of Brazil's growth in spite of the new global competitiveness scenario. The government announced PDP with a “continuity with evolution” approach - regarding PITCE - aiming to provide more execution power to the ongoing industrial policy.

It is interesting to notice the dimension of these policies. The broad spectrum of government actions proposed by PDP involved many different institutions. According to the São Paulo State Federation of Industries (FIESP), the main goals of the industrial policy in order to be achieved would include 386 instruments to be managed by 13 ministries, 3 public banks, 7 regulatory agencies and 8 national partnership institutions (FIESP 2009: 28).

Figure II provides an illustration of the scope and sectors being targeted by government, which in a structural level were divided in programs for strategic areas, programs to strengthen competitiveness and programs to consolidate Brazilian leadership (ABDI, 2009).

Figure II – Productive Development Policy (PDP)



Source: Brazilian Industrial Development Agency (ABDI), 2009

In regards to innovation itself, it was once again recognized as a national priority and along its two main objectives - supply capacity and exports - it defined the strategic axis of PDP. The innovation capacity of Brazilian firms was interpreted as a key challenge for growth sustainability. This condition was indispensable to adding value to goods and services, increasing competitiveness of firms in the domestic market and strengthening Brazil's role abroad (Casa Civil, 2008). That was the case in regards to both consolidating positions in sectors where Brazil already enjoyed competitive advantages or in areas where innovation capacity was seen as the determinant of competitive advantage. Its main goals for 2010 (considering 2007 as starting point) were:

- Increase investment-GDP ratio from 17.6% (U$257 billion) to 21% (U$354 billion);
- Increase global share of exports from 1.18% (U$161 billion) to 1.25% (U$209 billion); and
- Increase private R&D expenditure from 0.51% (U$7 billion) to 0.65% (U$10.3 billion).

(Casa Civil, 2008 – figures at 2008 exchange rates)

Although this is a brief description of the main innovation policies since the enactment of the Innovation Law in 2004, it summarizes the principal policy actions and choices of the federal government in Brazil. It is still relatively early to precisely evaluate its results, but the next two chapters will do an assessment based on the best available data.

Before that, let us take a look at a more dynamic aspect: the real world of political economy. What types of alliances has the Lula administration been promoting? What type of private sector advice may be shaping these Brazilian innovation policies? The Superior Electoral Court of Brazil (TSE) is the starting point.

Alliances – The Few Visible Hands

Professor Peter Evans, from Berkeley University, studied extensively the process of industrialisation of Brazil, South Korea and other countries and came up in 1995 with the concept of "embedded autonomy". In his understanding, alliances between the state and society are a fundamental characteristic of the new developmental state. According to him:

"The ability to effect transformation depends on state-society relations. Developmental states must be immersed in a dense network of ties that bind them to societal allies with transformational goals. Embedded autonomy, not just autonomy, gives the developmental states its efficacy" (Evans, 1995: 248).

This is the same point of view of this dissertation, which is in accordance with the previously mentioned “rational capitalists” of Max Weber or Schumpeter's “entrepreneurs”. Alliances are necessary. The real world of political economy demands it. But Evans is pretty clear: “allies with transformational goals” (Evans, 1995).

Let us take a look at just how “transformational” - or in this case how “innovative” - President Lula's administration allies are. A natural step seems to be crossing campaign financing and corporate representation on the strategic government councils which design industrial policies. Not that all relations and alliances can be pictured in this simple manner, but an observer will at least have a better idea of just how innovative are the companies which advise the President precisely on innovation.

A few hours of research at the Superior Electoral Tribunal (TSE) in Brasília already provides interesting results. Since President Lula's first term in office (2003), 31 members of the private sector were nominated as members of the National Council of Economic and Social Development (CDES) for a two year term. Out of these 31 executives, only 9 were not reappointed for an additional two year term or even in some cases for a third or forth term (TSE, 2010 and Menezes, 2010a).

Table I shows the names of these executives, the companies and sectors they represent and number of terms served in CDES. The columns in the middle indicate the amount each company financed during President Lula's 2002 and 2006 candidacies.

TABLE I – Campaign Financing and Nominations to CDES

CORPORATE PROFILE				CAMPAIGN FINANCING	
Name	**Company**	**Sector**	**Terms**	**2002**	**2006**
Abílio Diniz	Pão de Açúcar	Food	4 terms	R$ 100,000	R$ 450,000
Alain Belda	Alcoa	Aluminum	1 term		
Amarílio Proença de Macêdo	J Macedo	Food	4 terms		
Antoninho Trevisan	Trevisan	Consulting	4 terms		
Benjamin Steinbruch	CSN	Steel	3 terms		R$ 1,950,000
Daniel Feffer	Suzano	Paper	4 terms		R$ 390,000
Eugênio Emílio Staub	Gradiente	Electronics	4 terms		
Fernando R. Moreira Salles*	CBMM	Mining	3 terms	R$ 1,005,000	R$ 505,000
Ivo Rosset	Cia Marítima	Textile	4 terms		R$ 52,000
Gustavo Marin*	Citibank	Banking	3 terms		R$ 2,000
Jorge Gerdau Johannpeter	Gerdau	Steel	4 terms	R$ 500,000	R$ 3,100,000
José Carlos Bumlai	Investor	Biofuels	4 terms		
José Luis Cutrale	Sucocítrico Cutrale	Food	3 terms		R$ 4,000,000
Luiz Carlos Delben Leite	Fort Knox	Security	3 terms		
Maurílio Biagi Filho*	Maubisa	Ethanol	4 terms		R$ 2,000
Paulo Vellinho	Avipal	Food	4 terms		
Roberto Egydio Setubal	Banco Itaú	Banking	3 terms		R$ 3,500,000
Roger Agnelli	Vale	Mining	3 terms		
Sergio Haberfeld	Dixie Toga	Plastics	1 term		
Rogelio Golfarb	Ford	Automobiles	3 terms		
Alair Martins do Nascimento	Martins	Logistics	1 term		
Ivan Zurita**	Nestle	Food	1 term		
Luiza Helena Trajano	Magazine Luiza	Retail	2 terms		R$ 30,000
Mauricio Botelho	Embraer	Aeronautics	2 terms	R$ 500,000	R$ 1,300,000
Nelson José Côrtes da Silveira	DF Vasconcellos	Capital Goods	2 terms		
Sônia Regina Hess de Souza	Dudalina	Clothing	2 terms		
Murillo de Aragao	Arko Advice	Consulting	2 terms		
Adilson Primo	Siemens	Technology	1 term		
Antonio C. Valente da Silva	Telefónica	Telecom	1 term		
Luiz Eduardo Abreu	NSG	Financial	1 term		
Renato Conill	Sud Metal	Capital Goods	1 term		
Walter Torre	WT Engenharia	Construction	1 term		
				R$ 2,105,000	**R$ 15,281,000**
*includes personal donation				**10.00%**	**45.00%**
**donation of family member					

Sources: Tribunal Superior Eleitoral (TSE) 2010, Presidência da República, 2010 – Research and Table: Menezes, 2010a.

