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Gap in Techno-Scientific Activity:

The Iberoamerican Context[1]

Juan R. Coca[2]

Jesús A. Valero Matas[3]

Francesca Randazzo[4]

Abstract: The aim of this paper is to apply the hermeneutic approach to social imaginaries of science and technology. Special attention will be given to discuss how the techno-scientific system intends to face poverty, although the system focuses to a different direction, which is a growing inter-penetration with the economic system. The techno-scientific system, as well as its politics, sets aside poor people. In such a context, the scientific-technologic gap continues to grow, generating gradually two different paces of international development. Factors like the cyborgization, robotization, the development of ITCs, etc., have an impact into the poorest regions, ending up into situations of technologic-scientific neo-colonialism. In spite of peripheral states efforts, the possible development of these regions is an always faced and never overcome challenge. Transformations of the scientific-technologic system, which are more and more scientifically and technologically dependent every day, constitute as a gap.

Key words: Science; technology; poverty; scientific-technologic gap

Nowadays, the possibilities for human auto-transformation through the development of (bio)technologies are increasing (Coca and Valero 2010). Thinking the human being as a *cyborg* is less of a sciences fiction scenery and more of the daily world. The era or paradigm where we are immersed is not free from great controversies and challenges. One of which, and perhaps, the main one, is that of the possibilities of (bio) technological human self-transformation. As a consequence, the human being starts to be considered as a cyborg, which implies many fields: ethical, political, anthropological, philosophical, social, etc. This new way of understanding what it means to be human is based upon the development of a conjunction of bio-technologic social imaginaries. In this paper, our premise is the growing inter-penetration between the techno-scientific and the economic systems and we study in depth the social imaginaries which are formed based on it. This analysis points as well to the north-south gap, implemented upon the social imaginaries which take part on this inter-systemic interaction. It must be

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[2] Centro de Estudios y Análisis Social de Galicia. www.ceasga.org. E-mail: info@ceasga.org.
[3] Departamento de Sociología y Trabajo Social. Universidad de Valladolid. Campus de Palencia.
[4] Universidad de Santiago de Compostela.

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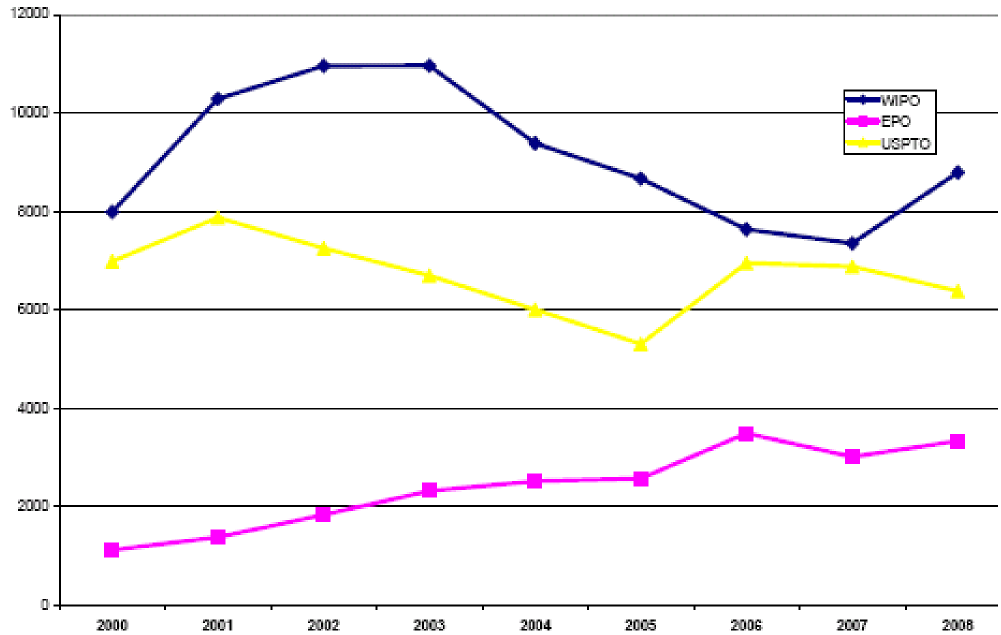
taken into account that this paper is centered, specifically on the Spanish-speaking region, with more emphasis on Spain.

