

GLOBELICS WORKING PAPER SERIES

THE GLOBAL NETWORK FOR ECONOMICS OF LEARNING,
INNOVATION, AND COMPETENCE BUILDING SYSTEM

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and policies: Chris Freeman's legacy

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Working Paper

No. 2017-02

ISBN: 978-87-92923-22-6





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Rio de Janeiro, 8 March 2017

Abstract

Revisiting Chris Freeman's main legacies, this paper highlights those considered as fundamental for the comprehension of the present challenges and opportunities posed to development. It attempts to recuperate some of his seminal contributions, focusing on: the importance of a broad and contextualized understanding of development, innovation, and national systems of innovation; changes of techno-economic paradigm and the role of government policies; financialization, sustainability, and crises; usual biases in innovation research and policy agendas; the need to contextualize analytical and policy frameworks; and the threats of alienation of economic theory. Arguing a substantial enlargement and refinement of both research and policy agendas was achieved; the paper stresses the importance of fostering and consolidation of national, regional, and international research cooperation on these issues. The conclusion addresses the possibilities to improve innovation research and policy agendas, accentuating the role of lecturers, researchers, and policy-makers, particularly those participants of the regional and national networks and related research activities on learning, innovation, and competence building systems.

Key-words

Innovation; national systems of innovation; development and innovation policy; social and environmental sustainability; local innovation and production systems; Chris Freeman; Latin American Structuralist Approach; RedeSist; Brazil.

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I – Introduction²

This paper is based on the Freeman Lecture presented during the 2016 Globelics Conference held in Bandung, Indonesia on the 13th of October. I was pleased and honored to be invited to talk about Chris Freeman's contributions, during one of the meetings of a research network, which its existence I place among his main legacies, precisely, the one that took place in Bandung, 61 years after the famous Asian–African Conference, the historical gathering of Asian and African State leaders aiming at promoting freedom, cooperation, and development, based on human rights, sovereignty, territorial integrity, and equality of races and of nations.

One of the chief stimuli for my preparation of the invited presentation was to consider what sort of research agenda Chris would present in Bandung in the second half of the 2010s. I decided to focus on a set of his main legacies instrumental for the understanding of the present challenges and opportunities posed to development, especially those relating to the changes in the present socio-techno paradigm, the increase of financialization, crises and the pressures of sustainability. Initially, I would draw attention to three major groups of legacies. The first refers to Chris Freeman's influential contributions to the advancement of knowledge about development, innovation, innovation systems, local innovation and production systems (LIPSs), learning innovation and competence building systems (LICSs), and associated policy implications. The second group relates to the substantial enlargement and refinement of both research and policy agendas and the third to the vital fostering and consolidation of national, regional, and international research cooperation on these issues, such as RedeSist, Globelics other regional and national LICS networks and activities.

This paper attempts to organize and discuss some of these legacies in the following manner. Section II addresses Chris Freeman's contributions for the comprehension of development and innovation focusing on nine selected topics:

- innovation and the role of geography and history;
- development trajectories: differences, concentration and exclusions;
- acquisition of technology and the need to foster domestic capacities;

² I thank José Eduardo Cassiolato for his precious comments to a first version of this paper and also Ben Lundvall, Björn Johnson and Gert Villumsen - editors of the Globelics WP Series - for their suggestions to condense the original version of the paper, which is available in redesist.www.ie.ufrj.br.

- national systems of innovation: characteristics, narrow and broad approaches;
- technological changes and the role of government policies;
- financialization, sustainability and crises;
- the pressures for a sustainable development and the usual bias in innovation research and policy agendas;
- the need to contextualize analytical and policy frameworks;
- the threat of alienation of economic theory.

The concluding section III recuperates some of Professor Freeman's major lessons, especially regarding the possibilities to improve the innovation research and policy agendas. It also aims at depicting the role of lecturers, researchers, and policy-makers of RedeSist³ - as well as Globelics, other regional and national LICs networks and their related research activities, conferences, and academies - in diffusing, using, and refining his main contributions.

II - The advancement of knowledge about development and innovation

It is worth stressing that the progress in the understanding of innovation in the 1980s and 1990s indicated the need to develop analytical instruments and broader and more complex policy guidelines than those offered by traditional economic theory. Such advance brought about new lines of reasoning, which steered a review of the conventional design and forms of support of private and public policies fostering science, technology, and innovation (ST&I). In accordance with the assumption of different schools of thought, particularly in line with Schumpeter and his followers, Chris Freeman considered innovation and technology as the motor of development. However, his was a much broader, advanced, and humanistic vision of development than usual.

The intention of this section is to examine some of Freeman's - and his closest partners, mainly Carlota Perez - essential contributions to the understanding of development. In the recuperation and discussion of his contributions, it is also highlighted the significant

³ The Research Network for Local Innovation and Production Systems (LIPSS) was created in 1997 in Brazil and has since then developed investigations articulating researchers all over the country and also in Latin America, BRICS and other parts of the world. See www.redesist.ie.ufrj.br.

convergences between his reflections and the Latin American Structuralist Approach - LASA.⁴ As argued above, there are at least nine themes under which Chris' seminal ideas enrich our understanding of the matter. The first relates to the role of space and time in the innovation studies.

1 – Innovation and the role of geography and history

One main point to call attention upon refers to the obvious, but generally forgotten, understanding that it is not possible to isolate the study of innovation or any other economic phenomena from their territorial, historical, and socio-political contexts. As Freeman recalled, various authors, especially Schumpeter, 1939, have forcefully argued that general history (economic, political, social and cultural) constitutes a crucial element in the analysis of development. He also insisted, in several of his contributions, different development and institutional trajectories create and shape systems of innovation with very specific local features and dynamics (Freeman, 1982a, 1987, 1995).

In line with neo-Schumpeterian and other schools of thought, major criticisms have been made of the neoclassical abstract and narrow treatment of innovation and technological evolution, noting technology embodies specific, local, often tacit, and only partially appropriable knowledge. Far from being a free good or something that can be merely bought or sold, technology involves economic, social, institutional, and political processes (Nelson and Winter, 1982; Rosenberg, 1982; Dosi et al., 1988). By defining technical change as a fundamental force in shaping the patterns of transformation of the economy, Freeman's arguments were based on a theoretical view of these processes, which implied a broader view of innovation and the restoration of history to a central place in economic thought. Hence, his critical view of the abstract and de-contextualized models and theories:

“In its anxiety to be the ‘theoretical physics of social sciences’ and to achieve logical elegance and mathematical formalization, neoclassical economics elaborated and refined quantitative equilibrium analysis and mathematical models, which although useful as a modeling exercise on highly restrictive assumptions, neglected some of

⁴ In former papers we argued that in the discussion of innovation and development it is possible to find several of these convergences. See Cassiolato, Guimarães, Peixoto & Lastres (2005); Cassiolato & Lastres (2008).

the crucial elements involved in the long-term behavior of the system ... the main weakness of this theory has been inadequate attention to social learning processes, particularly technological accumulation and the institutions affecting these processes” (Freeman, 1988, p. 3).

The role of historic and territorial processes, with its socio-economic, institutional, political, and environmental conditions, was reinforced as a key element responsible for differences in the path of national and local development. Distinct contexts - with their cognitive, incentive, and regulatory systems, and formal and informal means of articulation, dialog, and learning - were deemed vital in explaining the differences in acquiring, using, and disseminating, especially tacit knowledge.⁵ They lead to different ways of generating, assimilating, using, and accumulating knowledge and present specific policy requirements. Therefore, the conclusions: (i) specific historical, geopolitical, and territorial conditions are essential to explain which and how production and innovation capabilities should be acquired, used, and developed; and (ii) analytical models, taxonomies and policy prescriptions that disregard these parameters put their usefulness seriously at risk (Lastres and Cassiolato, 2005 and 2006).