Note: R$1.75 = U$1 aprox., as per average July 2010 exchange rate - Cotação, 2010.

One of the things that this table tells us is that there is a striking difference between the two elections. What are the potential factors behind disparities in these two periods? Answering this question could imply another study of its own, but there are some indications which may be highlighted. One is that 2002 was Lula's fourth time running for President and he had never been successful. Another is that he is one of the founders of the Worker's Party (PT) as well as a union leader and had always been

identified as such - certainly not the usual best friend of business elites. A good reference to this rationale is the risk index utilized by global investors, which shot from a couple hundred points to 2,436 units just before the elections, signaling investors' concerns with the potential shift Lula could represent (Fitch, 2003). As a result, for 2002 he was able to fund raise a relatively small amount, R$ 21,072,475 (approximately U$ 12 million). Most importantly, in this case only 4 companies which ended up being nominated to CDES were among the ones donating. Their share was R$ 2,105,000 (or U$ 1,2 million) (Menezes, 2010a).

Take now the 2006 figures – year in which the total budget of the campaign added up to R$ 75.766.476,00 (U$ 43,3 million). Having kept most of the Cardoso government's investor-friendly policies and even nominating the former president of a global bank to head the Central Bank, the “Lula scare factor” completely faded away just a few months after he had being elected. In the 2006 campaign, 14 of the 31 members of CDES donated financial resources to Lula's committee; this means 45% of the corporate representation. In regards to absolute and relative figures, donations this time added up to R$15,635,000, or 21% in relative terms. Moreover, if you exclude the executives which served for just one term (9 of them) the absolute resulting figure is impressive for its almost static nature: R$15,281,000. Thus, not only being appointed and financing seem to have some relation but also financing and staying on board (TSE, 2010 and Menezes, 2010a).

What this table demonstrates is a reasonable correlation between financing campaigns and being appointed to the most prestigious council of the Republic. Also, what appears as a shy relationship in 2002 becomes a lot more robust when 2006 is added to the analysis.

Let us explore a little the angle of innovation itself by adding some new aspects to the facts: nominations to CDES and innovation awards. There are various sources which provide data from surveys and awards revealing the “highly innovative” companies in Brazil. To avoid any personal judgment from this author and considering the subjective concept of “innovative” itself, the criteria being used here is the convergence between different organisations, all of which have being monitoring innovation activity in Brazil for quite a long time.

It is the case of ANPEI (National Association of Innovative Companies), FINEP (Ministry of Science & Technology Innovation Agency), and two media groups Exame and Época. When these sources are crossed, what comes out is that in the best case scenario (companies evaluating themselves, ANPEI's case) out of the 31 members of CDES only 6 are considered to be innovative companies (ANPEI, 2010). If the perspective is that of government (FINEP, which grants a national innovation award since 1991) only 1 out of all those companies - Embraer - is considered to be a best practice in innovation and worthy to have received an innovation award at some point in the last 19 years (FINEP, 2010). If we take media perceptions into account (Exame and Época) the figure goes down to zero (Exame, 2008 and Época, 2008).

This analysis of the innovative nature of those companies shows that not only there is a correlation between financing campaigns and being appointed to CDES, but also that the ones which innovate have served on average less terms in this strategic policy council than the ones which do not.

The complex economic, political and institutional setting of Brazil does not make this topic an easy one to explore, but this academic exercise does seem to demonstrate that the administration of President Lula has been quite pragmatic in choosing its policy advisors. As Stiglitz and Dosi point out, effective

industrial policies should include both a “rent-curbing stick” and an “innovation-enhancing carrot” (Stiglitz and Dosi, 2008: 10). This picture of informal alliances is just a warning (based on what can be seen) on state-society relations and industrial policy in Brazil.

As Evans puts it, alliances are fundamental. The main question to be raised is based on what values and with what actors government should promote its partnerships. If these alliances may be indirectly driving policymakers away from their initial target of innovation promotion, it seems to be legitimate for society to question them. This overall assessment points out something simple: the “friends” being chosen by President Lula - and financing his campaigns - are clearly “low-tech” and traditional businesses. Some of the implications of this will now be explored in Chapter III.

As Professor Brunsson from the Stockholm School of Economics sees it, given the conflicting demands governments face there is usually a great distance between “talk, decision and action”, so the results of a policy may very well be quite different from what was initially intended (Brunsson, 2003).

Chapter III

High-tech or low-tech? The disconnect of Brazilian policy

The Office of the President in Brazil has under its Strategic Affairs Secretariat an institute that since 1967 provides technical and institutional advice to policymakers; it is the Institute of Applied Economics Research (IPEA). In 2009, this organisation released a report on President Lula's current industrial policy. One of it's first observations is that the Productive Development Policy (PDP), previously described here, was launched under very special circumstances. According to the report:

> "PDP was launched in a positive state of affairs, a moment in which Brazil was about to be upgraded to investment grade by international agencies. The country had been obtaining consistent trade surpluses, accumulating foreign currency, reducing public debt and income distribution. Brazil had completed 23 consecutive quarters of industrial production expansion, 15 quarters of increased consuming and 13 quarters of investment growth" (Almeida, 2009: 18).

That is indeed quite a positive scenario. Regardless of any judgement on whether it is better for a government to launch a new industrial policy under favourable or challenging conditions, what IPEA tried to signal with their study is that the overall positive Brazilian macroeconomic indicators may have induced government to stimulate traditional sectors - mainly commodities and low value goods - instead of increasing the innovation capacity of the economy. According to them, the former PITCE and now PDP policies would be promoting the reverse of the neoschumpeterian synthesis:

“The XXI century global trade pattern, pulled by the insertion of China as a unique food and commodities consumer favours and consolidates the current Brazilian productive structure, concentrated in exports of low technological intensity. The industrial policy, instead of balancing this demand-effect actually strengthens it by stimulating the concentration and internationalisation of Brazilian producers of commodities and low technology products” (Almeida, 2009: 25).

