

## Constructivist Paradoxes Part 2: Latin American STS, between Centers and Peripheries

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### Abstract

There is a certain ‘failure’ in what we could call the *modern* development of the STS field over the past decade, i.e. a large number of studies—particularly empirical—that were deployed from the 1970s onwards. Indeed, one of their original and crucial objectives was to emphasize the local, situated, contingent character of the processes of production and negotiation of knowledge. However, these studies mostly concentrate on one part of the world, i.e. the most developed countries, precisely where modern science, commonly referred to as “Western Science,” developed. This limitation—surely intuitive or “natural”—has several consequences analyzed in this article. In summary, these limitations can be analyzed in terms of the objects of research (the various forms of knowledge) but also in terms of the theories and methods used to account for them. The aim is to discuss the construction of a double (or even triple) peripheral situation, which calls into question the old principles of symmetry and impartiality ([Bloor 1976](#); [Collins 1981](#)): on the one hand, the peripheral character of the objects analyzed (i.e. science and scientific development outside Euro-America) and, in parallel, the peripheral situation of the communities of specialists who dedicate themselves to studying them. Connected to this, an additional question emerges: What are the theoretical frameworks and methodologies best suited to account for these objects in their respective contexts? Is it suitable to simply apply to these objects of study the same theoretical frameworks and methods commonly used to analyze hegemonic science? And last but not least, how to approach the (scientific, cultural, political) relationships between different contexts in a highly globalized world? This is the second of two parts: while in the first one I discuss the “failures” of the hegemonic paradigm in STS and its consequences in relation to non-hegemonic contexts, in this second part I focus on the problems raised by post-colonial approaches, on the “peripheral techno-science” as an object for STS scholars and, as a specific case, the development of STS research in Latin America and the dynamics of its specific agendas.

### Keywords

situated knowledge; centers and peripheries; global science; Latin America

### Introduction

In the first part of this article ([Kreimer 2022b](#)), I was concerned with pointing out the problems or failures presented by the constructivist approaches: although there was a strong emphasis on the situated character of knowledge, these currents only dealt with the mainstream sites where it is produced (generally speaking Euro-America, according to [Law and Lin 2017](#)), and left aside the rest of the world, i.e., the “peripheries.” I

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wondered, there, what are the theoretical frameworks and methodologies best suited to account for these objects in their respective contexts? Is it suitable to simply apply to these objects of study the same theoretical frameworks and methods commonly used to analyze hegemonic science? And what kind of approaches can help understand the (scientific, cultural, political) relationships between different contexts in a highly globalized world?

I propose here to discuss, as a starting point, the ideas put forward by postcolonial studies, since they proposed—in a very creative way—an awareness of the hegemonic character of the views on science anchored in certain common sense. Then, I will comment on two concepts that have been quite controversial for several years: “asymmetry,” and “centers and peripheries.” From there, I will analyze research agendas and orientations of STS studies in Latin America, one of the non-hegemonic regions that have been more active in recent decades. Based on this, I will propose the notion of “double peripherality” to explain the position of STS researchers in non-hegemonic contexts. Finally, I will present a supplementary section, with the topics that have organized research on STS issues in Latin America, together with a selection of reference works.

#### **Attempts to De-Center Science and Technology Studies: Postcolonial STS**

Facing the aforementioned difficulty or failure of hegemonic STS studies to understand knowledge located beyond the central or more developed countries, one of the perspectives that attempted to generate analytical frameworks that overcame these limitations were the postcolonial currents. Indeed, this perspective was not only deployed in relation to the social studies of science and technology, but is part of a larger movement that questioned the Eurocentrism present—explicitly or implicitly—in various approaches within the social sciences and humanities. These perspectives represented an important advance in the thematization of the issue but from my point of view, while their authors are very relevant scholars in the STS field, their contributions are not entirely satisfactory, as I will try to show below.