One major related argument is there is not a model to be imperatively followed. Each case must be understood according to its peculiarities. As emphasized by Lundvall (2007), “to develop a general theory of IS that abstracts from time and space would undermine the utility of the concept both as an analytical tool and as a policy tool” (p. 17). In a similar line, other neo-Schumpeterian and Latin-American structuralist authors have pointed out that technical progress aligns with complex socio-institutional changes, whose logic one should try to grasp as a “first step to any study of development” (Furtado, 1983).

2 – Development trajectories: differences, concentration and exclusions

A main issue to be highlighted refers to the conclusion that, *historically, the generation and dissemination of technological progress are characterized by the concentration in a few countries, regions, and firms, which is in contrast with there being a supposed natural*

⁵ For details, see for instance, Johnson & Lundvall (2003).

tendency to converge. On one hand, development is produced and, on the other, underdevelopment. As Chris Freeman pointed out in his contributions to the first book published by the Brazilian Research Network for Local Innovation and Production Systems (RedeSist):

“Schumpeter always maintained that the spread of innovations was necessarily uneven, both with respect to timing and to space, and this was certainly the case with the spread of those innovations which comprised the British Industrial Revolution (Freeman, 1999, p. 117). ... a group of countries, today referred as ‘developed’ or ‘industrialized’, drew far ahead of the rest of the world (later known as ‘underdeveloped’) during the last two centuries” (Ibidem, p. 110).

Therefore, he reaffirms: “uneven development is a much more accurate characterization of growth than convergence. Variations in growth rates between countries have been wider” (Freeman, 1999, p. 127). Claiming unequal distribution of social costs and benefits was visible in the statistics on income distribution in the turn of the century, Freeman (2004) points out the relevance of neo-Schumpeterian ideas to the understanding of problems of income distribution and social cohesion is not obvious. However, he emphasizes a deeper comprehension of these problems requires the exploration of cycles of investment, changes of techno-economic paradigm (TEP), and the associated problems of unemployment and skills. One main issue is that waves of technical change have profound long-term effects on income distribution, in terms of unemployment and the earnings of those who are employed.

This understanding was reaffirmed by the Latin American literature on development and innovation. As pointed out by Raúl Prebisch (1949), the spread of technical progress, from the countries of origin to the rest of the world, has been slow and uneven, with the new forms of production benefiting only a small proportion of the world population. The major world industrial centers were created, around which the periphery of the new system was also formed. This line of thought was followed and elaborated by several other authors, such as Celso Furtado, who in 1961, stated underdevelopment and development should be considered “two aspects of the same historical process”; therefore, underdevelopment

“could not be understood as a phase of the development process that would tend to be overcome”.⁶

3 – Acquisition of technology and the need to foster domestic capacities

The understanding of innovation as a context specific - economically, socially, and politically determined process - has also allowed demystifying ideas about the possibilities of generating, acquiring, and using knowledge and technologies. It clarifies, for instance, acquisition of technology abroad is not a substitute for local efforts. One needs a lot of knowledge to interpret information, select, buy (or copy), assimilate, use, and transform technology. As noted by different authors, including Chris Freeman (1982a, 1987, 1995, 1999), the acquisition of equipment and technology developed abroad can never replace the need to create and foster local and national capacity-building. Hence, in parallel to the recognition that imported technologies and a broader access to specialized equipment and skills may have an important role, Freeman, stressed: “however, such efforts will meet with only limited success, unless accompanied by a variety of institutional changes designed to strengthen autonomous technological capability within the importing countries” (1995, p. 17-18).

It is also worth underlining the assimilation and use of imported knowledge and technology require considerable capabilities and learning, *which derive mainly from the ability to put the acquired knowledge and technology into practice*.⁷ Once it was understood the capacity to generate and internalize new knowledge depends directly on its use, priority was given to policies that support national production development and aim at endogenizing capacities.

These conclusions are in line with LASA's stress on industrialization to promote structural changes and on the “**endogenization of technical progress**” as the most powerful tool for

⁶ Reiterating that underdevelopment could never be seen as a stage of development, but as its very consequence, Eduardo Galeano (1978), pointed out that: “in these lands, we do not see any savage childhood of capitalism, but its decrepitude” (p. 372).

⁷ This discussion also led to the review and balance of the emphasis on the capacity **to learn** and **to use** new knowledge and technologies. Arocena and Sutz (2003) for instance, emphasized the need to better understand the opportunities to learn and, mainly, to apply creatively what has been learnt, highlighting that these objectives could not be taken in isolation from broader economic, social and political power issues. In the same line, Cassiolato and Lastres (2016) discuss some of the major challenges that prevent Brazil and other peripheral countries to innovate and to use new technologies in the 2010s.

development (Prebisch, 1949; Furtado, 1961). The need to control the pattern and the intensity of technological evolution and to create and to nurture domestic capacities has oriented several elaborations on this issue. Otherwise, and as alerted by several authors, the confrontation with the trap of increasing dependency, distortions, and exclusions would be inevitable.

Maria da Conceição Tavares, for instance, emphasized: “underdeveloped countries import a kind of technology conceived by leading economies according to a constellation of resources that is totally different from ours” (Tavares, 1972, p. 50). As noted by Furtado, 1961, imported technologies by underdeveloped countries are those that reflect cost and price structures of advanced countries, not those that allow for a speedier transformation of their production structure. The expected positive result of such imports is often a slow modification of the production and occupational structure of the underdeveloped country. Therefore, even with a high degree of industrial diversification, less developed countries are not capable of shattering the occupational structure nor with the economic domination they are inserted in.⁸ In a similar line, Freeman (1982) also called attention to the social consequences of imported technologies, pointing out: “the indiscriminate import of technologies developed for entirely different environments may have disastrous employment and other social effects in weak poor countries” (p. 184).

Another example of distortion relates to the notion of “*spurious competitiveness*” put forward by Fernando Fajnzylber. This notion was elaborated when this author concluded the competitive advantages obtained by the Latin-American countries in the 1980s were mostly based on: (i) very low labor costs; (ii) the exploitation of natural resources without a long-term perspective; (iii) the manipulation of interest and exchange rates; and on (iv) the use of fiscal incentives.⁹ Therefore, emphasis was placed on the need to promote development, invest in education, domestic capabilities, and social capital, instead of pursuing low cost practices based on the depreciation of labor and natural resources (Fajnzylber, 1988). Because of these findings, the objectives to ensure the adequacy and to manage the intensity of science and technology (S&T) progress were further reinforced.

⁸ See for details Cassiolato et al. (2005).

⁹ Lastres, 2005; Cassiolato et al. (2005).