Trade figures help illustrate the potential impact that the “China commodities drive” may be exerting on Lula's policies. In 1994, Brazilian exports to China represented U$822 million (1.89% of total exports). In 2009, that number reached U$20.19 billion (or 13.2%). Imports went from U$463 million (1.4%) to U$15.91 billion (12.46%). It is a formidable growth - one which already positions China as Brazil's most important trading partner (surpassed the United States in 2009) (MDIC, 2010). That may be seen as good news, but as Baumann notices, in 2009 not less than 68% of Brazilian exports to China corresponded to iron ore, soya and oil - and an impressive 76.3% of all Brazil's soya had one single client: China. This means that exports became over time increasingly concentrated in a few merchandises (intensive in natural resources), with low technological content: 78% of total Brazilian exports to China are basic products. And it is the opposite with imports (Baumann, 2009: 6 and Menezes, 2010b).

Besides the China drive there is also the status-quo “drive” (or no drive for that matter). In an economy as diversified as Brazil's (and being it a large democracy), the legitimacy of an industrial policy sometimes depends on traditional sectors being included in pretty much any stimulus provided by the state. This intensifies the dilemma of industrial policies: the industry one desires (technology intensive) versus the industry one has (non technology intensive). Thus, the real industrial policy may end up having a greater chance of strengthening the current productive structure rather than steering key

sectors to a high-tech profile. It is precisely this demand for generalist policies which "may explain the changes from the first industrial policy of President Lula - adopted in 2004, with a greater neoschumpeterian focus - to a much broader second policy adopted in 2008" (Almeida, 2009: 16).

Let us look at some numbers. According to De Negri and Kubota (2009: 8), even though Brazilian participation in global exports went from 0.86% in 2000 to 1.25% in 2008, a great portion of this growth came from the favourable evolution of commodity prices. As per Table II, the participation of high technology intensity products in Brazil's exports are clearly going down and commodities are going up.

TABLE II – Brazilian Exports & Technological Intensity (2000-2008)

	Exported Products, According to Technological Intensity Classification					
Year	**Commodities**	**Labour & Natural Resources**	**Low Intensity**	**Medium Intensity**	**High Intensity**	**Other**
2000	**37%**	14%	8%	18%	**18%**	5%
2001	39%	13%	7%	18%	16%	7%
2002	39%	13%	8%	17%	15%	8%
2003	40%	13%	8%	19%	12%	8%
2004	39%	12%	10%	19%	12%	7%
2005	38%	11%	10%	20%	12%	9%
2006	39%	10%	8%	20%	12%	11%
2007	41%	9%	8%	18%	12%	11%
2008	**43%**	7%	9%	16%	**11%**	13%

Source: De Negri and Kubota, 2009: 8 - Table: translated by the author.

Moreover, despite the government's industrial policy efforts to stimulate sectors which are technology intensive, the most competitive industrial sectors of the Brazilian economy in 2008 - measured by trade balance - are almost the same of 1996. Years 2000 and 1996 are the only two minor exceptions (for textile, leather and shoes). According to the Ministry of Development, Industry and Foreign Trade:

TABLE III – Brazilian Balance Of Trade & Technological Intensity (1996-2008)

SECTORS	1996 Million US$	2000 Million US$	2004 Million US$	2008 Million US$
Industrial Products *	**(5,089)**	**(3,168)**	**25,511**	**(1,294)**
(I) HIGH TECHNOLOGY INDUSTRY	**(8,380)**	**(7,342)**	**(7,548)**	**(21,932)**
Aeronautics & Space	(61)	1,840	1,755	1,114
Pharmaceutical	(1,522)	(1,979)	(2,093)	(4,642)
Office Material & Informatics	(1,347)	(1,473)	(1,232)	(3,104)
Radio, TV and Communication Equipment	(3,728)	(4,168)	(3,968)	(9,786)
Optics and Precision Medical Instruments	(1,722)	(1,563)	(2,009)	(5,513)
(II) MEDIUM HIGH TECHNOLOGY INDUSTRY	**(9,727)**	**(8,695)**	**(2,447)**	**(29,169)**
Electrical Machinery and Equipment **	(1,219)	(1,814)	(1,239)	(2,339)
Automotive Vehicles and Towing Parts	(708)	972	5,695	2,203
Chemical Products, Besides Pharmaceutical	(4,005)	(4,858)	(6,824)	(20,109)
Railway Equipment & Transport Material	(120)	(136)	Zero	(767)
Machinery & Mechanical Equipment **	(3,674)	(2,858)	(78)	(8,156)
(III) MEDIUM LOW TECHNOLOGY INDUSTRY	**2,887**	**1,434**	**10,182**	**9,648**
Naval Construction & Repair	171	(6)	1,251	1,469
Rubber & Plastic Products	(327)	(342)	(176)	(1,144)
Refined Petroleum & Other Products	(1,901)	(2,749)	1	(2,707)
Other Non-Metallic Mineral Products	209	433	989	870
Metallic Products	4,735	4,098	8,118	11,160
(IV) LOW TECHNOLOGY INDUSTRY	**10,130**	**11,435**	**25,324**	**40,158**
Manufactured Products ** & Recycled Goods	86	470	1,029	468
Wood and Its Products, Paper & Cellulose	1,505	2,759	5,061	6,572
Food, Beverages & Tobacco	6,472	5,735	15,474	31,292
Textile, Leather & Shoes	2,067	2,471	3,759	1,825
Non-Industrial Products	**(510)**	**2,403**	**8,129**	**26,040**
TOTAL	**(5,599)**	**(765)**	**33,640**	**24,746**

Source: Ministry of Development, Industry and Foreign Trade, 2010 and Almeida, 2009 - Table: translated by the author.
Notes: (U$ 1 = R$1.75 aprox., as per average July 2010 exchange rate - Cotação, 2010),
* classification according to OECD's Directorate for Science, Technology and Industry (STAN Indicators).
** not specified in any other category / parenthesis indicate negative figures.

Only two sectors of groups I and II of Table III present surpluses: aeronautics and space industries (strongly influenced by Embraer) and the automotive vehicles industry, which, in the case of Brazil, is entirely property of foreign multinationals. This shows that the Brazilian competitiveness pattern did not change significantly in the last twelve years; the companies which export the most are not

concentrated in “high-tech” sectors (Weg and Embraer - and maybe software exports - being the only exceptions). It is in natural resources and commodities where surpluses are located and where Brazil's comparative advantage still lies.

A detailed assessment on what is likely the main engine of the Brazilian industrial policy must be made: the National Bank of Economic and Social Development (BNDES), a public bank which has an investment capacity greater than that of the World Bank. In the twelve months period from May 2009 to May 2010, BNDES had financed nothing less than U$86.12 billion (BNDES, 2010). Taking a picture of BNDES' actions is a good indicator of where things are likely heading.