#### **Attending to the Relationship between ‘Peripheral’ and ‘Hegemonic’: Western Science Limitations**

The “postcolonial” is a problematic concept. In the first issue of the journal *Postcolonial Studies* (1998, 8), the editors noted that “The term, undeniably and necessarily vague, a gesture rather than a demarcation, points not towards a new knowledge, but rather towards an examination and critique of knowledges.” Such vagueness may explain the postcolonial concept’s success, as happened, according to Michel Callon and Bruno Latour (1991), with the famous term paradigm proposed by Thomas Kuhn in 1962 (Kuhn 1962): its vagueness and ambiguities instead of being a source of weakness, hold the key to its widespread dissemination for decades to come.<sup>1</sup> The two terms actually bear a familiar resemblance: as concepts, they are used to break with an existing theoretical order; the notion of science as accumulating knowledge indefinitely without a break in Kuhn’s case; the notion of “Western or hegemonic thinking” in postcolonial

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<sup>1</sup>These authors say: “The success of Thomas Kuhn’s book [...] lies in a magic word, which carries all the meanings and all ambiguities, namely ‘paradigm’” (Callon and Latour 1991, 17).

studies. According to the editorial comment mentioned above, the choice of this concept is justified as follows:

Postcolonialism is what we employ to excavate the marginal, the magical, the erotic [sic] and the everyday. It means engaging seriously with circuits of knowledge that lie outside the well-worn paths of the North American academic market. ([ibid., 10](#))

Warwick Anderson ([2002, 643](#)) points to something similar, no longer referring only to “postcolonial studies,” but to the more specific “postcolonial STS studies”—“‘Postcolonial technoscience’ is a deliberately ambiguous title, calculated to elicit the question: ‘What might it mean?’” And he concludes;

The term ‘postcolonial’ thus refers both to new configurations of technoscience and to the critical modes of analysis that identify them. ([ibid.](#))

Since then, postcolonial literature has steadily expanded. The purpose is clear, but the concept grates, at least from a Latin American standpoint. And that is paradoxical because part of the inspiration sprang precisely from this region.

The concept grates, in part, because the postcolonial period in Latin America runs through the nineteenth century, from the first wave of Spanish independence around 1810 to the independence of Brazil and Cuba towards the end of the century. Of course, throughout the twentieth century, the notion of economic colonialism was discussed in the region at length, but it coexisted with many other concepts.<sup>2</sup> Naturally, the concept can be used metaphorically or figuratively, but from a strictly historiographical point of view, the formal rupture of the colonies took place, in most countries, from the beginning of the nineteenth century, and during the following decades a period of organization of national states and the articulation of economies highly dependent on raw materials developed, but certainly very different from the colonial period ([Halperin Donghi 1969](#)).<sup>3</sup>

Many authors are aware of the difficulties entailed by the idea of the “postcolonial.” Sandra Harding ([2011](#)), for example, published an exciting book aimed at students, in which she selects various texts tackling different aspects of the issue. In the introduction, she acknowledges that the notion of the postcolonial has been much discussed and that, far from being unequivocal, it offers various meanings. My personal reading is that, in this case, the mobilizing power of the concept is more important to Harding than conceptual

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<sup>2</sup>For an extensive discussion of the notion of colonialism in the region, see the book compiled by Edgardo Lander ([1993](#)), “La colonialidad del saber: Eurocentrismo y ciencias sociales,” with such iconic authors of this school of thought as Anibal Quijano, Walter Dignolo, Enrique Dussel, Arturo Escobar, and others.

<sup>3</sup>Interestingly, Roy MacLeod distinguishes between “formal” and “informal” scientific colonial domains: “There are also obvious differences in the requirements of ‘official science’ in different places, and thus in the overall complexion of ‘imperial science’ in the political configuration of the settled colonies, India, the ‘occupied’ empire, and the informal empire of Latin America” MacLeod ([1980, 14](#)).

precision. In other words, insofar as postcolonial dimensions allow various categories of ignored, subaltern, or even marginalized or repressed issues to be included, it is justified, more politically than academically—though these boundaries are certainly fuzzy—to deploy this notion. Indeed, in a previous text, Harding stated that “We can employ the category of the postcolonial strategically as a kind of instrument or method of detecting phenomena that otherwise are occluded” ([Harding 1998, 8](#)).

In short, I have to say that I share—enthusiastically—both purposes, but that I am not convinced by the solution adopted to date, for reasons I will go into below.

Warwick Anderson, for his part, admits that;

[. . .] the ‘postcolonial’ has proven a productively ambiguous intellectual site. It has been taken to signify a time period (after the colonial); a location (where the colonial was); a critique of the legacy of colonialism; an ideological backing for newly created states; a demonstration of the complicity of Western knowledge with colonial projects; or an argument that colonial engagements can reveal the ambivalence, anxiety and instability deep within Western thought and practice ([Anderson 2002, 645](#)).