Additionally, and as argued by Fernando Sagasti (1972) more than producing exclusions and distortions, rapid advances in science and technology in developed countries were making “technological supremacy the major form of domination of underdeveloped countries by developed ones” in the second half of the twentieth century. Such perverse consequences and threatening traps were presented mainly, but not exclusively, to the least developed countries and regions of the world. In the attempt to find ways to avoid them, one of the many bridges built in international knowledge focused on the proposition of a complete change in the style of development (Dagnino, 1977). As reminded by this author, India, at the end of the 19th century, was recognized as the cradle of what is called in the West as Appropriate Technology. The objective was the rehabilitation and development of traditional technologies practiced in their villages: “between 1924 and 1927, Gandhi devoted himself to building programs aimed at popularizing manual wiring carried out in a rock recognized as the first technologically appropriate equipment, the Charkha, as a way to fight against social injustice ... in India.” (Dagnino, Brandão and Novaes, 2004, p. 19). These authors stressed the importance of arousing the political consciousness of millions of villagers in that country. Additionally, as observed by Amílcar Herrera:

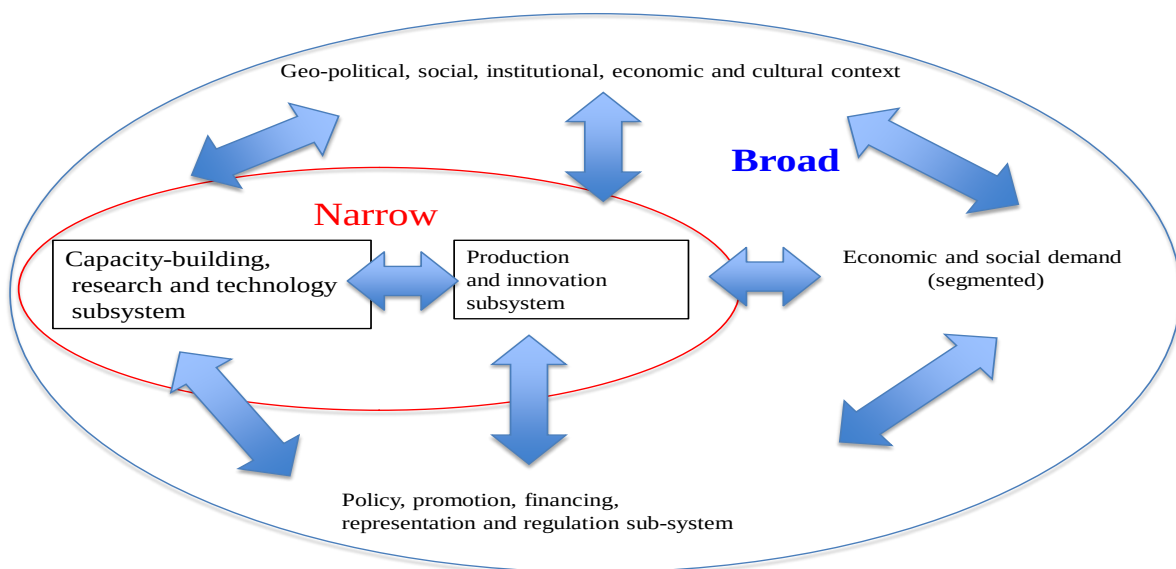
“Gandhi's concept of development included an explicit S&T policy, which was essential for its implementation. His insistence in the protection of handicrafts villages did not mean a static conservation of traditional technologies. It entailed the improvement of local techniques, the adaptation of modern technology to the environment and the conditions of India, as well as the promotion of S&T research, to identify and address the immediate major problems. Their ultimate goal was the transformation of the Hindu society, through a process of organic growth, made from within, and not through an external imposition” (Herrera, 1983, p. 10-11).

Hence, the motto “*production by the masses, not mass production*” and the creation of the Development Group of Appropriate Technology, conceived in the 1970s by Ernst Friedrich Schumacher, who published, in 1973, the book *Small is beautiful: economics if the people mattered*.

4 - National systems of innovation (NSI)

The emphasis on the importance of understanding innovation as a process, with different forms, sources, and consequences, especially the conceptualization of national systems of innovation (Freeman, 1982b, 1987, 2003), are recognized as Chris' most important legacies all over the world.¹⁰ However, as he noted, there are different approaches to the understanding of the NSI approach (Freeman, 1995, 1999). The narrow focus on the public and private organizations directly involved with research and development (R&D) and ST&I efforts and policies. The broader approach considers not only these, but includes other agents and activities that directly and indirectly influence the acquisition, use, and diffusion of capabilities and innovations. It is important to stress that, once more, emphasis was put on the role of historical and geopolitical processes, which account for differences in development trajectories (Figure 1).¹¹ As in Freeman's own words: "the 'broad' approach recognizes that these 'narrow' institutions are embedded in a much wider socio-economic system, in which political and cultural influences, as well as economic policies, help to determine the scale, direction and relative success of all innovative activities" (Freeman, 1999, p. 115).

Figure 1: The National System of Innovation: the narrow and broad versions



¹⁰ As underlined by Lundvall, 2009, the NSI concept "developed in the middle of the 1980s ... is now used worldwide as tool for analysis and policy" (p. 3).

¹¹ For further details see Freeman (1987; 1990a); Lundvall (1992); Lastres (1994).

The NSI approach clarified that production and innovation dynamics relate to capacities encompassing the production of raw materials, equipment, final goods and services, and the commercialization segment. More than focusing on economic activities, organizations, and their environment, it also comprises political and social agents in charge of their promotion, regulation, financing, and representation, and those responsible for the generation, assimilation, use, and diffusion of knowledge and capabilities.

In this discussion, it is important to recall (i) several criticisms have focused on the biased and restricted use of this concept. As for instance, stressed by Lundvall et al. (2011) narrow definitions of the NSI are not only of limited relevance, but “misleading when it comes to inform innovation policy strategy everywhere” (p. 24); (ii) the understanding of innovation as a systemic process, bound to national and regional frontiers, reinforced the conclusion there is not a “model” to be imperatively followed. Each case must be understood according to its peculiarities (Freeman, 1987).

This understanding of the systemic and localized nature of innovation allowed for two crucial dimensions of the innovation systems approach to be further elaborated: the role of historical and national trajectories and the importance of considering the productive, financial, social, institutional, and political contexts, and micro, meso, and macro spheres.¹² It is worth adding the concept of national system of innovation was developed precisely when the idea of a globalized new economy was spreading all over the world, followed by the conclusion that national features and policies would lose relevance. However, as counter-argued by Freeman:

Contrary to some recent work on so-called 'globalization', ... national and regional systems of innovation remain an essential domain of economic analysis. Their importance derives from the networks of relationships which are necessary for any firm to innovate. Whilst external international connections are certainly of growing importance, the influence of the national education system, industrial relations, S&T

¹² These were consensual conclusions further elaborated by Freeman and other authors in the book published in English by RedeSist in 2003 (Cassiolato, Lastres & Maciel, 2003). See Freeman (2003); Johnson & Lundvall (2003); Arocena & Sutz (2003); Humbert (2003); Lastres, Cassiolato & Maciel (2003).

institutions, government policies, cultural traditions and many other national institutions is fundamental” (1995, p. 5).

As specifically claimed by Freeman and Perez (1988), an active national system of innovation may facilitate or hinder the establishment of a new techno-economic paradigm (TEP). It may also provide the environment for a change in economic and technological leadership. Despite the emphasis on the cumulativeness of the process or innovation and the acknowledgement that past success constrains the future, it was recognized that there are times when the strength of a technological tradition may inhibit further innovation.

5 – Technological changes and the role of government policies

One chief argument elaborated by Freeman and Perez (1988) was that the adaptation of the economy will be a slow and painful process if left to itself, especially in a period of radical changes. The role of government was appointed as vital in breaking resistance, in stimulating the renewal of development blocks, and in supporting the formation of new ones.¹³ Again it was reaffirmed this role had to deal with all sort of policies related to the general economic, social, political, and institutional environment; therefore, the agenda for active policies was enlarged, instead of made obsolete. As re-emphasized by Freeman (1999 and 2003) periods of radical and systemic changes require the implementation of even more sophisticated forms of promoting development.