According to IPEA, despite BNDES' numerous contributions to development in Brazil, given its huge impact on every sector if it decides to act or not to act, the bank is actually working to strengthen the current productive structure and not the technology intensive sectors.

Table IV shows that from 2002 to 2007 the proportion of direct loans of the bank to low and medium-low technology sectors went from 46.5% to 60% (U$6.4 billion or R$11.2 billion to U$8.7 billion or R$15.2 billion) (Almeida, 2009: 28).

TABLE IV – BNDES' Total Expenditure & Industrial Technological Intensity (2002-2007)

INDUSTRIES	2002		2007	
	Million R$	Percentage of Total	Million R$	Percentage of Total
HIGH TECHNOLOGY INDUSTRY	**7,988**	**33.1%**	**2,412**	**9.5%**
Radio, TV and Communication Equipment	230	1.0%	271	1.1%
Optics and Precision Medical Instruments	25	0.1%	67	0.3%
Pharmaceutical & Pharma-Chemical	161	0.7%	595	2.3%
Electronic & Informatics Components	251	1.0%	507	2.0%
Aeronautics & Space	7,321	30.3%	972	3.8%
MEDIUM HIGH TECHNOLOGY INDUSTRY	**4,939**	**20.4%**	**7,752**	**30.5%**
Chemical Products, Besides Pharmaceutical	1,235	5.1%	1,883	7.4%
Machinery & Mechanical Equipment	1,307	5.4%	1,716	6.8%
Electrical Machinery and Equipment	293	1.2%	837	3.3%
Automotive Vehicles and Towing Parts	2,054	8.5%	3,065	12.1%
Railway Equipment & Transport Material	49	0.2%	251	1.0%
MEDIUM LOW TECHNOLOGY INDUSTRY	**4,717**	**19.5%**	**7,481**	**29.5%**
LOW TECHNOLOGY INDUSTRY	**6,513**	**27.0%**	**7,750**	**30.5%**
TOTAL	**24,157**	**100.0%**	**25,395**	**100.0%**

Source: National Bank of Economic and Social Development (BNDES), 2010 and Almeida, 2009 - Table: elaborated by the author.

Note: (R$1.75 = U$1 aprox., as per average July 2010 exchange rate, Cotação 2010)

Other operations of BNDES also indicate a major support to low tech businesses. In 2008, eight of the ten largest direct investments of the bank were in low and medium-low technology industries, with a clear predominance of loans to promote the internationalisation of large commodities corporations (Almeida, 2009: 28). The loans provided in 2008 to Bertin, JBS-Friboi and Marfrig are good examples. Bertin, the single largest operation of BNDES in that year represented U$1.43 billion; JBS-Friboi U$629 million; Marfrig another U$400 million. Apart from these loans the bank also has a significant capital participation in all of them: Bertin 26.9%, JBS-Friboi 13.0% and Marfrig 14.7%. Furthermore, this trend is not only seen in the food sector. It has been very similar in mining and steel industries (with Gerdau and Vale do Rio Doce), beverages (Ambev), petroleum (Petrobras), paper and cellulose (merger of VCP and Aracruz) and others (Almeida, 2009: 28 and BNDES, 2010).

A look at the recent past - 2003 to 2007 - shows that this focus on large businesses has been going on for a while. In those five years, the participation of loans to large corporations represented 84.4% of total expenditures (with a 28% average annual growth). In the case of small companies, that figure was 6.8% (with an annual reduction of 3.4%). Moreover, is it not interesting to know that out of the 30 largest Brazilian multinationals 100% of them have government incentives from BNDES? Not to mention that 22 have direct capital participation from the bank; if we were to add the pension funds of public companies to that rational this number would easily reach hundreds (FIESP, 2009: 37)

This raises the question of sustainability for both the bank's loans and investments profile as well as the industrial policy itself. It seems there would be no problem if the bank could do everything; finance both the large and traditional businesses and also the small companies and entrepreneurs of Brazil. But is this even feasible? Is there no limit to BNDES' funds?

Numbers show there is. What is important to notice is that the most relevant source of resources for BNDES is the Workers' Assistance Fund (FAT) - constitutionally linked to the bank - which is now running a considerable deficit. FAT simply does not have any additional capacity to keep up with the rhythm of BNDES. And even if it did, just like the fund is constitutionally linked to the bank, the same constitution imposes a 40% limit on FAT's transfers to BNDES. Thus, the institution seems to have reached not only it's financial limits but also it's legal limits (Almeida, 2009: 55).

Professor Glauco Arbix, from the University of São Paulo's Innovation Observatory, recognizes that BNDES is certainly the main instrument of Brazil's industrial policy - and a reason for many countries to be envious - but raises an interesting concern (Presidência, 2009: 88):

“It is very good that a country may be able to run a development bank; it is not good if that bank starts to run the country”.

What the current scenario seems to indicate is that the macro pressures of China and the micro pressure of “low-tech” businesses (and the connections between the two factors) are gearing the Brazilian industrial policy away from its initial emphasis on the development of technology intensive sectors. What prevails is the exportation of primary commodities and low tech products, which together respond for almost 60% of Brazilian exports to the world. In the case of global trade it is precisely the other way around: medium and high tech products respond for 60% of what is traded among all nations (MDIC, 2010).

On aggregate, these figures present a warning. If it stays on this road, will Brazil ever be able to truly catch up - in the way Furtado saw it - and become a knowledge economy? As argued before, what is at stake is the extent to which an industrial policy can support the creation of “global champions” without giving up the creation of an innovation economy and promoting development. As IPEA - an institution linked to the Office of the President itself - sees it:

> “The behaviour of BNDES is not compatible with the definition of industrial policy itself. The creation of leading companies in the low and medium-low tech sectors increases the competitiveness of these organisations, consolidating the current economic structure of Brazil” (Almeida, 2009: 55).

This overview of the main characteristics of the Brazilian innovation system, PITCE, PDP and the role of BNDES will be complemented in the next and final chapter with some of the improvements in Brazil in recent years and also some of the barriers still to be faced. Most importantly, Chapter IV will present an alternative development model which could convert the real drivers of the industrial policy - China and “low-tech” businesses - from challenge into opportunity.

Chapter IV

Challenges and opportunities for development

Policymaking is a constant challenge. If it involves innovation and institutions then it is even a greater endeavour - particularly in democracies. In fact, as Prof. Carlota Perez sees it, opportunities for development are a “moving target” and successful strategies are the ones which anticipate those cycles (Perez, 2001). In the case of Brazil, one has to recognize some important improvements since the drafting of the Innovation Law.