At first, the postcolonial perspective in STS was used as a weapon to get rid of approaches that prevented the observation of technoscientific development in non-hegemonic contexts, beyond diffusionist perspectives, such as those of Georges Basalla ([1967](#)), which practically assumed that the contexts of reception were little more than a tabula rasa. And the same was true for even more refined perspectives, such as Lewis Pyenson’s detailed work on the expansion of German ([1985](#)) or French ([1993](#)) science.

In a second moment, these perspectives proposed to advance in two closely linked issues: on the one hand, to break with the dichotomies that, in a binary form,

still operate in terms of global/local, first-world/third-world, Western/Indigenous, modern/traditional, developed/underdeveloped, big-science/small-science, nuclear/non-nuclear, and even theory/practice. . . ([Anderson 2002, 644](#)).

In contrast to these dichotomies, attention has been drawn to the contact or trading zones ([Galison 1999](#)) that show the complex, negotiated, localized character of technoscientific relations between diverse actors endowed with different cultural or economic capital. Certainly, this approach makes visible, as Harding ([1998](#)) pointed out, that which would otherwise remain hidden or barely visible.

On the other hand, most postcolonial STS studies focus on the relationship between modern science and “other cultures”: on the links between indigenous or traditional knowledge and “Western” knowledge, on highlighting that “non-Western” peoples are also bearers of knowledge and that they often challenge Western science, instituted as the source of rationality par excellence. A good example of these are the excellent texts compiled by Harding ([2011](#)) in *The Postcolonial Science and Technology Studies Reader*. However, studies about the asymmetries within modern science, i.e., the different ways of practicing science in a globalized world—what I recently called *peripheral modernities* ([Kreimer 2019](#))—are very scarce.

Paradoxically, as postcolonial STS studies became more anthropological, with the aim of rescuing other knowledge that official science makes invisible under the label of irrational, pre-modern or the like, they were leaving aside the ways of producing “Western science” in non-hegemonic contexts. This had been more prevalent in the more traditional studies of science and empire. As I have tried to show some years ago ([Kreimer and Lugones 2002, 2016a](#)), in these sites, which we could call “semi-peripheral,” beyond the fact that some actors produce “other” valuable forms of knowledge, scientific elites are deeply integrated to Euro-American science. It is just that their form of integration is strongly subordinated to power relations.

Thus, in parallel to (or in contrast to) postcolonial STS studies, I prefer to emphasize the emergence and development of STS studies in semi-peripheral contexts. In them, their theoretical frameworks and methodologies may be relatively similar to mainstream STS (a process that sometimes takes the form of “uncritical importation” of concepts and methods, as I pointed out in the previous part of this article, [Kreimer 2022b](#)), but nevertheless, their agendas are structured around other axes, and point to different issues.

Therefore, I consider that one of the central issues that we will have to emphasize is the persistence of asymmetries within “Western science,” and not only between Western science and “other” forms of knowledge. Thus, we need to revisit in a new light the notions of centers and peripheries, as I will do in the following section.

### Centers and Peripheries: A Conceptual and Empirical Proposal

The notion of “center” and “periphery” as outlined by Edward Shils in [1961](#)—and taken up by many other authors in subsequent years—certainly had its problems. Understood both as a social theory and as an attempt to conceptualize the existence of scientific center and periphery, the concept derives from a structural approach, in which a set of variables is a powerful determining factor for the relative state of each context. To greatly summarize the contributions, we can state that this was present in the theory of unequal exchange, with the gradual deterioration of its terms of trade, as Prebisch ([1950](#)) pointed out, and in the analysis of Gunder Frank, for whom;

“My thesis is that these capitalist contradictions and the historical development of the capitalist system have generated underdevelopment in the peripheral satellites whose economic surplus was expropriated, while generating economic development in the metropolitan centers which appropriate that surplus—and, further, that this process still continues.” ([Gunder Frank 1965, 12](#)).

Analyses close to Gunder Frank’s can be found in a whole generation of Latin American critical authors, such as Pablo González Casanova ([1969](#)), Ruy Mauro Marini ([\[1973\] 2008](#)), and possibly the most widely known work is Fernando Henrique Cardoso and Enzo Faletto’s *Dependency and Development in Latin America* ([1969](#)), an icon of dependency theory.