However, as particularly remarked by Humbert (2003) the neoliberal promotion of globalization, in the transition of the millennium, was a clear call for dismantling all barriers so the nation-state territorial production apparatus of any country could become open to any actors of the global system. Along similar lines, Chesnais and Sauviat (2003) criticized the “short-sighted apology of a market-dominated conception” of development and warned the pressures are not only financial; they were also ideological, under the repeated slogan that “everything the state did or still does the private sector, whether domestic or foreign, can do better.” As these and other authors have argued, the critical question is not about

¹³ See also Mazzucato (2011), who has insistently noted that “the State has not just fixed markets, but actively created them ... the government has not simply created the ‘conditions for innovation’, but actively funded the early radical research and created the networks between state agencies and the private sector” (p. 85).

the size of government and the intensity of its intervention, but about whom government is for.¹⁴

Contrary to the opposition between State intervention and market evolution, the “eclipse of the State” and “*no alternative*” theses, Freeman called attention to the need of: (i) further understanding the features of the new accumulation pattern, the local and national development conditions and the new forms of governance at world level; and of (ii) designing new and proper policies and regulation regimes. One main point in this discussion, regarding the role of the State, was the recognition of the importance of counterbalancing the new forms of inequalities produced by the diffusion of ICTs and the acceleration of globalization. Because it was recognized that novel and more complex divides and disparities were generated – not only in the capacity of developing, producing, using, and profiting from the new technologies, systems, and contents – but also among individuals, firms and organizations, regions, countries, and blocks. As Perez stressed:

“A TEP involves ... a technological revolution, ... very disturbing of the social status-quo and have accompanied the explosive growth of new wealth with strong polarizing trends in the income distribution. These and other imbalances and tensions, including major financial bubbles and collapses, require an equally deep transformation of the whole institutional framework (Perez, 2009, p. 5-6).

It is worth reinforcing the implementation of a wide set of ever more complex policy instruments was observed, namely in the most developed countries.¹⁵ It was also noted the opportunities brought about the abovementioned transformations were better taken by societies with greater cohesion and the capacity to define strategies and measures to profit from these changes.¹⁶ Strengthening one of his most enduring arguments, Freeman insisted on the need of global and national regulation “to limit or prevent undesirable social consequences of any new technology” (Freeman, 2003, p. 122) and of adequate policy guidelines to orient growth and development. He also identified four main elements relating to the diffusion of the new TEP that are precious for the discussion proposed in this paper:

- the need to understand the financial dimension of globalization and its relationship with innovation and the diffusion of the ICT paradigm (presented in item 6);

¹⁴ For details see, among others, Ferrer (1997); Furtado (1998); Santos (2001).

¹⁵ For details see Lastres, Cassiolato & Maciel (2003); Mazzucato (2011 and 2016).

¹⁶ See Coutinho (2012).

- the pressures for a more socially and environmentally sustainable development pattern and the usual bias in innovation research and policy agendas (item 7);
- the necessity to contextualize analytical and policy frameworks (item 8) and the escalating threat of alienation of economic theory (item 9).

6 – Financialization, sustainability and crises

In his analyses on the long-term cyclical characteristics of innovation and development, Freeman pointed out that alternating phases of retrenchment and egalitarian trends have characterized industrial capitalist societies throughout the 19th and 20th centuries. He also stressed these long swings, related to the diffusion of new technologies, are usually accompanied by cycles of over-capacity and of shortages. Analyzing these trends in the beginning of the 2000s, he highlighted the role played by political decisions in orienting the use of information technology (IT), its articulation with the financial system, and the generation of crises:

“These phenomena in the ‘real’ economy interact with political events and with financial markets to generate the instability characteristic of the periods of structural ‘crises of adjustment’. In the 1890s as in the 1990s, outward flows of speculative investment to ‘emerging economies’ aggravated this instability. The headlong deregulation and liberalization of capital movements in the 1970s and 1980s has created a particularly unstable situation in the world economy at the turn of the millennium, as both the speed and scale of capital movements are greatly increased by the use of IT and of ingenious financial innovations such as derivatives” (Freeman, 2007, p. 21).

He drew special attention to how the predominance of the financial capital - with its preference for liquidity and focus on short run profits – contributed to question investments of high risk, cost, and maturity period, such as those in education, science, technology, and innovation.¹⁷ Even more seriously, Freeman (2003) alerted:

“The liberalization of capital movements, which has occurred in the last quarter of the twentieth century, ... has rendered almost every country more vulnerable to the

¹⁷ See Freeman, 2003 and also Chesnais & Sauviat, 2003.

instability and shocks which can be propagated throughout the system, however well local innovation systems may have been performing in a narrower sphere” (p. 120).

He also observed the trend to conform macroeconomic regimes, ever more dependent on the logic of financial capital, hinders the possibility of implementing policies everywhere, particularly in the US and in European countries.¹⁸ His visionary perception of future events evolved sideways with his modesty and his concerns about the necessity to consider the uneven development of the world economy and the inevitability of new financial crises. In a paper - written in early 2000, but first published in 2003 - he foresaw the upcoming of the 2001 financial crisis:

“No one can predict the future course of events with certainty. Neither the evidence about long-term productivity changes, nor the historical reflections, nor the scale of corporate and household debt, nor calculations of the possible future rate of returns on ICT investments, can conclusively show that there will be a hard landing ... Nevertheless, taken together, they should give cause for serious reflection. **Fasten your seatbelts**” (Freeman, 2003, p. 140).

Reinforcing the need for political regulation, he underlined that a broader comprehension of the real challenges to be faced was required for the “extremely difficult task of strategic policy-making” (Freeman, 2003). Drawing a parallel with the East Asian crisis of 1997-8, he brought attention to several points that deserve to be better understood, precisely because similar conditions continue to be reproduced in different parts of the world:

“Many of the comments on the East Asian crisis of 1997-8 are characterized by emphasis on the supposed sins of the ... governments. In particular, they have blamed corruption of governments for some of the unwise and inept investment decisions of the 1990s. Of course, there has been corruption in many countries ... There has also been corruption in European countries and in the United States. But it is fanciful to put the whole blame for the collapse on corruption and to ignore the misallocation of private investment” (Freeman, 2007, p. 19).

¹⁸ In a similar line, Aldo Ferrer (1997) claimed that “globalization has destroyed the sovereignty of the State, at least in economic and financial matters”.

He quoted Jeffrey Sachs in his acknowledgement that “it is somehow comforting to blame corruption and mismanagement in Asia for the crisis”, and in all countries from 1993 to 1996, international money market managers and investment banks “went on a lending binge” and the “short-term borrowing from abroad was used, unwisely” (Ibidem).