According to a research done by ANPEI with innovative companies in Brazil, the new policies have established a better legal environment (which now allows greater cooperation between companies and public research centers), they have increased the scope and reach of fiscal incentives and have reduced the cost of capital to some entrepreneurs (ANPEI, 2009: 8). All that is good news.

Contrasting the last few decades - prior to PITCE and PDP - also demonstrates that Brazil is better prepared for some of the opportunities ahead. Between 1976 and 2006 the number of post-graduation courses in the country shot from 673 to 3,422 and in 2006 the annual outcome of masters and doctorates degrees reached 27,000 and 10,000, respectively (De Negri, 2007: 43). Moreover, from 1993 to 2004 the number of full-time researchers increased from 21,500 to 158,000 and Brazil's share of

global scientific publications went from 0.64% to 1.73%, with an impressive 3.08% participation in agricultural sciences (World Bank, 2008: 60). Nevertheless, whatever cycle innovation policymakers in Brasília may want to anticipate, education remains a critical challenge and a great opportunity for Brazil. According to the World Bank:

> "Universal primary education has nearly been achieved, and universal access to secondary education is imaginable on the horizon, so Brazil has a large and potentially productive population base with which to build an innovation economy. The problem is that the educational system has not yet oriented itself toward meeting the challenge. Improving educational quality and human capital is also Brazil's most significant opportunity" (World Bank, 2008: 53).

That is why timing is critical and the platforms in which to build Brazil's future must be aligned with the pressures it is now facing. As Prof. Hubert Schmitz from IDS points out, the globalisation of innovation is now presenting an unique opportunity to some countries:

> "A small number of developing countries have begun to make the difficult transition from being economically successful in industrial production to building up innovation capabilities. Even though the depth and width of this transition is not yet clear, it is giving rise to a fierce debate, not just amongst researchers but also policymakers and in the media. This debate is driven by concerns of whether the OECD countries can cling on to the innovation jobs which are the bedrock of their economic prosperity" (Schmitz, 2008: 7).

What this means is pretty simple. Some countries, mainly large developing markets, are now reaching levels of competitiveness in their education and innovation systems which are even greater than the ones found in traditionally "innovative" economies. China, India and South Korea are some examples (Booz & Co., 2009). The issue is that given the competitive pressures also within developing countries, these capabilities should be aligned with the comparative advantages of each nation.

As argued in previous chapters it is the “low-tech” drive of the current industrial policy which constrains the most the sustainability of President Lula's development model. Harvard philosopher Mangabeira Unger (and President Lula's Minister of Strategic Affairs), declared in 2008 that Brazil had no future “if it tried to be a China with less people” (Unger, 2008: 2).

That is why there are serious reasons for the tropical member of the now famous BRIC acronym (Brazil, Russia, India and China) to be concerned. Prof. Jenkins from the University of East Anglia warns that the Sino-Brazilian bilateral trade already resembles a center-periphery type of commerce:

> “the trade pattern between China and Brazil is as much a ‘North-South’ type as that with any other industrialized economy” (Jenkins, 2008: 8-9).

This means that Brazil may not only be missing opportunities to boost its innovation potential but also risking deteriorating its present capacity. According to IPEA, the reluctance of Lula's administration to recognize that they are still adopting 1960's and 1970's industrial policy practices contributes to its low performance; although the focus of the new industrial policies is said to be the promotion of innovation, “these modern policies still face the politics of choosing winners in sectors in which Brazil is already competitive” (Almeida, 2009: 7).

So what is the alternative? If PITCE, PACTI, PDP and other instruments being employed by the Brazilian government may be gearing the country towards the wrong direction, what could be done different then? What vision and model of development would present a way out? In the opinion of this author, just how education is both an opportunity and a challenge for Brazil, it is the macro pressures shaping the “China challenge” which should be the main ingredient for constructing a successful industrial policy. But the other way around: “decommoditisation”.

There are far more reasons for optimism than for pessimism. An interesting argument is made by Navas-Alemán et al: the “price scissors” which Singer and Prebisch pointed out in the 1950's may have been fundamentally changed. It is a new game. The contrast between steady price increases in manufactured goods and decreases in the price of raw materials is now subject to two new and critical factors: China, with its cheap labor and unprecedented demand, and information technologies, with incredible productivity gains for firms throughout the economy. This association lowers the price of manufactures and increases the price of energy and raw materials (Navas-Alemán et al, 2009: 6).

Multinational corporations have also changed. As IBM's chairman Palmisano describes it, they are becoming truly “globally integrated enterprises” and focusing more and more in “open innovation” (Foreign Affairs, 2008). Not because they suddenly became altruists. It is just that today's technology allows them to maximize their results by setting-up global innovation networks which extract the best of all its actors - what they do like no one else. Moreover, in some high value businesses even patents - an institution itself in science and technology - are bit by bit losing their importance. It is the aggregate global innovation capacity which provides global competitiveness.

The result of all these macro factors is that a new cycle and a new opportunity is open to Latin America in general and Brazil in particular. That is why this dissertation argues that today's industrial policies should revisit the classic Ricardian theories of comparative advantages. To Prof. Carlota Perez, the first advocate of a contemporary natural resources vision, this is how development in Latin America should be targeted:

“The traditional problem of mono-export of raw materials could be turned into a high-tech and high-growth future by taking intelligent advantage of the current and, most likely, also future favorable prices of these products in order to fund an effort in developing the technologies and the human capital related to those very products. The continent could become the supplier of material inputs, food and other agricultural goods (from the most standard to the most tailored and sophisticated) to the rest of the world” (Perez, 2008: 13).

The business of high volume, low price and low margin is open just for a few global players. The computer industry is good an example. Asia simply got there before; they anticipated a cycle. Even IBM sold its computers division to China. They are now chasing the higher value.

The point is that even if there was still room left it is not this path of low value and high volume (and competing with a country like China) which would make Brazil “conquer decision centers” and become a “center in its own right”, as Celso Furtado envisaged (Furtado, 1959). It is innovation:

“Mature manufactures which depend on ubiquitous, highly codified technologies are suffering from a process of 'commoditisation' and are as vulnerable to downturns as the lower echelons of natural resources, being just as likely to have decreasing margins. It is the rents from innovation that give the real profit advantage” (Navas-Alemán et al, 2009: 20).