These approaches refer to two key issues: the first provides a robust analytical framework to the issue of asymmetries, challenging the “one-way” theory suggested, for example, by the well-known book by Walt Whitman Rostow ([1960](#)), who established a canonical model based on the stages of economic growth that

should be followed, in a more or less similar way, by most developing countries. This process began with the traditional society and ended in self-sustained growth, or take-off ([ibid., ch. 2–4](#)). In contrast, dependency theorists argued that there is no single path to economic growth, i.e., that developing countries are not simply more “backward” on the same path, but that there are structural conditions that operate as barriers to development. Thus, they conclude that underdevelopment is functional to the success of more advanced countries: both paths—development and underdevelopment—were connected as “two sides of the same coin.” And second, they clearly indicate the structural basis for the state of centers and peripheries.

I propose to conduct a parallel interpretation of these structuralist criticisms of the “single path” with criticisms of the scientific development model, also formulated in “stages” by Basalla ([1967](#)). Indeed, Basalla suggested the details of the phases in the spread of Western science from center to periphery. According to Basalla, in phase one, expeditions in the periphery merely provided raw material for European science; during phase two the derivative and dependent institutions of colonial science emerged; and sometimes, an independent and national science, called phase three, would later develop.<sup>4</sup>

Just as there were refutations of the unilinear perspective of economic development (exemplified in Rostow’s perspective), from developmentalism to dependency theory, so too was the diffusionist and one-way perspective of scientific development challenged from Latin America. In the field of science and technology studies, Amílcar Herrera’s book *Ciencia y política en América Latina* [Science and Politics in Latin America] was published around the same time and by the same publishing house as Cardoso and Faletto’s pioneering book. Herrera is considered, along with Oscar Varsavsky, Jorge Sábato and others, as one of the founders of the “Latin American Thought in Science, Technology and Society” between the 1960s and 1970s:<sup>5</sup>

First of all, it is necessary to emphasize that the difference in quantity and quality of scientific production is only one aspect of the gap that separates our countries from the more developed ones. In advanced countries, most scientific and technological research is carried out in relation to subjects that are directly or indirectly connected with their national objectives, whether these are defense, social progress, prestige, etc. Scientific progress is immediately and spontaneously reflected in the operation of their factories, in their agricultural technology, in their infrastructure and, in general, in the constant increase of production. In Latin America, on the contrary, most of the scientific research carried out bears very little relation to the most pressing needs of the region ([Herrera 1971, 19](#)).

In turn, Oscar Varsavsky ([1969](#)) was one of the first to focus on research agendas in Latin America, pointing out that they were imposed by hegemonic countries and accepted by local elites. He also pointed out that

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<sup>4</sup> For a discussion of the implications of Basalla’s diffusionist analysis, and alternative views, see MacLeod ([1980, 2000](#)). For previous discussions of the parallel between the diffusionist model and the linear model of economic development, see Anderson ([2018](#)), and Kreimer ([2019](#)).

<sup>5</sup> On this movement, see Feld and Kreimer ([2012](#)), Feld ([2015](#)), Kreimer and Vessuri ([2017](#)), among others.

there was an appropriation by the center of the scientific products generated in the periphery, as these countries do not have the capacity to deploy them productively, a topic also pointed out by Herrera.

Taking up these early Latin American reflections, as well as the rich tradition of historical studies that focus on colonial and imperial science ([Barratt-Brown 1963](#); [Alam 1978](#); [Allen 1967](#); [MacLeod 1980](#); [Pyenson 1985](#)) and the emergence of the sociology of scientific knowledge since the 1970s, with its emphasis on situated knowledge, allowed to analyze the international dimensions of “peripheral science” ([Diaz, Texera, and Vessuri 1983](#)) in greater depth and to develop approaches that, with an empirical (sociological and ethnographic) basis, call into question the rigid frameworks of the notion of scientific “center and periphery.”

Indeed, this was about finding a way to surmount both the idealistic limitations of a universalist model and the structural (dualistic or binary) constraints posited by center–periphery models. To this end, I set out several years ago ([Kreimer 1997](#), [Kreimer and Lugones 2002](#)) to look at various issues in order to establish the key concepts: (a) determining the level of meaningful analysis; (b) on that basis, complexifying each regional area, rather than considering large aggregates like “the North” or “developing countries”; (c) focusing on relational analysis and “exchange zones” or “contact zones,” rather than only observing fairly stable structures of domination; (d) focusing on asymmetries. Let us take a very brief look at each concept.