Freeman went further, discussing how key international organizations - created to manage the global financial system and to provide financing for development - had contributed to accentuate crises. He then quoted James Wolfensohn, as one of the first to (i) recognize “what began as a financial crisis has spilled over into the real economy, severely hitting both production and employment” and (ii) to put forward the question if, in the East Asian case, was the miracle a mirage and the answer that: “emphatically not. No other group of countries in the world has produced more rapid economic growth and dramatic reductions in poverty” (Ibidem, p. 20). Freeman, quoted again Jeffrey Sachs, who pointed to the lack of accountability and transparency in the operations of the IMF, adding disagreement with its advice became synonymous of “a sinful rejection of financial rectitude punishable by the markets” and these advices have “often been mistaken and not only in East Asia” (Ibidem).¹⁹

Freeman’s conclusion was that this handling of successive crises in Latin America, East Europe, and East Asia in the late 1990s put a question mark in the ability of these international organizations to deal with the volatility of the capital market in a way that “does not damage future growth in countries in which the ‘fundamentals’ for sustained growth are relatively favorable” (Freeman, 2007, p. 20). Hence, he finished his analysis by remarking: dependence on the global economy and on the IMF and World Bank “can be a mixed blessing so that the reform of the IMF is now becoming an urgent question for the management of the global economy” (Ibidem, p. 20). In the sequence, he derived four main lines of recommendation:

“Firstly, ... the IMF and World Bank should be reformed to bring them closer to the original Keynesian ideal. Secondly, *social* policies should assume a much higher priority. The general trend of these policies should be designed to reduce inequalities in the system, both at the national and the international level. Thirdly, these

¹⁹ “It forecast growth of 1.5 per cent in Mexico in 1995 ..., but actual growth was minus 6.1 per cent and again in Argentina forecast growth was 2 per cent and actual growth minus 4.6 per cent” (Freeman, 2007, p. 20).

movements should be far more closely regulated and controlled, as for example, by the tax on short-term capital transactions imposed in Chile. Finally, the trend towards inegalitarian taxation and social policies should be reversed by a return to the principles of redistribution. ... World-wide redistributive policies should be financed by the "Tobin Tax", a tax on the speculative transactions in international financial markets ... This ... would also help to reduce the huge surges of short-term capital movements which destabilize governments and societies" (Freeman, 2007, p. 22).

Of course, the configuration of the accumulation regime results from and reflects political and institutional changes that have characterized the evolution of the most developed organizations and countries in the second half of the XX century. These have oriented, not only the upsurge and diffusion of the new ICT paradigm and the acceleration of globalization, but also a mounting movement towards privatization, liberalization, deregulation of markets and financial systems, and erosion of the sovereignty of the State worldwide. Obviously, these are not natural, neutral, and uncontrollable movements. Particularly when discussing new policy initiatives to guide the rhythm and direction of these transformations, we cannot ignore the trend towards the consolidation of an accumulation regime oriented by a financial logic and, above all, the consequences already identified (Lastres, Cassiolato and Maciel, 2003).

In Brazil, the progression of financialization - with its short termism, *rentier* logics, and primacy of recessionary austerity policies - has reinforced "regressive industrialization" processes, increased imports of goods and technologies and of remittances abroad, leading to stagnation, instability, inequality, and precarization of work and living conditions.²⁰ It has also contributed to the erosion of economic and political space of governments. What is even worse, and as brought to light by Fabio Erber, the "neoliberal institutionalist convention" - adopted in Brazil, since the 1990s and that still prevails - has generated negative serious effects on development, strengthening "malignant macroeconomic regimes"²¹ capable to make null, not only actions and public and private policies, but any and every national development strategy (Erber, 2011; Lastres et al., 2016c). Similar consequences and trends can also be observed in other developing and

²⁰ See Lastres et al. (2016c); Cassiolato, Szapiro & Lastres (2015).

²¹ See Coutinho (2003).

developed countries.²² Here, it is important to recall several remarks, such as those elaborated by Celso Furtado, on the possible future of the developing countries facing the increase of the globalization process, especially in its financial dimension:

“The struggle against the ambiguities of the monetarist doctrine demands a critique of the practice of peripheral development in the transnationalization phase. What is at stake is more than a problem of ideological demystification. ... We have to ask ourselves whether the peoples of the periphery will play a central role in the construction of their own history, or whether they will remain as spectators while the process of transnationalization defines the place that each one should occupy in the immense gear that promises to be the globalized economy of the future. ... The new doctrinaire orthodoxy, by claiming to reduce everything to formal rationality, obliterates the awareness of this option. If we want to revive it, we must begin by restoring to the idea of development its political-value content” (Furtado, 1982, p. 43-44).

7 – The escalating pressure for sustainability and the bias in innovation research and policy agendas

In the early 1980s, far ahead of what is almost common sense nowadays, Freeman, argued: “historically, very little of the world's R&D is in fact directly concerned with the elementary needs of the majority of the world's inhabitants... The bias in the world research innovation system is so great as to constitute a danger to the future of human society” (Freeman, 1982a, p. 184).

Different authors elaborated on this line of argument. Dalum, Johnson and Lundvall (1992) for instance, noted several of the most serious unsolved problems of the world (poverty, hunger and disease) reflect political and institutional barriers to change, rather than a lack of technical knowledge. Milton Santos (2001) emphasized that never in human history has existed scientific and technical condition as appropriate as today to build “the world of human dignity”, only these conditions were expropriated, adding it is up to us to give “a different direction to these material conditions.” Such warnings to the threats on the social

²² See, among others, Ferrer (1997); Furtado (1998); Palma (1998); Ocampo (2000); Katz (2000, 2003, 2005); Coutinho (2003); Corrêa & Pereira (2016).

cohesion of different economies and societies were also strengthened by Foray and Lundvall (1996) who called attention to the risk of IT becoming an acronym for Intellectual Tribalism, instead of Information Technology.

As the pressures for socio-environmental sustainability have thrown new light on the need to tackle these challenges, an increasing number of authors have joined the reaffirmation that: “the growth of inequality within and between countries is likely to become ultimately a source of great political and social tension” (Freeman and Soete, 1997, p. 409) and have further elaborated the discussion on this subject. This important debate has produced at least two main consensual conclusions. First, the observation that most ST&I policies implemented all over the world aim at achieving economic growth and competitiveness, not at dealing with poverty or inequalities (Arocena and Sutz, 2003; Dutrenit and Sutz, 2014)²³, and the effects of promoting purely market-led ST&I efforts aggravate the existing exclusions and sustainability problems (Abrol, 2004; Joseph et al., 2010 and 2014; Soares, Scerri and Maharajh, 2014). Second, there is a vast amount of innovation - usually referred as: social, pro-poor, or below-the-radar - based on the so-called traditional, local knowledge that rests marginalized and tends not to be perceived (Lastres, 2006; Lastres et al., 2016b), remaining imperceptible to the mainstream research and policy gaze (Joseph et al., 2010). Noting that, as innovation policies and the academic debate concentrate on issues of competitiveness Arocena and Sutz (2012) highlighted problems of social exclusion not only became invisible to the research agenda but are also excluded from the academic reward system.

The significance of the arguments is the need to promote development, without dissociating the economic from the social dimension, and the importance of policies that help to diminish inequalities, instead of reinforcing them (Marcelle, 2005; Arocena and Sutz, 2005; Baskaran and Muchie, 2005; Lastres, 2005b).²⁴ In this discussion, it is worth underlying, as confirmed by the Brazilian experience in the first decade of the XXI century, there are major opportunities in associating these two dimensions of development:

²³ See also: Herrera (1972); Sagasti (1972); Fajnzylber (1983); Furtado (1983); Srinivas & Sutz (2008); Cozzens & Sutz (2012) among others.

²⁴ These papers were presented in the Globelics Conference held in Pretoria, 2005. See www.globelics.org. Of course there are many more contributions stressing this so important conclusion. In the case of Brazil see: Cassiolato, Lastres & Soares (2014); Lastres et al. (2016b).

“Taking on the challenge of eliminating hunger and extreme poverty and universalizing basic public services, such as education, health and sustainable urban spaces, reveals alternatives in innovation and industrial development, which are needed to create a robust and long-lasting internal market. The main lessons learned from the crisis have shown that concerns previously understood as exclusively social, regional or environmental - and for this reason not connected to the goals of economic growth - are in fact at the core of public and private policy, aiming not only at increasing income, but also at broader, appropriate and sustainable development” (Coutinho, 2012, p. 13).