This is not to say that the country should simply forget about industries and global champions. There is an immense number of industries which are connected to natural resources markets and this vision of development takes that into consideration. It is just a matter of what drives what and a more realistic alternative in which “high-tech natural resources” would be the engine of Brazil's growth. There is no development strategy which can afford a weak industrial base. In Perez's perspective:

> "The idea is to engage in a concentrated effort to master the processing industries, from large-scale aluminum, paper, refining, beer, petrochemicals or food, through medium-scale specialties (chemical, biotechnological, nanotechnological) to small-scale customized materials and special chemicals or other niche products. The goals would be to migrate gradually towards higher and higher value-added products with greater and greater specialized and customized features and to establish strong networks of innovation" (Perez, 2008: 14).

Other exogenous factors help make the case for future research on this alternative industrial policy. The economics of mass production is now subject to new conditions. Carbon taxes and associated regulations are hot topics for a reason: climate change is now a fact. Shipping low value goods to the other side of the planet will become more expensive. The rational of keeping processing industries close to the markets which demand those products is now changing. And volatility of commodity prices is not a great argument against this vision. Given the limits on resources in China and India and their current and future demands of commodities, the volatility seen in the past is likely to occur at higher levels. Moreover, the strategy defended here is about targeting high-value niche markets which are willing to pay a substantial premium for what they get (Navas-Alemán, 2009: 14, 21).

Nanotechnology and biotechnology will expand the current frontiers of natural resources in many new directions: "lighter or cleaner oil, better grapes for a certain type of wine, more beautiful woods, bigger eggs, sweeter oranges, more aromatic cocoa" or "tissue culture as means of plant reproduction, vaccines for cattle and fish, use of bacteria for mining" are just some examples. (Navas-Alemán, 2009: 13, 15). By truly positioning innovation and natural resources as the real focus of industrial policy, an almost infinite number of possibilities could be created.

Brazil is not starting from zero. On the contrary. A country which has the agricultural research capacity of EMBRAPA, a public institution with almost 10,000 employees and 2,113 researchers (74% of those with doctorate degrees) and which has generated since 1974 nothing less than 9,000 technologies for tropical agriculture is certainly in a competitive position to consider a natural resources development strategy (Embrapa, 2010). This is actually where some boldness might be good for Brazil. In the current state of affairs, rethinking the value of its comparative advantages seems to be a logical step. For a country with 851 million hectares, but only 244 million being used for crops or pasture (IBGE, 2010), there is plenty of room for incredible growth (without cutting one single tree).

Why not “run” all of Brazil's cattle on RFID (radio-frequency identification)? Why not acquire more knowledge abroad? Why not instead of exporting just coffee beans go there and simply buy Starbucks? Why not foster greater international public-private research cooperation? The biofuels success is just one of many examples of Brazil's potential in this high-tech natural resources paradigm.

The type of transition which is being suggested here implies building a national understanding of the opportunities and challenges ahead as well as the risks associated in constructing any knowledge economy. Based on natural resources or not. Good intentions are not enough. It is a hard and everlasting effort to shape institutions and master the creative destruction cycles of Schumpeter.

The four-year mandate makes it even harder. But democracy is a price which fortunately Brazil is not willing to negotiate. What should be under negotiation is the future. With so many opportunities, simply watching an industrial policy miss its target because of China (or a few visible hands) is far from reasonable. Consolidating today's economy instead of building tomorrow's would never make Brazil a center in its own right. That's the beauty of democracy. Governments can be replaced.

Conclusion

This dissertation attempted to identify the main drivers of the current Brazilian industrial policy and contrast those findings with the challenges and opportunities to prepare Brazil for global competition and for development. In that context, the preceding chapters presented a brief literature review on innovation, institutions and development as well as a picture of the main choices, incentives and alliances of President Lula's administration. Having designed in 2003 a policy aligned with what is known as the neoschumpeterian synthesis and which clearly positioned innovation as “the key element of competitiveness” (PITCE - Casa Civil, 2004: 4), this research indicated that notwithstanding initial results in that direction there are internal and external pressures which seem to be progressively disconnecting Brazilian government from its principal target.

Despite innovation policymakers' best efforts at the Ministry of Development, Industry and Foreign Trade, Brazil now has to face a new and growing challenge: China. The Asian partner has simply surpassed the United States and became Brazil's number one exports market, jumping from 1.89% participation in 1994 to 13.2% in 2009 (MDIC, 2010). That may be good news for large Brazilian exporters of commodities, but as some authors point out the trade pattern between China and Brazil has already become as much as a “North-South type” as with any other industrialized economy (Jenkins, 2008: 8-9). Unfortunately that trend does not only concern China. Figures help illustrate the overall “low-tech” prospect of Brazilian trade and the need to promote a review of the ongoing policies.

In a 2000 x 2008 comparison, Brazil's commodities exports to the world increased from 37% to 43% and that of “high tech” goods decreased from 18% to 11% (De Negri and Kubota, 2009: 8). Moreover,

despite many contributions to the country, what is considered to be the engine of the industrial policy - the National Bank of Economic and Social Development (BNDES) - seems to be drifting away and promoting the reverse of what the industrial policy envisaged: from 2002 to 2007 BNDES' loans to “high-tech” industries plummeted from 33.1% to 9.5%, while in 2008 80% of the largest loans of the bank went to low and medium-low tech industries (Almeida, 2009: 8). With expenditures greater than that of the World Bank - now having reached U$86.12 billion in 12 months (BNDES, 2010) - it seems that the “too big to fail” alarm should be going off in Brasília. As Professor Arbix from the University of São Paulo's Innovation Observatory sees it: “It is very good that a country may be able to run a development bank; it is not good if that bank starts to run the country” (Presidência, 2009: 88).

The association of the external pressure of China with the internal demands of large commodities businesses - the government's campaign financing engine - seem to indicate that instead of building a “high-tech” tomorrow President Lula is actually promoting the consolidation of a “low-tech” today.

The above factors represent some of the reasons why this dissertation proposed a vision led at the same time by natural resources and innovation. Brazil's unique natural resources competitiveness, the “commoditisation” of manufactures itself, the globalisation of innovation, climate change and the unprecedented demand of China (and India) are just some of the components of that rationale. That is why it is the very own macro pressures shaping the challenge of Brazil's development which should be the main ingredient to constructing a successful industrial policy, but the other way around: “decommoditisation”. Flexfuel vehicles is just one successful example (ethanol already generates 1.28 million jobs in Brazil) (CNI, 2010: 145). Being the only country in the world with more cows than people (IBGE, 2009), would it not be interesting to see all of Brazil's cattle “running” on RFID (radio-frequency identification)?

References

ABDI, 2009. *Productive Development Policy (PDP)*. Available at: http://www.abdi.com.br/q=system/files/ABDI_Reginaldo_Arcuri.pdf. Accessed: 04May10.