Different techno-scientific agents are required to carry out research projects, where both the university and the enterprise share common goals. Thus, economic-business factors that condition, alter, and influence the techno-scientific system have to be considered to understand the development of current techno-science. At the same time, we focus on the development of the biotechnology sector in order to be aware of the techno-scientific system. We must point out that the process of patenting products is a basic process in enterprises with a technologic base; it allows to protect the results of an activity previously known as R&D (research and development) and currently known as R&D&i (research and development and innovation). This fact creates a negative social protection problem among the social system sectors, which value the business system negatively. Furthermore, patents play a key role in company's business strategy. In fact, some companies (according to the market, the economic potential, the developed product and their competitors' current situation) can end up deciding that the best option to protect their inventions is hiding and being secretive about them (Barrete, 2009).

When studying the current development of patents in Iberian America, the team coordinated by Barrete (2009) focused on the data coming from the World Intellectual Property Organization (WIPO), the United States Patent and Trademark Office (USPTO) and the European Patent Office (EPO).

Data coming from the WIPO show that during the two-year period of 2000-2001 there was an important increase of patents, from 7,989 to 10,827, that is, an increase of 29% during that period regarding the data of 2000. The number of patents registered in 2001 stayed the same the following year and it started to decrease after 2002. Oddly, in 2006 there were fewer patents than in 2000 (less than 8,000). In 2007, the figures continued to drop. However, in 2008 the tendency changed dramatically, reaching a similar number to that of 2005—8,763 patents.



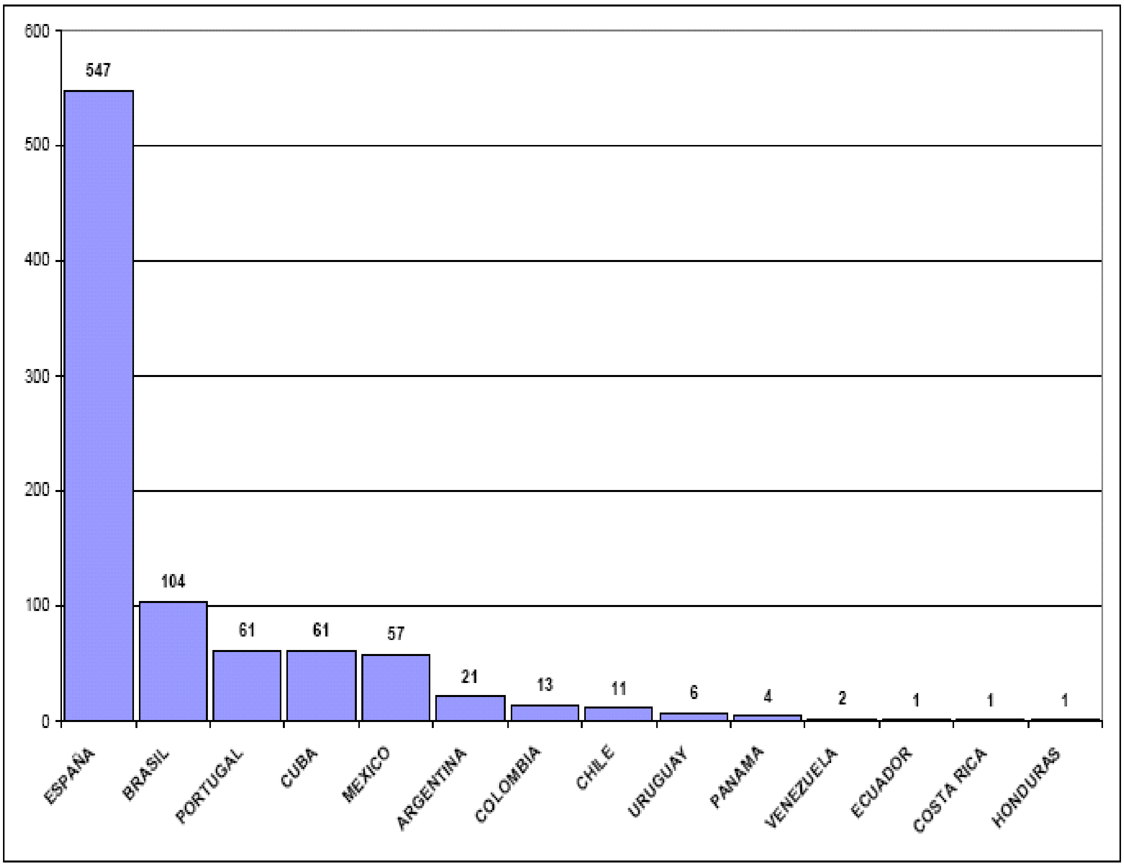
Source: Barrete, 2009.