Once the amalgamation of large aggregates has been dismantled (empirically easy, but ideologically complicated, since these categories are firmly anchored, even, as we have seen, in postcolonial authors), the level of analysis is crucial. Universalist and structuralist traditions alike tended to draw two amalgams that are, in my view, untenable: on the one hand, lumping together all the contexts of the “North” or the “periphery” in the same category, which iron out extremely different local realities; on the other, viewing “science” as a fairly homogeneous space, where what goes for a specific field (mathematics or astronomy, for example) is akin to what happens in other fields of knowledge. The key to beating this trap—this fallacy—is to consider a specific field of knowledge and, at the same time, trace the dimensions of its local development, together with the links in that field that occurred in other national or regional contexts.<sup>6</sup>

A perspective that can be useful is the theory of fields, and especially of inter–field relations ([Hess and Fricke 2014](#)). Starting from Pierre Bourdieu’s ([1976](#)) well-known definition of field, several studies have developed the relations of one or several scientific fields with other fields of material and symbolic production. Thus, the notion of the autonomy of scientific fields according to the Bourdieusian formulation is put under tension, and progress is made towards the relations and mutual determinations between scientific fields and other spheres of social organization ([Lave 2012](#)).

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<sup>6</sup> Note that I talk of “fields of knowledge” without aligning them with disciplines, which are often the result rather than the cause of these processes (see [Kreimer 2016b](#)).

In addition to establishing the level of internationalized scientific fields as an object of research, the field theory perspective brings greater robustness, both empirical and theoretical, to the analysis, insofar as it allows us to observe the different types of relationships that unfold. In the particular case of Latin America, as Herrera (see above) and other representatives of the “Latin American Thought” had pointed out, the development of the various scientific fields had strong links with international fields, but very few with other fields at the local level ([Varsavsky 1969](#); [Kreimer 2016a](#)).

Thus, if we focus on a more appropriate level of analysis, we can observe the relational aspects and trading zones. I proposed a particular type of relationship, which I called “subordinated integration” ([Kreimer 1997](#)), arising from my research into the development of knowledge in molecular biology in Argentina. A brief explanation is that a country’s elite of researchers with a degree of “modern” scientific development is, far from being isolated, tightly integrated into international networks. To these networks, they contribute various kinds of knowledge and resources (local knowledge, access to specific cognitive objects, technical capabilities, and so on), while also benefiting from belonging to them. However, effective control of such networks, both intellectual and material, is wielded by groups located in hegemonic contexts.

Looking at Latin American groups’ participation in European programs in the various EU framework programs, we note that “peripheral” groups make significant contributions, but they are restricted to a type of research termed “hyper-normal” ([Lemaine 1980](#)). Here the definition of the topics to be studied, the theoretical control, the technical dimensions and also possible technological applications, are controlled by the groups leading these networks. This led us to mention a new “international division of scientific work” ([Feld and Kreimer 2019](#)). Analyzed at the level of different knowledge fields, this presents us with certain regularities that show that, while metropolises can be mobile, as MacLeod ([1980](#)) interestingly points out, this does not mean that the asymmetries disappear, but that they become more complex in new ways of relating to each other. New centers and new peripheries may, of course, emerge depending on the historical period, as we see with the global nanosciences ([Levin et al. 2016](#)) and the rapid emergence of China-based groups which very quickly became hegemonic. This leads us to a preliminary conclusion of this section: instead of throwing out point-blank the notions of center and periphery, we have to think of *centers* and *peripheries* in the plural, seen as dynamic spaces dependent on the level of social and cognitive aggregation we are analyzing.

### **The Issue of STS Agendas from the Latin American**

We discussed above the problem raised by postcolonial STS studies, which paid more attention to the relations between Western science and other forms of knowledge in peripheral contexts than to the relations between “peripheral Western science” and “mainstream Western science.” Therefore, in this section we will briefly observe how the focus on these questions organized STS research agendas in Latin America in a different way, even if a good part of the theories and methods have been taken (and reproduced) from mainstream STS.