Accenture, 2008. *The rise of emerging markets multinationals*. Available at: https://microsite.accenture.com/mpw/Pages/landing.aspx. Accessed: 05May10.

Almeida, M., 2009. *Desafios da real política industrial brasileira do século XXI*. Texto Para Discussão No. 1452. Instituto de Pesquisa Econômica Aplicada (IPEA), Brasília.

Altenburg, T., Schmitz, H. and Stamm, A., 2008. *Breakthrough? China's and India's transition from production to innovation*, World Development No. 36.2: pp. 325-44.

Amsden, A., 2001. *The rise of the rent. Challenges to the West from late industrializing economies*. Oxford University Press, Oxford.

Andreski, S., 1983. *Max Weber: on capitalism, bureaucracy and religion. A selection of texts.* George Allen & Unwin, London.

ANPEI, 2009. *Os novos instrumentos de apoio à inovação: uma avaliação inicial.* Available at: http:// www.cgee.org.br/publicacoes/nov_instr_inov.php. Accessed: 29Apr10.

ANPEI, 2010. *Selo Anpei - Empresas Contempladas*. Available at: http://www.anpei.org.br/selo-anpei/empresas-contempladas/. Accessed: 02Apr10

Arbix, G., 2007. *Plano de mobilização brasileira pela inovação tecnológica (MOBIT).* Universidade de São Paulo (USP/IEA), Centro Brasileiro de Análise e Planejamento (CEBRAP) e Agência Brasileira de Desenvolvimento Industrial (ABDI). São Paulo.

Bates, R., 1988. *Towards a political economy of development.* University of California Press, Berkeley.

Bell, M. and Pavitt, K., 1993. *Technological accumulation and industrial growth: contrasts between developed and developing countries.* Industrial and Corporate Change No 2(2): pp. 157-210.

Bernal, J., 1939. *The social function of science*. Routledge, London.

BNDES, 2010. *Dados institucionais - BNDES*. Available at: http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Sala_de_Imprensa/Noticias/2010/financas/20100701_desempenho.html. Accessed: 11Jun10.

Booz & Co., 2009. *Beyond borders: the global innovation 1000*. Available at: http://www.booz.com/media/uploads/Innovation_1000-2009.pdf. Accessed: 16May10.

Brito Cruz, C. H. and Mello, L., 2006. *Boosting innovation performance in Brazil.* OECD Economics Department Working Papers, No. 532, OECD Publishing, Paris.

Brunsson, N., 2003. *The organization of hypocrisy: talk, decisions and actions in organizations.* Copenhagen Business School Press, Copenhagen.

Cardoso, F. H., 1972. *Dependent capitalist development in Latin America*. New Left Review 74, 83-95.

CASA CIVIL, 2004. *Lei 10.973/04*. Presidência da República, Brasilia. Available at: http://www.planalto.gov.br/ccivil_03/_Ato2004-2006/2004/Lei/L10.973.htm. Accessed: 07May10.

CASA CIVIL, 2004. *Política industrial, tecnológica e de comércio exterior (PITCE)*. Presidência da República, Brasilia.

CASA CIVIL, 2005. *Lei 11.196/05*. Presidência da República, Brasilia. Available at: http://www.planalto.gov.br/ccivil_03/_Ato2004-2006/2005/Lei/L11196.htm. Accessed: 07May10.

CASA CIVIL, 2008. *Política de desenvolvimento produtivo (PDP)*. Presidência da República, Brasilia.

Cassiolato, J., Lastres, H. and Maciel, L. (eds.), 2003. *Systems of innovation and development; evidence from Brazil*. Cheltenham: Elgar.

Chang, H. and Cheema, A., 2002. *Conditions for successful technology policy in developing countries*. Economics of Innovation and New Technology, No. 11, pp. 369-398.

Cimoli, M. and Dosi, G., 1995. *Technological paradigms, patterns of learning and development: an introductory roadmap.* Journal of Evolutionary Economics, Springer, *Vol. 5 (3), pp. 243-68.*

CNI, 2010. *Uma agenda para crescer mais e melhor*. Confederação Nacional da Indústria, Brasília.

Cotação, 2010. *Média cotação cambial; libra esterlina e dólar americano*. Available at: www.cotacao.com.br. Accessed: 01Aug10.

De Negri, F. and Kubota, L., 2009. *A Política de Desenvolvimento Produtivo*. Instituto de Pesquisa Econômica Aplicada (IPEA), Brasília.

De Negri, J. and Salerno, M. (eds) 2007. *Inovações, padrões tecnológicos e desempenho das firmas industriais brasileiras*. Instituto de Pesquisa Econômica Aplicada (IPEA), Brasília.

Doctor, M., 2009. *Furthering industrial development in Brazil: globalisation and the national innovation system*. Latin American Studies Association, Rio de Janeiro.

Dosi, G., 1982. *Technical paradigms and technological trajectories*. Research Policy No.2, pp. 147-62.

Dosi, G. et al, 1990. *The economics of technical change and international trade*. Wheatsheaf, Brighton.

Embrapa, 2010. *About us*. Available at: http://www.embrapa.br/english/embrapa/about-us. Accessed: 10Jun10.

Evans, P., 1995. *Embedded autonomy: states and industrial transformation*. Princeton: Princeton University Press.

Evans, P., 1979. *The alliance of multinational, state and local capital in Brazil*. Princeton University Press, New Jersey.

Exame, 2008. *O Brasil que Inova*. Available at: http://portalexame.abril.com.br/revista/exame/edicoes/0911/gestaoepessoas/m0150952.html. Accessed: 23Mar10.

FIESP, 2009. *Avaliação da política de desenvolvimento produtivo (PDP)*. Cadernos de Política Industrial, N.01. Available at: www.fiesp.com.br/competitividade/downloads/pdp_decomtec.pdf. Accessed: 13Jun10.

FINEP, 2010. *Prêmio FINEP de Inovação*. Available at: http://www2.finep.gov.br/premio/index.php?pg=historico. Accessed: 19Mar10.

Fitch, 2003. *Investment ratings, Brazil*. Available at: http://www.fitchratings.com/jsp/general/login/LoginController.faces. Accessed: 13May10.

Foreign Affairs, 2006. *The globally integrated enterprise*. Samuel Palmisano, IBM. May Edition.

Freeman, C., 1995. *The national system of innovation in historical perspective*. Cambridge Journal of Economics, No. 19, pp. 5-24.

Furtado, C., 1959. *Formação econômica do Brasil.* Fundo de Cultura, Rio de Janeiro.