Figure 1: TOTAL PATENTS GRANTED IN BIOTECHNOLOGY (WIPO, USPTO, EPO)

According to the USPTO, the number of patents registered in 2000 was about 7,000, reaching almost 8,000 in 2001 and then decreasing constantly until 2005. Later, in 2006 the figures were similar to those in 2000 and they stayed more or less constant until 2007. They finally dropped the following year to 6,000 patents.

The data coming from the EPO differ from that coming from other sources. In fact, the number of patents registered for the period 2000-2008 increased basically every single year. However, the chart shows that this rise was moderate in the two-year period of 2006-2008. But if we only consider the Iberian American regions, we can see that Spain was the country with the largest number of patents compared to the rest of countries of this macro-region. In fact, over the period of 2000-2008 the number of registered patents (according to the holder of them) was 547 for Spain, followed by 104 in Brazil, 61 in Portugal and Cuba, 57 in Mexico, 21 in Argentina, 13 in Colombia, 11 in Chile, whereas the rest were below 10.

Data shows that Spain is the Iberian American country with the largest number of patents over the last few years. We can use this as an example to comprehend the guidelines of progress and development of the biotechnological sector. In fact, according to Barrete, the number of patents held by Spain reached 60% of all those developed in Iberian America. Furthermore, biotechnological patents were concentrated in the five first countries which produce biotechnological patents, reaching 95% of the total production of Iberian America (Barrete, 2009).



Source: Barrete (2009).

Figure 2: IBERIAN AMERICAN PATENTS IN BIOTECHNOLOGY (WIPO) AS FOR THE COUNTRY OF THE HOLDER

As we know, one of the more developed biotechnological sectors is genetically modified crops. In this sense, over the period ranging from year 1996 to 2007, there has been a constant and continued increase of the world surface used for these kind of crops (James, 2007). On the other hand, in 2007, the number of countries which produced this type of biotechnological crops reached 23, 12 of which were impoverished, while 11 were industrialized (James, 2007). This shows us that unfavorable regions see a possibility to try to get out of their economically difficult states through the production of biotechnological organisms.