Schematically, we can establish 4 stages in the development of STS research agendas in Latin America:



1. Political concerns.

This stage was that of the pioneers, deployed during the 1960s and '70s by the representatives of "Latin American thinking on STS" (i.e., Amílcar Herrera, Jorge Sabato, Oscar Varsavsky, and Francisco Sagasti). The political concern was twofold: on the one hand, the relationship between science and socialist revolution (these were the years after the Cuban revolution); on the other hand, the concern for the establishment of public policies to strengthen the development of local science and technology. A common concern was to gain greater degrees of autonomy in the face of dependence on hegemonic science (as we have seen, the notion of dependence was common currency in those years).<sup>7</sup>

Although in theoretical terms there was an influence of systems theory, the search was to generate original thinking that would be at the basis of a techno-scientific development useful for the region ([Feld and Kreimer 2012](#)). The problem identified even then was the lack of relations between the world of academic science and the rest of society ([Herrera 1971](#)). Research had a strong "normative" tone and was oriented towards public intervention.

2. Understanding the emergence and development of Latin American technoscience.

While the practitioners of the previous stage were hard scientists or engineers, in this second stage, which began in the 1980s, researchers from the social sciences (sociologists, historians, anthropologists) prevailed, who focused on reconstructing the origins of technoscientific development in these societies, under the general view that it was a "peripheral science" ([Diaz, Texera, and Vessuri 1983](#)). The studies were aimed at understanding the epistemic dimensions and practices in the development of various specific fields, at observing international links (the "reception" of Western science) and at analyzing the relations with the society in which these practices took place.

3. The introduction and use of new theoretical and methodological perspectives: SSK, SCOT, ANT,<sup>8</sup> Coproduction, etc.<sup>9</sup>

This stage, which begins in the final years of the last century, is strongly marked by the development of hegemonic perspectives in the international STS field. There is a particular focus on observing technoscientific practices in the workplace (laboratory studies), negotiations and controversies between various actors, as well as—in particular—the study of various networks. As I pointed out, many times these studies applied more or less mechanically the hegemonic perspectives, without a critical look at the adequacy of these analytical frameworks to the Latin American reality. In parallel, other studies aimed at

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<sup>7</sup> In Latin languages (like Spanish or French) the same word (*política, politique*) is used to designate both "political dimensions" and "policies."

<sup>8</sup> Sociology of Scientific Knowledge (SSK), Social Construction of Technology (SCOT), Actor - Network Theory (ANT).

<sup>9</sup> As we have seen in the first part of this paper, this appropriation did not occur only in Latin America; Fu ([2007](#)) shows a similar phenomenon in East Asia.

finding their own frameworks to account for the development of Latin American technoscience in a context in which increasing globalization was becoming more and more evident.

#### 4. Emergence of new topics, and resurgence of political concerns.

Well into this century, new topics emerged, some of them aligned with international agendas, while others were more characteristic of Latin American development. Thus, we observe studies developed from feminist perspectives, research on environmental issues and ecological disasters, the relationship between man, science and nature, or inquiries about open science and publishing strategies, among other topics. In parallel, other more specifically local issues also emerged, such as studies applied to the role of science and technology for social inclusion, or inquiries about the barriers to the usefulness of scientific knowledge in peripheral contexts, among others. In all of them we observe a concern for the political dimensions that had been partially left aside in the preceding stages and, in a certain sense, a reformulation of the questions formulated half a century earlier by the pioneers.

We can see below a table with a synthesis of some of the most salient topics addressed by STS scholars in Latin America (the list is not exhaustive) and their most prominent authors.<sup>10</sup>

**Table 1: Latin American STS Agendas**

1. Political Concerns	
South–North migrations (and the so–called “brain drain”)	Enrique Oteiza, from 1960s and ’70s.
The need for a national S&T policy and for the development of “autonomous” national systems	Amilcar Herrera, Jorge Sabato, Oscar Varsavsky, Francisco Sagasti, ’60s and ’70s and Renato Dagnino, from the ’80s onwards.
The circulation and importation of policy frameworks: from the creation of National Councils in the 1950s and ’60s, to National Innovation Systems in the 1990s (and many others)	Léa Velho, Rosalba Casas, Adriana Feld, Carlos Nupia, and others, from the ’90s onwards.
University–Industry Relationships	Judith Sutz, Mario Waissbluth, Gabriela Dutrénit, Leonardo Vaccarezza, María Elina Estebanez, Hebe Vessuri, Sandra Brissola, José Eduardo Cassiolato, Eelena Lastres, from the ’70s onwards.
Critical perspectives on innovation policies	Jorge Katz, from the ’70s onwards. Mario Cimoli, Daniel Villavicencio, Judith Sutz, Gabriela Dutrénit, Daniel Chudnovsky, Guillermo Ary Plonsky, and others, from the ’80s onwards.