Hirschman, A., 1958. *The strategy of economic development.* Yale University Press, New Haven.

Hirschman, A., 1961. *Latin American issues*. The Twentieth Century Fund, New York.

Humphrey, J. and Schmitz, H., 1996. *The triple c approach to local industrial policy*. World Development, No 24 (12), pp. 1859-77.

IBGE, 2010. *Brasil em síntese*. Available at: http://www.ibge.gov.br/brasil_em_sintese/default.htm. Accessed: 14Jun10.

IBGE, 2009. *Pesquisas agropecuárias*. Available at: http://www.ibge.gov.br/home/estatistica/economia/ppm/2007/default.shtm. Accessed: 16Jul10.

Kaplinsky, R., 2000. *Spreading the gains from globalisation: what can be learned from value chain analysis*. IDS Working Paper, V. 110, May.

Lundvall, B. (ed.), 1992. *National systems of innovation - towards a theory of innovation and interactive learning*. Pinter Publishers, London.

Martin, B. and Nightingale, P., 2000. *The political economy of science, technology and innovation*. Edward Elgar - University Press, Cambridge.

MCT, 2006. *Sistema nacional de ciência e tecnologia*. Available at: www.mct.gov.br/index.php/content/view/7969.html. Accessed: 02Jun10.

MCT, 2009. *Investimentos nacionais em pesquisa e desenvolvimento (P&D) de países selecionados, em relação ao produto interno bruto, per capita e por pesquisador.* Available at: www.mct.gov.br/index.php/content/view/7969.html. Accessed: 07Jul10.

MCT, 2010. *Legislação, Inovação Tecnológica*. Available at: http://www.portalinovacao.mct.gov.br/pi/#/pi/conteudo$MTEw. Accessed: 28Jul10.

MDIC, 2010. *Foreign trade statistics, Brazil - China*. Available at: http://www.desenvolvimento.gov.br/sitio/interna/interna.php?area=5&menu=576. Accessed: 07Jun10.

Menezes, J., 2010a. *How "influential" are the innovative companies in Brazil? An analysis of campaign financing and corporate representation in strategic government councils and fora*. Paper on Science, Knowledge and the Politics of Development. Institute of Development Studies, Brighton, UK.

Menezes, J., 2010b. *How has the economic rise of China affected the economy of Brazil?* Paper on Competing in The Global Economy. Institute of Development Studies, Brighton, UK.

Mytelka, L. (ed.), 2007. *Innovation and economic development.* Edward Elgar, Cheltenham, UK.

Navas-Alemán, L., Perez, C. and Marin, A., 2009. *The possible dynamic role of natural resource-based networks in Latin American development strategies*. CEPAL-SEGIB Project.

Nelson, R. and Winter, S., 1982. *An evolutionary theory of economic change*. Harvard University Press, Cambridge, MA.

Nelson, R., 2004. *The challenge of building an effective innovation system for catch-up*. Oxford Development Studies, Taylor and Francis Journals, Vol. 32 (3), pp. 365-374.

North, D., 1990. *Institutions, institutional change and economic performance*. Cambridge University Press, Cambridge.

North, D., 2005. *Understanding the process of economic change*. Princeton University Press, Princeton.

Nurkse, R., 1953. *Problems of capital formation in underdeveloped countries.* Basil Blackwell, Oxford.

OECD, 2009. *Main science and technology indicators*. Available at: http://www.oecdbookshop.org/oecd/display.asp?sf1=identifiers&st1=5KSGJZP22HZP. Accessed: 12May10.

Pacheco, C. A., 2003. *As reformas da política nacional de ciência, tecnologia e inovação no Brasil (1999-2002)*. Campinas.

Perez, C., 2008. *A vision for Latin America: a resource-based strategy for technological dynamism and social inclusion*. Globelics Working Paper WPG 0804. Available at: http://dcsh.xoc.uam.mx/eii/globelicswp/wp0804-en.pdf. Accessed: 26Jun10.

Perez, C., 2001. *Technological change and opportunities for development as a moving target*. CEPAL Review, No. 75, pp. 109-130.

Perez, C., 1983. *Structural change and the assimilation of new technologies in the economic and social system*. Futures, Vol. 15, No. 4, pp. 357-75.

Polany, K., 1944. *The great transformation: the political and economic origins of our time*. Beacon Press, Boston.

Prebisch, R., 1950. *The economic development of Latin America and its principal problems*. United Nations, ECLAC, New York.

Presidência, 2009. *Instituições & inovação: uma agenda para o desenvolvimento*. Secretaria de Assuntos Estratégicos, Brasília.

Presidência, 2010. *Composição do Conselho de Desenvolvimento Econômico e Social*. Available at: http://www.cdes.gov.br/exec/conselho/exibe_membros.php. Accessed: 02Jun10.

Reinert, E., 2007. *How rich countries got rich and why poor countries stay poor*. Constable, London.

Rodrik, D., 2007. *One economics, many recipes: globalization, institutions and economic growth*. Princeton University Press, Princeton.

Rosemberg, N., 1974. *Science, invention and economic growth*. Economic Journal, No. 86, pp. 90-108.

Schmitz, H. and Strambach, S., 2008. *The organisational decomposition of the innovation process: what does it mean for the global distribution of innovation activities?* IDS Working Paper No. 304, UK.

Schumpeter, J., 1961. *A teoria do desenvolvimento econômico*. Celta Editora, Lisboa.

Seers, D., 1981. *Dependency theory; a critical reassessment.* Frances Pinter, London.

Serra, J., 1973. *Latin America: from dependence to revolution.* John Wiley, New York.

Singer, H., 1950. *The distribution of gains between investing and borrowing countries*. American Economic Review, No. 44, pp. 473-85.

Singer, H., 1975. *The strategy of international development: essays in the economics of backwardness*. Macmillan.

Stiglitz, J. and Dosi, G., 2008. *The political economy of capabilities accumulation: the past and future of policies for industrial development*. Oxford University Press, New York.

The Economist, 2009. *Brazil Takes Off*. November 14th edition. Available at www.economist.com.

Tribunal Superior Eleitoral, 2010. Estatísticas - Eleições 2002 e 2006. Available at: http://www.tse.gov.br/internet/eleicoes/index.htm#. Accessed: 22May10.

UNCTAD, 2005. *World Investment Report 2005: transnational corporations and the internationalisation of R&D*. Geneva and New York: United Nations.

Unger, R. M., 2008. *Ensaio sobre a reforma*. Presidência da República, Brasília.

World Bank, 2008. *Knowledge and innovation for competitiveness in Brazil*. WBI, Washington D.C.

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