Table 1: World surface cultivated with agri-biotechnological products in 2007

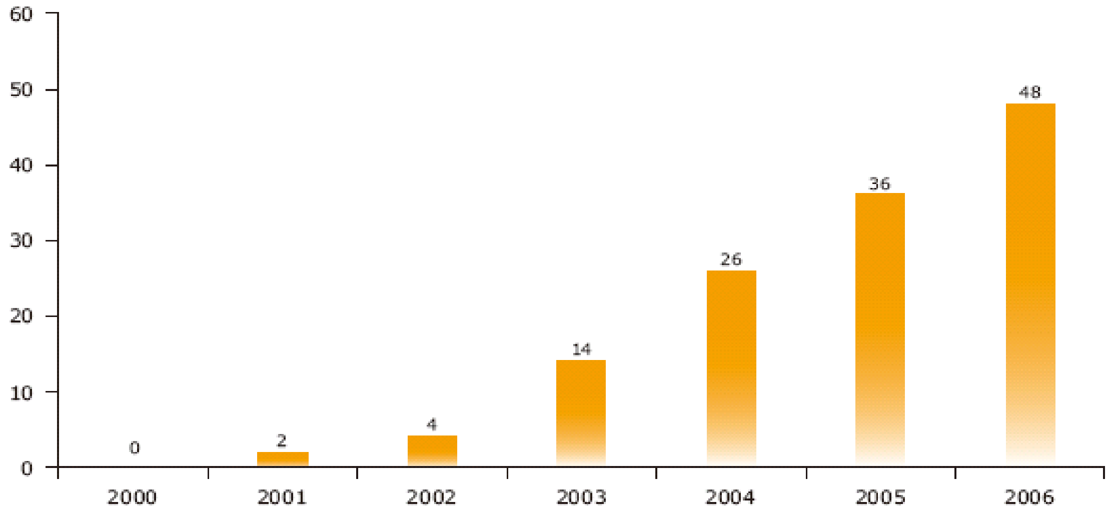
Rank	País	Surface (millions of hectares)	Type of crop
1	USA *	57.7	Soy, corn, cotton, pumpkin, papaya, colza and alfalfa
2	Argentina *	19.1	Soy, corn and cotton
3	Brazil *	15.0	Soy and cotton
4	Canada *	7.0	Colza, corn and soy
5	India *	6.2	Cotton
6	China *	3.8	Cotton, tomato, poplar, petunia, papaya and sweet pepper
7	Paraguay *	2.6	Soy
8	South Africa *	1.8	Corn, soy and cotton
9	Uruguay *	0.5	Soy and corn
10	Philippines *	0.3	Corn
11	Australia *	0.1	Cotton
12	Spain *	0.1	Corn
13	Mexico *	0.1	Cotton and soy
14	Colombia	<0.1	Cotton and carnation
15	Chile	<0.1	Corn, soy and colza
16	France	<0.1	Corn
17	Honduras	<0.1	Corn
18	Czech Republic	<0.1	Corn
19	Portugal	<0.1	Corn
20	Germany	<0.1	Corn
21	Slovakia	<0.1	Corn
22	Rumania	<0.1	Corn
23	Poland	<0.1	Corn

* Biotechnological mega-countries which grow at least 50,000 hectares of genetically modified crops.
Source: Clive James (2007).

As we can see, the USA is the world's number one producer of genetically modified organisms, with a production which amounts to 50% of the total amount of GMOs (genetically modified organisms). Thus, the USA has a leading role —according to the description of international relations based on the center/periphery code— in the center of the biotechnological system based on the production of GMOs, as well as according to the levels of patents developed. However, certain countries, such as Argentina and Brazil, are gradually increasing their crop surfaces to reach relatively wide levels after a positive assessment of the economic and social possibilities that could be generated by these biotechnological devices. At the same time, according to James (2007), the forecast for year 2015 is that both the number of agri-biotechnological countries and the crops and hectares will be duplicated. In fact, countries such as Burkina Faso and Egypt are the next in line to develop GMOs; Vietnam may also be included among them. All this will mean that the number of future GMO farmers will reach a total of 100 million.

Regarding the Iberian American region, Spain is the state with the most biotechnological production, if we measure the data in terms of patents, followed distantly by Brazil. In this sense, according to the report *Biotechnology in Iberian America*, there is a lack of private sector dynamism since the main biotechnological patent holders are Spanish. In fact, nine out of ten of the main holders are Spanish, whereas the rest are of Cuban origin. At the same time, among the Spanish holders, the CSIC (Spanish National Research Council) is the main holder by far. For this reason, just looking at the biotechnological economic system in Spain is enough to understand the situation, with the sole exception of the data shown above.

On the other hand, the report *Relevance of Biotechnology in Spain 2007* carried out by the 'Fundación Genoma España', shows the data of production of technological enterprises in Spain. This information is important because it gives us an idea of the biotechnological sector evolution in an economic-business context.



Source: Garcés, F.; Montero, J. and Vega, M. (2007).

Figure 3: Evolution of the number of *spin-off* created following Spanish universities

In this sense, over the period 2000-2006, there has been a remarkable increase in the number of biotechnological enterprises created in Spanish universities. In fact, there were zero enterprises in year 2000, but in 2006 there were 48. After the phase 2002-2003 we can observe the tendency of a constant increase in the creation of spin-off (technological enterprises). In fact, 4 corporations were created in year 2002, whereas the increase was of 10 new enterprises in 2003, 12 in 2004, 10 in 2005 and, finally, 12 in 2006. This shows us that the initial pattern started in Spanish universities—which can also be generalized to higher education centers in Latin America—where they try to cause research groups to become the seeds of future enterprises. For this reason, the current techno-scientific system tries to teach and make the new techno-scientific students into future entrepreneurs. The education system becomes a transmission center between the new co-evolutionary process, the techno-scientific system and the economic-business system.