Freeman was also one of the pioneers to address in the 1980s the challenges of environmental sustainability, linking it with both technical change and social inequality. Again, in his contribution to the first book published by RedeSist, he emphasized:

“The growing environmental problems facing the whole world may also impose a rather different pattern of economic and political development than that which has prevailed in the twentieth century. The development of environmentally friendly technologies and their universal diffusion may impose a more cooperative civilization and an entirely new pattern of institutional change and of knowledge accumulation” (Freeman, 1999, p. 146).

It is important to single out his stress on the need of a global, combined, and concerted response to such problems, as they concern human beings and their different societies. This is also well captured and summarized by Rasigan Maharajh:

“The specific objective conditions that underpin the current phase of global capitalism demand the emergence of collectively determined responses that seek to build global solutions, international cooperation, and solidarity. ... Internationalizing research and development will help to build capabilities across territories of the world” (2015, p. 17).

Here, I recall one of my favorite Chris Freeman’ quotations: “Breadth, enlightenment and social solidarity are essential for any innovation system” (1999, p. 148), underlining the bias in innovation research and policy agendas refers also to the absence of a contextualized and integrated view of economic, social, environmental, and political dimensions, and stressing the issue of power is hardly ever considered in this important discussion.

8 – The need to contextualize analytical and policy frameworks

One main corollary of the discussion above points to the urgent need to deepen the understanding of the transformations occurring globally and to contextualize analytical and policy frameworks and agendas. This is crucial to deal with the different conditions of local, regional, and national systems of production and innovation and to make sure these frameworks and agendas are capable to address two basic and related elements.

First, these agendas should target the development priorities of the country or region in focus (Singer et al, 1970). In several of his contributions, Freeman emphasized: (i) production and innovation efforts are neither limited to economic growth, nor to the activities of particular companies, sectors, and regions (Freeman, 1982a, 1987, 1999); (ii) innovation policies can and should contribute to reduce regional and social inequalities and exclusions and to foster sustainability (Freeman, 2003).²⁵ Such line of reasoning means one essential step is to break invisibilities and exclusions in both research and policy agendas, focusing on informal actors and activities; traditional communities; gender, racial, and other power imbalances. Tackling these challenges can offer considerable opportunities to improve innovation policies, not only within underdeveloped contexts.

Second is the need to recognize and deal with the mode of insertion of a country or region within the global geopolitical scenario. As proposed by Freeman, the IS perspective requires linking all dimensions (micro, meso and macro) of production and innovation. Important constraints to technological (and productive) development derive, not from problems that occur at the level of the firm (micro), but by obstacles that occur at the macro and meso level and at the interaction of all these dimensions.

It is worth recalling, since the 1970s, Latin American and Caribbean authors have emphasized factors contributing to hinder learning and capacity building in these countries are often associated to the instability and vulnerability of the macroeconomic, political, institutional, and financial environments. Problems such as trade liberalization, market deregulation, exposed and dysfunctional financial systems, high external debt and high

²⁵ See also Arocena & Sutz (2003); Chesnais & Sauviat (2003); Lastres, Cassiolato & Maciel (2003); Abrol (2004); Cassiolato & Matos (2012); Joseph et al. (2010); Dutrenit & Sutz (2014), among others.

interest rates are frequent constraints to technological (and industrial) development. Herrera (1971), Sagasti (1978), Erber (1983) and Katz (1996) have shown how macroeconomic policies influence firm technological strategies more than specific industrial and innovation policies. Because of their greater capacity to affect strategic behavior of firms than those policies that explicitly target innovation and industrial development, they were called, “implicit’ industrial and technology policies” (Herrera, 1971).

Coutinho (2003) further elaborated this idea, showing how key macro variables - the rate of interest, the foreign exchange rate, the expected inflation level, and other macroeconomic policies and conditions - shape microeconomic decisions. This author also distinguishes “benign” from “malignant macroeconomic regimes”, arguing the latter heavily penalizes investments - mainly those that involve high risk and long-term results - with harmful effects to domestic production and competitiveness. Coutinho reaffirmed this has represented a significant challenge to industrial and technological policies, being capable of annulling them.²⁶ Hence, emphasis is given to the need to reinforce the linkages between macroeconomic policies and technological and industrial policies.

As claimed by Jorge Katz (1996) the mainstream literature on technology has consistently ignored the relation between the behavior of macroeconomics variables in a society and the evolution of its microeconomic structure. He sustains this constitutes a chapter of the economic analysis not yet fully written. Katz’s work - on the 1990s market-oriented reforms and the transformation of Latin American innovation systems - was instrumental in revealing important limitations of traditional approaches to technology and development:

“the lack of an adequate theory of innovation is what has induced Latin American economists and policymakers to take for granted that the ‘discipline of markets’ was all that was needed for countries in the region to enhance their technological and innovative performance and their long-term competitive insertion in the world economy (Katz, 2003, p. 5).²⁷

Studies focusing on India also showed how an IS framework can help address issues related to institutions and norms of social exclusion (Joseph et al., 2010). Comparative research effort in BRICS systems of innovation highlighted this issue, pointing to the need

²⁶ See Villaschi (1993) and Szapiro (2005) for similar views and findings.

²⁷ For further details see also Cassiolato, Lastres & Peixoto (2013).

of identifying opportunities: to design and implement novel development and innovation policies (Scerri and Lastres, 2013;), to fight inequalities (Soares, Scerri and Maharajh, 2014), to strengthen SMEs (Arroio and Scerri, 2014), and to mitigate the drawback brought by an over weighted presence of transnational enterprises in local economies (Cassiolato et al., 2014). Studies in South Africa stressed the importance of how formal and informal economies connect, as the institutional and macroeconomic context may dissuade small enterprises from entering the formal economy (Aliber et al., 2006). These are only a few examples of an increasing number of contributions that focused on how these different macro conditions can stimulate or limit national and territorial systems of innovation and development. To operate with these processes is fundamental to understand them. This became more difficult with the spread of abstract and de-contextualized theories, concepts, and models that gained momentum in the 1980s and 1990s with the hegemony of neoliberal thinking.

Therefore, demystifying the supposed neutral and universal nature of the priorities for innovation consists in the first challenge to be faced in the building of an innovation agenda. The second relates to the importance of implementing diverse, contextualized, and appropriate research and policy efforts, starting from concepts and models that orient them to indicators and other parameters used to evaluate them. In this sense, one major challenge to be confronted refers to the escalating threat of alienation of economic theory.

9 - The threat of alienation of economic theory

The failure of economic forecasting and macroeconomic modeling to predict the crisis highlighted some of the fundamental flaws of a theory increasingly disconnected from the real world and its complex, territorial, and systemic functions. Pointing out the limitations of quantitative analyses based on abstract models, both Freeman (1982a) and Lundvall (2007) emphasized the advantages of reasoned history methods and joined Schumpeter in one of his main alerts, registered in the first part of the last century:

"It is absurd to think that we can derive the contour lines of our phenomena from our statistical material only. All we could ever prove from it is that no regular contour lines exist ... We cannot stress this point sufficiently. General history (social, political and cultural) economic history and industrial history are not only indispensable, but really

the most important contributors to the understanding of our problem. All other materials and methods statistical and theoretical are only subservient to them and worthless without them" (Schumpeter, 1939, p. 19-20).