<sup>10</sup> A detailed literature can be found in a supplementary document ([Kreimer 2022c](#)). For an overview of the development of Latin American STS, see Kreimer and Vessuri ([2017](#)).

<b>2. Understanding the emergence and development of Latin American technoscience</b>	
The origins of national sciences and their hybridization with “universal science”	Juan José Saldaña, Marcos Cueto, Jaime Benchimol, Simon Schwartzman, Mauricio Nieto, Ismael Ledesma, and others, from the '80s onwards.
The emergence of new fields in peripheral contexts	Ana María Ribeiro, Alfonso Buch, Pablo Kreimer, Henrique Cukierman, José Carlos Arboleda, Emilio Quevedo, Diego Hurtado, and others, from the '80s onwards.
Structural asymmetry in international cooperation processes	Hebe Vessuri, Pablo Kreimer, Alexis de Greiff, Lea Velho, from the '80s onwards.
<b>3. The introduction and use of new theoretical and methodological perspectives: SSK, SCOT, ANT, Coproduction, etc.</b>	
The hybridization of “Western Science” and indigenous knowledge	León Olivé, Mauricio Nieto, Hebe Vessuri, Santiago Liaudat, from the '80s and '90s.
The tensions around the orientation of “local” research agendas	Pablo Kreimer, Alexis de Greiff, Adriana Feld, Fernanda Beigel, Leandro Rodríguez Medina, Noela Invernizzi, from the '90s onwards.
The social construction of science and technology and actor-network theory in Latin America.	Ivan da Costa, Hernan Thomas, Henrique Cukierman, and others, from the '90s onwards.
<b>4. Emergence of new topics, and resurgence of political concerns</b>	
The “black box” of “imported” regulatory knowledge	Various authors, though still an underdeveloped topic.
Conflicts around scientific publications, open science and the role of English in scientific knowledge production	Renato Ortiz, Fernanda Beigel, Hebe Vessuri, in the 2000s.
Intellectual property, cognitive exploitation, blind technology transfer and other global issues	Mariano Zukerfeld, Dario Codner, Cecilia Rikap, and others, from 2010s onwards.
Controversies, Climate change, and disasters	Manuel Tironi, Sebastián Ureta, Carlos Nupia, Rebeca de Gortari, Michelle Chauvet, and others, from the 2000s onwards.

If we look at each individual issue on the list, we can see that most of them have been relatively marginal to STS studies on hegemonic centers. We can, of course, find certain texts produced by “northern” scholars about particular topics, like works by Jacques Gaillard ([1994](#)) on migrations or asymmetric cooperation (see also Wesley Shrum et al. [2007](#), or Caroline Wagner [2005](#)), by Susan Cozzens et al. ([2011](#)) on collaborative learning in the global South; Nancy Stepan’s ([1976](#)) excellent book on the origins of science in Brazil, L. Pyenson’s remarkable books on the expansion of the French and German sciences ([1985](#), [1993](#)) and, certainly, Harding’s ([2016](#)) texts on Latin American decolonial studies. But, as I said, these are marginal expressions within a far broader universe.

This fact, in principle, would not be problematic if the issues listed above referred to exclusively *local* issues. Yet this is not the case: these issues refer to dynamics that go beyond the local context, having to do with systems of relationships, links, and power structures. And these power structures affect both non-hegemonic and hegemonic contexts. A paradigmatic case of this is the participation of Latin American research groups in European projects, within the areas of health and environment that I mentioned in the first part of this article ([Kreimer 2022b](#)). We observed there that Latin American groups did not participate only because of their interest in becoming more cosmopolitan, but because they were actively invited by European leaders, who “needed” them for different reasons ([Feld and Kreimer 2019](#)), such as: a) to have observation sites that did not exist in Europe (such as southern skies, or the course of large rivers, like the Amazon); b) to have access to material or cognitive resources needed for research (such as sub-Antarctic waters); c) to have access to knowledge about specific resources (such as Latin American scientists who know about those topics, like knowledge about sub-Antarctic fishes); d) to have access to experiments that are difficult or impossible to carry out in Europe (such as GMO cultivation or clinical experiments with patients), or e) because they can outsource technical or data collection activities to Latin American colleagues, while the leading groups concentrate on information analysis, theoretical production, and the formulation of recommendations.