Regarding the main biotechnological products of Latin America, the Spanish National Statistics Institute (INE) shows that, in year 2007, the total number of enterprises that developed biotechnology to a great or lesser extent was 764. However, not all of them were involved in innovative creation, an activity which generates new applications and knowledge. Therefore, the number of enterprises involved R&D in 2007 was 561, most of them with less than 250 employees. On the other hand, the number of corporations that use biotechnology either mainly or exclusively is 257, whereas those which use biotechnology secondarily are 179. Of all Spanish enterprises, 257 (33.6%) are involved in biotechnological activities mainly and/or exclusively; whereas 179 (23.4%) have biotechnology as their secondary business activity. Finally, for 328 companies (43%) biotechnology is a key, but not primary, production activity.

This data series about the situation of biotechnological enterprises in Spain illustrates the increasing importance of this activity in the development of the Spanish economic-business system. In fact, over the last few years, biotechnology (in the broader sense) is, together with information and communication technologies, one of the main pillars of the so-called "new" production system. The development of the techno-scientific energy sector has also been acquiring importance over the last few years; for this reason, it has become another basic economic-business sector. However, some of the breakthroughs coming from this sector involve biotechnological developments. For example, progress generated after the studies and research on third and fourth generation bio-fuel, production of GMOs to obtain biomass or oils to obtain bio-fuel, etc.

Table 2: Use of biotechnology by activity sectors, main variables and size of company (2007).

Unit: millions of Euros

	< 250 employees	250 and more employees	Total 2007
COMPANIES			
Companies active in biotechnology (Bt)	691	73	764
Companies active in R&D in Bt	506	55	561
Companies classified in accordance with the Bt they generate: Genetic Code	36	38	36
Companies classified in accordance with the Bt they generate: Functional units	33	38	34
Companies classified in accordance with the Bt they generate: Cell and tissue culture and engineering	32	44	33
Companies classified in accordance with the Bt they generate: Bio-processes	48	52	48
Companies classified in accordance with the Bt they generate: Sub-cellular organisms	14	19	14
Companies classified in accordance with the Bt they generate: Other	20	10	19
Companies where Bt activities are: main and/or exclusive	238	19	257
Companies where Bt activities are: a second business line	163	16	179
Companies where Bt activities are: a necessary tool for production	290	38	328
Companies classified according to the area(s) of final application of the use of Bt: Human health	43	48	43
Companies classified according to the area(s) of final application of the use of Bt: animal and aquaculture	21	14	21
Companies classified according to the area(s) of final application of the use of Bt: Food	37	33	37
Companies classified according to the area(s) of final application of the use of Bt: Agriculture and forest production	21	12	20
Companies classified according to the area(s) of final application of the use of Bt: Environment	20	15	19
Companies classified according to the area(s) of final application of the use of Bt: Industry	13	5	12

Source: Spanish National Statistics Institute, INE (http://www.ines.es)

Therefore, from an economic-business perspective, the relevance of the biotechnological sector is increasing relative to other sectors, although the economic-business development of this new technology in Iberian American States is clearly inferior compared to the USA's development. However, there is a widespread institutional consideration that the biotechnological development will bring more benefits than damages. For this reason, countries such as Argentina, Brazil, Paraguay and Uruguay have decided production is their best bet, and are among the 10 top-producing regions of ago-biotechnological devices (as we see in the above data). The data, on the other hand, does not show a correlation with an increase of patents coming from these countries; this means that these regions are becoming sources of biotechnological material but are still dependent on the necessary development tools as well as the development of new biotechnological varieties.

All this lead us to assert that there is a current Social Imaginary (SI) which we will name the *development/underdevelopment SI*. With this name we try to underline the discourse —positive or negative—of the influence of biotechnology in the world's impoverished regions. This SI leads to a certain discourse where, on the one hand, there are those who assert that developing these biotechnological devices will increase food, economic and social security in those States. The following are clear examples found on the Internet:

> "The report [Biotechnology for Europe] demonstrates that biotechnological applications for the agricultural food sector have improved production efficiency and food safety (www.consumer.es 26 April 2007)"
>
> "According to the FAO report, in the next 30 years about two billion people will depend on agriculture; thus, it will be necessary to develop technologies that combine aims such as increasing the yield, protecting the environment, responding to customers' worries regarding food quality and safety, promoting rural means of subsistence, and food safety for the poorest communities. The FAO insists that biotechnology should complement traditional agriculture technologies because they think that biotechnology can accelerate the conventional improvement programs and reach solutions when conventional technologies fail" (www.consumer.es 18 May 2004).