Again, in his visionary manner, Freeman commented: "the mathematical pretensions of the derivatives models ... even if they are developed by Nobel prize-winners, would be laughable if they were not tragic in their consequences" (2007, p. 21).²⁸ It is worth underlining the distortions and other problems resulting from the use of concepts, indicators, and models based on unrealistic and inappropriate assumptions. It is also worth recalling the relevance of similar alerts on the use of concepts, indicators, and models that: (i) dissociate social and economic development, ignore territorial conditions, social and power tensions, reach only a limited group of those most visible and financially sound agents, activities, and regions; (ii) encapsulate political choices, excluding relevant social and economic agents and activities and regions, from the research and policy agenda (invisible exclusion). Therefore, there is an urgent need to overcome the mimetic syndromes that lead to the use of fragmented, de-contextualized, and inadequate analytical and policy concepts and methodologies, and cognitive injustice, invisibilities, and misunderstandings and to devise new ways of mobilizing development.²⁹

The objective of underlining the obvious conclusion - that foreign experiences, theories, and models should broaden our knowledge and not limit our intelligence - leads to the relevance of answering the following reflections:

- What sort of knowledge orients our teaching, research, and policy agendas?
- To what extension is "the need to dialogue with the hegemonic thinking" draining our efforts of knowledge generation and of debating policy-making alternatives?

Reductionism in the research and policy agenda can lead to serious negative consequences.³⁰ Beyond the inherent limitations and distortions, in the analytical dimension, there is a failure to perceive and understand local and national conditions. A

²⁸ When this paper was written there were no doubts about such indeed tragic consequences spread all over the world. See: Mason (2015); Hein, Detzer, Dodig (2016); and in the case of Brazil: Cassiolato, Szapiro, Lastres (2015); Lastres et al. (2016c); Gadelha (2016); Sarti & Hiratuka (2016); Corrêa & Pereira (2016); Laplane (2016). Most of these contributions claim for international arbitration and regulation.

²⁹ For details see, for instance, Lastres (2006, 2007); Lastres et al. (2016a); Arroio & Scerri (2014).

³⁰ As, for instance, stressed by Nuñez & Marreiro (2014), "political analyzes are replaced by the problems of management, which rest on truths and formulas ... beyond all doubt. Everything consists of applying well the recipes of experts. The debate about the values that underlie these designs and the questioning of their social

huge percentage of the world's economic and knowledge activities remains invisible and, therefore, out of the innovation agenda. In the policy dimension, adding up to this massive exclusion of important activities, agents, and territories, there is a trend to submit local conditions to inappropriate models and to blame these conditions not to conform to the models and their prescriptions, within a really Procrustean fashion³¹, and - as pointed out by Freeman, 2007, in the case of East Asian crisis of 1997-98 - to find ways to justify wrong analytical conclusions and policy prescriptions. The lack of adequacy and the resulting reinforcement of inequalities, distortions, paradoxes, and chasms are even stronger with large-scale less developed countries and regions, such as Mexico (Dutrenit and Ramos, 2012) and Brazil (Cassiolato and Matos, 2012).

In this discussion, one must consider, in times of changes of TEP, the strength of a particular knowledge basis may inhibit further advances. While cases of “institutional sclerosis” were reported (Freeman and Soete, 1997), newcomers were seen as more able to create and adopt the required technical, social, and institutional innovations than the more rigid “arthritic” structures of established leaders (Freeman and Perez, 1988). One conclusion is the least developed regions of the world must be seen not only as backwards, but also as territories - economically, socially, and politically built – that have been more distant or presented more resistance to incorporate the hegemonic TEP and mode of development. The second related conclusion is they may contribute to revealing various sustainable development alternatives. However, in this discussion, one must consider, on one hand, the interests of those who occupy hegemonic positions in the current main economic and political spheres. On the other hand, it is important to note the pressures to renovate the present TEP and the warnings that the global knowledge basis must be enlarged. These arguments were reinforced by Freeman (1995), who stressed the “*evolutionary advantages of variety*”, alerting, particularly in times of paradigm changes, “a technological monoculture may be more dangerous than an ecological monoculture” (p. 18).

In a similar line of thought, Vandana Shiva (1993) has persistently alerted that the dominant scientific knowledge creates a “monoculture of the mind” by removing the space of local

aims is considered to be disruptive. ... There is a broad consensus that these technocratic prescriptions only helped to consolidate poverty, underdevelopment and dependency” (p. 138).

³¹ See Lastres, Arroio & Lemos (2003); Lastres & Cassiolato (2005); Lastres (2006).

alternatives, much like the monocultures of imported plant varieties, which leads to the substitution and destruction of local diversity. She called attention to the fact that local knowledge vanishes through its interaction with the imposing and “dominating Western knowledge” at many degrees and scales “by simply not seeing it, by negating its very existence” (Shiva, 1993, p. 21). In addition, she argued the relationship of knowledge and power is inherent in the dominant system because, as a conceptual framework, it is associated with a set of values based on power (Ibidem) and consequently: “it generates inequalities and domination by the way such knowledge is generated and structured, the way it is legitimized and alternatives are delegitimized, and by the way in which such knowledge transforms nature and society” (Ibidem). Highlighting the importance to understand the dominant system is also “the product of a particular culture”, she claimed: “power is built into the perspective which views the dominant system not as a globalized local tradition, but as a universal tradition, inherently superior to local systems” (Ibidem).

Latin American authors also recognized and developed acute criticism about this dominance and the naive importation of concepts and propositions from central countries. In the 1970s, Jorge Sabato, stressed the need for the region to develop frames of reference more appropriate to its condition: “looking at our reality with our own eyes is not less merit, while it is surely the first step to modify it. However, ... it is common to import theoretical schemes - or simply slogans of fashion - which are then imposed as a straitjacket, with forgetfulness or ignorance of their own characteristics” (1975, p. 27). Similarly, Sagasti added - even considering its accomplishments - Western S&T culture could not be considered as a universal model that other countries should imitate. He also recommended to “abandon the arrogance implicit in Western culture”, which makes it “consider itself as a model for the developing world.” Concluding with the positive perspectives opened by the conformation of local cultural heritage with modern science, Sagasti (1980) accentuated “there needs to be a more ecumenical perception of the processes of progress and development in which the possibilities of the many (local) cultures ...are dignified and valued.” (p. 132).

In this same stream of thought, Arocena and Sutz (2003) emphasized Southern frameworks of thought, developed mostly in the 1950s and 1960s, “have not been replaced by a new holistic view.” They underline that, as hegemonic thinking would claim because: “there is no need for ‘regional’ frameworks of thought any more. Alternatively, it is possible to claim that

they are indeed needed but that hegemonic thinking makes it very difficult to build them” (2003, p. 293).³² In a recent work, these authors re-emphasize power is an issue to be centrally included in the approach to innovation and development (Arocena and Sutz, 2016).

III – Conclusion

This paper revisited some of Professor Chris Freeman’s seminal contributions on innovation and development, arguing that among his main legacies are the substantial enlargement and refinement of both research and policy agendas and the vital fostering and consolidation of national, regional, and international research cooperation on these issues, such as: RedeSist³³, Globelics other regional and national LICS networks and activities.