On the other hand, there are those who assert the opposite, that is, a greater insecurity and dependence of these regions:

> "Developing countries, particularly those with low incomes, reject this type of food because most of them are unsure about said food's benefits and safety and are afraid of depending on multinational corporations and losing opportunities to sell in the European market" (www.consumer.es 29 October 2007).

We can construct three binary codes which are quasi-synonymous: humanitarianism/ colonization, future/past, and innovation/tradition. In this discourse of the SI of development/ underdevelopment, the need to acquire new bio-technologies for humanitarian progress as an innovative and positive future for human development is demonstrated. On the other hand, we see the negative-outcome code: colonization, past, and tradition—it is a smaller concern, as it simply looks at the discursive appendix, which argues to reject GMOs. Therefore, the underdevelopment, SI was once open to the economic-business context, promoting the *myth of the pacifying market* (Sánchez Capdequí, 2003). This causes the transmission of this SI's information about the negative functional operator to be closed and encapsulated by the first.

> "In 2007, biotechnological crops were a very important milestone with humanitarian consequences: for the first time, there were more than 10 million poor small farmers who benefited from these kinds of crops in developing countries" (James 2007:5)

These words by Clive James are a clear example of our assertion. The increase of production of biotechnological organisms is always positive and has a great impact on humanity because "developing" countries have the opportunity to improve their current situation. For this reason, in this SI it is common to see the use terms such as "opportunity," "occasion" or "possibility" referring to the use of bio-technologies (or their products). They use a vassalage rhetoric because the biotechnological products (that is, of the countries in the system's center) offer them a new means of escaping from their current situation. When presented with such a chance, the vassals have the "opportunity," "occasion" or "possibility" to use and apply these products and activities to escape from the "underdeveloped" situation in which they find themselves.

There has been no developmentalist discourse of biotechnology during the first stages of the debate about biotechnology's suitability. The above-mentioned rhetoric has come about as a reply to the biodiversity SI and the initial security SI (which is currently more business oriented) and it is accepted by experts. In fact, José Félix Tezanos shows that, thanks to the Delphi 2005 studies, where 51 experts in human genetics and biotechnology responded to 135 questionnaires, we can see that the experts think that scientific-technological innovations have the power to reduce hunger in the world—however, this also implies a greater international dependence and increases the north/south gap (Tezanos, 2007). At this point, it is important to remember the words of García Canclini (2006) in his work *Different, unequal and disconnected* where he says that:

> "[…] the illusion of being completely free, that we could change national identity, class and gender, made easier by anonymity and distance in virtual interactions evaporates when our ethnic aspects or our gestures make visible the history of belonging to one country or the other guarded customs of contemporary societies. It must be made clear that practices are not mere implementation of the habitus produced by family and school education, through the internalization of social norms. When practiced, they become actions, the dispositions of the habitus, which have found the best conditions in which to be implemented and, maybe, go on beyond mere repetition " (García Canclini, 2006: 158).

The words of Néstor García Canclini (2006), a clear reference to Pierre Bourdieu (1984) show us that, in a way, in spite of the fact that the underdevelopment SI demonstrates the ability to bring about transformations in the most impoverished regions (transformations which, it must not be forgotten, also imply an identity change beginning when they begin to employ the "western" techno-scientific activity), in their own identities, the "belongings on a frontier" cause a transcendence of what we could call as the biotechnological *habitus*. Therefore, either we take the processes of inner transformation or we fall into an attempted process of "identity cloning" or assumption of neocolonialism by means of the biotechnological activity increasing the transnational dependence processes, as well as a loss of their own techno-scientific identity.

At this point, we must keep in mind the fact that the discourse of the techno-scientific core implicitly contains a mythologization process of its activity. Hence, the techno-science transmits an SI that rejects any other non-techno-scientific knowledge because, on grounds of that myth, this knowledge is the only Truth possessor (Coca, 2009 and 2010). This is how the *truth mythologization* process of the inherent activity and the conditioned techno-scientific products is created, as well as by the existence of the other great modern myth: *The pacifying market myth*.

The spread of this group of myths ended up binding together a symbology that later turned into stories. This is where the main problem is because these stories ended up as the bedside book of those who defended the *-ism* and, therefore, became the pillar which supported this society (Valero and Coca, 2009: 235). For this reason, it is possible to prove that most of the techno-scientific agents take the *-ism* of the technoscientifism by setting up their own identity as system agents. In this myth of the techno-scientific truth, the aspects positivist paradigm held (neutrality, objectivity and progression) became more important. This myth permeated in a centripetal way (center → periphery) and is now held as their own by the system's peripheral regions, which, in a identity legitimization process, made it absolute and conceived it as the only way out, which allowed them to get out of the social and economic situation in which they found themselves.

However, the techno-scientific system is developed in a way that it sets up its later evolutions in previous techno-scientific foundations. For this reason, the regions with a greater biotechnological implementation are gradually distancing themselves from the rest. This is due to: 1) the lock process inherent to industrial patents, which, far from practicing a common policy of knowledge, searches for epistemic isolation, and 2) the fact that the new techno-science is extremely expensive, which creates a large economic filter, and thus not allowing the regions with lower GDP (Gross Domestic Product) to have good access to biotechnology.

All this is creating a sort of techno-scientific neocolonialism based on the knowledge and the devices used to implement it. This process is undertaken by the neo-colonized when they find that techno-scientific progress is linear and can only be carried out in one way. However, techno-scientific development fulfills a certain function within the social project where it is inscribed (Cohen, 2006). This is why there is a possibility to "walk" in a development path different to the current capitalist techno-scientist system. The question would be, then, to know the risks of taking that option.

In the Iberian American context, which is the object of this paper, most of the States in this region develop their techno-scientific activities using technologies, devices and knowledge coming from countries which are in the "center" of the techno-scientific system. In this context imagineries of the scientists are very important. They insist that they intend to produce contributions to social progress, and that their research methods are themselves value neutral. Thus, nothing that they do as scientists could be responsible for blocking social progress (Harding 2006: 2). Moreover, the scientific progress is determinate and inevitable, and is based in a new colonial proccess.

This new colonial process (postcolonial) has as a target maintaining the control of the biotechnological sector by establishing clear gaps between the center and the periphery, or between the north and the south of the planet, if that is what we prefer. This does not mean that periphery or semi-periphery regions, such as Iberian America, cannot take steps toward the acquisition of new biotechnological devices and improvements. What we try to assert here is that, in spite of everything, the differences between the center and the periphery will increase unless the less bio-technologically developed regions make a tremendous economic, social and educative effort to escape from the situation. However, we think that there are many uncertainties regarding this topic, as it has recently occurred in Spain, since the techno-scientific system is weak and not very socially consolidated, in an economic crisis like the current one, the budget items for this system are reduced, causing a techno-scientific involution.

Finally and as a consequence of taking as own the myth of the pacifying market, Iberian American societies bet on a "cloned" biotechnological sector. In this system the unification of company-university is not altered. On the contrary, it is seen as the functional mechanism for implementing the techno-scientific system of this region. However, internalizing this techno-scientific configuration favors even more the situation of (semi)dependence. This is due to the fact that the Iberian American spin-off's only target will be developing a biotechnological device with marketability and that, therefore, will not be focused on majority interests whose target group has a low- or medium-high economic level. For this reason and in order to minimize costs, they will resort to biotechnological devices developed by other corporations placed in the center of the system and will target the development and implementation of biotechnological products which, to a greater extent, have previously begun in other regions.

All this allows us to conclude that the current development of the techno-scientific system, taking biotechnology as an example, will maintain the gap and may even increase it. It will be necessary to keep researching and studying how the system evolves and to try to establish social engineering mechanisms (Dagnino & Thomas, 1999) that transform the system, correcting the mistakes. If we accept this, we will feel obliged to disregard a non-interventionist social system conception, but this idea will be developed in later works.

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