The experience of developing and using the concepts of IS and LIPSs in Brazil - to orient research work and policies for production, ST&I, and development - constitutes one clear example of how Freeman’s contributions led to the improvement of the industrial and technological research and policy efforts developed in the country. The second relates the creation of the RedeSist and the consequent development of the concept of LIPS in 1997.³⁴ It seems relevant to note the main objective of emphasizing the existing convergences between Freeman's (and other Schumpeterian scholars’) contributions and LASA is to reinforce two related arguments of this paper. First, by exploring and assimilating its convergence with other development frameworks, the system of innovation approach can broaden and strengthen its role as a tool to understand and orient the processes of capacity building, innovation, and development. Second, this effort could stimulate novel findings

³² Indeed this is not a phenomena limited to the Southern hemisphere. Various authors claim that the fight against unemployment, inequality and recession – that has oriented some of the most important theoretical transformations all over the world - has been neutralized by orthodox assumptions. Louçã (2004) for instance, analyzed the evolution of economic science in the last hundred years - including the successive generations of mathematical economics and the trajectories that led them to abandon criticism - and stressed the need to restore the linkage of economic science with the objectives of progressive social transformation.

³³ The Research Network for Local Innovation and Production Systems was set up in 1997. Comprising more than 200 researchers in 25 universities and other research and teaching organizations, spread all over the Brazilian territory - RedeSist has explored the issues of development, NSI and policies.

³⁴ The LIPS concept and its refinement, as pointed out by Cassiolato & Lastres (1999, 2008) is based on the Latin American Structuralist Approach (LASA) on development and structural change (Prebisch, 1949; Furtado, 1964; Fajnzylber, 1989; Rodriguez, 2006) and the Innovation Systems framework (Freeman, 1982, 1987; Lundvall, 1992).

from empirical and comparative analysis and, therefore, support and foster its further expansion and refinement.

RedeSist work has initiated an important process of creating, using, improving, and disseminating knowledge on national and local production and innovation systems. An intense interaction among researchers, policy-makers, entrepreneurs, and other participants in the academic and policy spheres has taken place.³⁵ Progress achieved in these 20 years of a significant collective learning and accumulation of experience includes a deeper interaction among researchers and policy-makers, not only in different parts of Brazil (RedeSist), but also in Latin America (Lalics), BRICS, India (Indialics), and at the global and regional levels (Globelics and other LICs networks).

The LIPS approach is perceived, by national and international experts, as one of the most relevant analytical proposals to understand production development with recognized success in both academic literature and in public policy (Torre and Zimmermann 2015), while the focus on LIPSs has been considered the main news and the most relevant industrial policy initiative in Latin America in recent decades (Peres 2011). Also, according to the assessment made by Mazzucato and Penna (2016): "In Brazil, the importance of the collective dimension in production and innovation has been reflected in economic policy making. In particular, policies to promote technological and industrial development have recognized that the agglomeration of firms and the benefits generated by their collective interactions can contribute to sustainable competitive advantage. The concept of ... LIPS ... (in Portuguese Arranjos Produtivos Locais), or APLs, plays an important role in national development policy and STI policy" (p.28).

Our studies confirm these findings and tackle other issues emphasized in this paper. It is worth addressing those based on Freeman's contribution by highlighting, first, the objective to overcome the abstraction and fragmentation of analytical and policy models - and the misunderstandings, cognitive injustices, and invisibilities - aiming at devising new forms to mobilize and integrate development, and second, the relevance of developing concepts and

³⁵ More than 100 LIPSs were analyzed in different sectors and localities in Brazil, more than 20 books were published discussing policy implications and experiences, as well as comparing with studies in Latin America, BRICS and other countries.

policy models proper and capable of devising and implementing new forms of contextualized, inclusive, and sustainable development.³⁶

As pointed out in various RedeSist policy reports³⁷, one major consequence of the fast spread of the concept of LIPS (APLs) in Brazil was to break the invisibility and to include the policy agenda – often for the first time - those examples of the above mentioned “invisible exclusion”, giving them prominence and priority. A second major consequence was the constant debate on the learning accumulated about some issues discussed in this paper: (i) the policy risks of the “*pasteurizing policies*” that “*exclude by definition*” important agents, regions, and activities from the research and policy agendas; and (ii) the threats posed by “*implicit policies*”, “*malignant regimes*” and “*Procrustes beds*”.

Some of these issues were addressed in a seminar by the Brazilian Development Bank (BNDES), the Inter-American Development Bank (IDB), the Brazilian Confederation of Industry (CNI), and RedeSist. Organized in Rio de Janeiro, in the end of 2010, it was dedicated to Professor Freeman for his invaluable contribution to the advancement of knowledge on the seminar theme: the new generation of production and innovation policies.³⁸ Five of his main lessons were selected as standing apart. First, the emphasis on the need to think innovation and policies beyond economic growth, aiming primarily at promoting sustainable development with equity and social justice. Second, the understanding of the systemic and contextual specificities - economic, political, social, cultural, and environmental – of the different production and innovation systems national, regional, and local and their dynamics in times of change and crisis in production, technology, and financing patterns. Third, the warning against the dangerous separation of financial speculation from the fundamental reality of production systems. Fourth, the perception that growth and innovation based on social inclusion, improved distribution of

³⁶ Perhaps as one result of one decade of joint work of RedeSist and the main policy organizations fostering micro and small enterprises, regional and local development, the focus on LIPS (APL) targeted almost exclusively those underdeveloped production structures and regions. It was extremely interesting to observe the establishment of the working group on LIPSs (APLs) by the Brazilian federal government in 2002. This group was based on the Ministry of Services and Industrial Development and worked with representatives of main national, regional and local public and private organizations dealing with the support of MSEs and territorial development. Key areas joining forces were the Ministry of S,T&I (important since the birth of RedeSist) and also the Ministry of Health, Regional Integration and Development, Rural Development, Social Development, Culture, the five official development banks, other private banks and organizations, as well as agencies such as the National Institute Land Reform, INCRA, and the Innovation Agency, Finep.

³⁷ See Apolinário & Silva (2010); Campos et al. (2010); Matos, Borin & Cassiolato (2015).

³⁸ See Lastres, H. M. M.; Pietrobelli, C.; Caporali, R.; Couto, M. C.; Matos, M. (2012).

income, and environmental sustainability are essential ingredients for the new policy models for development. And finally, his longest-standing arguments on the importance, mainly in times of ruptures and crises, of appropriate policies to guide development, within new basis, mobilizing, and reorienting national production and innovation systems, much like an engine of development (Coutinho, 2012; Lastres et al, 2012).

To these conclusions, I would add it is high time to recover the capacity to seek, plan, and implement a new generation of policies for development, inspired by Freeman, that: (i) addresses the main priorities of the Third Millennium: freedom, sustainability, and access to education, health, and other basic public services; (ii) relates to a logic compatible with diversity, cooperation, and dissemination of experiences, knowledge, and capabilities; (iii) is based on social participation in its design and implementation; (iv) aims at fostering deep-rooted, knowledge intensive, inclusive, cohesive, and sustainable development, based on a long-term perspective.

To end this reflection, it is worth adding: (i) the main message of the Rio 2016 Olympic Games that synthesizes a response for the escalating exclusion, inequality, and intolerance observed in different parts of the world: "We are here to discover and explore our similarities and especially to understand and celebrate our differences"; (ii) the responsibility of lecturers, researchers, and policy-makers dealing with innovation and development - and the important role of RedeSist, Globelics, other LICs networks and related research activities, conferences, and academies - in recuperating and enlarging the significant knowledge inherited from Chris Freeman and many other wise human beings; and (iii) Chris Freeman's message to the participants of the I Globelics Conference, held in Rio de Janeiro, in November, 2003:

"I hope that in your deliberations you will help to find some answers to the questions that T.S. Elliott asked already in the 1930s in his poetry:

Where is the wisdom that we have lost in knowledge?

Where is the knowledge we have lost in information?

I am sure that your meeting will help to prevent the domination of the global economy by reductionists, demagogues and colonialists and to diffuse a humanistic as well as a scientific spirit through the global knowledge economy."

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