All of these issues affect both the Latin American and European groups, modifying their practices, creating new networks, etc. However, they have only been the subject of interest in Latin American STS research, and it is a topic ignored by European STS scholars.<sup>11</sup>

To illustrate this “international division of work” within the STS field, let’s see some additional examples:

- a) The effects of brain drain have been studied—in Latin America and in other contexts—for the “expelling countries.” But this does not affect only peripheral contexts:
  - i. How did the migrations of scientists from less developed countries affect the laboratories and universities of “Euro-America?”
  - ii. What kind of cultural encounters were generated in the “North” laboratories?

In parallel with the factors of expulsion of scientists from developing countries, what kind of “attraction” policies were promoted by the more developed countries?

- i. What communication networks did the scientists who settled in central contexts establish with their colleagues who remained in their countries of origin?

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<sup>11</sup>Moreover, a preliminary version of an article analyzing these issues was submitted in 2018 to the journal *Science and Technology Studies*, edited by the EASST (European Association for the Study of Science and Technology), but was rejected by the Editor because from his point of view “it is not clear what is the interest of this topic [the participation of Latin American scientists in European research consortia] for the STS field.” (email from the Editor of STS journal to author).

For instance, the “5-Year Outlook” published by the American National Science Foundation in 1981 stated:

Universities, the armed services, and, in certain critical fields, industry are reporting severe difficulties in recruiting sufficient numbers of qualified engineers and scientists. Personnel shortages are most acute in computer sciences, in the fields of chemical, electrical, and industrial engineering, and, among scientific subspecialties, like solid-state physics, optics, analytical chemistry, and toxicology. Additionally, medical schools report increasing numbers of vacancies in faculty research and teaching positions ([NSF 1981, 7](#)).

Certainly, this statement must be taken into account when analyzing the global flux of scientific migrations from the '80's onwards.

- b) The relationship between Western scientific knowledge and traditional knowledge generates encounters and hybridizations in peripheral contexts. However:
- i. What is the role of international companies in the search for potentially industrializable traditional knowledge?
  - ii. Who are the mediators (actors) between the bearers of this traditional knowledge and these companies?
  - iii. What is the role of local scientists—integrated in international networks in their own disciplinary fields—in the negotiations between the various actors interested in traditional knowledge and its potential commercial uses?

A case that can illustrate this kind of negotiations is the discovery of the stevia in the Guarany zone (part of Paraguay, Southern Brazil and Northern Argentina) in the beginnings of twentieth century. Santiago Liaudat shows in a very convincing way how this traditional knowledge of the Guarany Indians became one of the most successful products in the history of the international pharmaceutical industry, as a natural sweetener, and replacement for saccharin ([Liaudat 2021](#)).

Therefore, I consider that it is difficult to isolate the trajectories of these kind of global firms from their relationships with “central” labs without taking into account, at the same time, the links established in peripheral contexts, the type of knowledge which is under dispute (or negotiation) among other issues.

- c) Regulatory standards are usually “imported” by local policy institutions in peripheral contexts. Certainly, this entails several tensions and inadequacies in relation to local cultures and knowledge. However:
- i. What consequences does the “import” of regulatory standards based on R&D expertise have for industries located in the most developed countries, which are established or have less developed contexts (for example, pharmaceuticals) as spaces for economic expansion?
  - ii. How are disciplinary frameworks reshaped when there is a network of correspondents in peripheral regions doing some of their empirical work (i.e., the international division of scientific work)?

- iii. What contributions do researchers from non-hegemonic countries make and how have they been capitalized on—economically or otherwise—in organized research in large networks?

For example, anthropometric tables for assessing the growth of children during the first years of life were for a long time developed under the auspices of the World Health Organization (WHO) and based on data collected in most central countries. However, they were applied by pediatricians in peripheral countries, without taking into account the different types of genetic endowment, nutrition, etc. It was only in 1999 that a multicenter study on growth patterns was commissioned. In the report “Infant and young child nutrition: The WHO multi-center growth reference study,” it is said that “In 1993 a WHO Expert Committee drew attention to a number of serious technical and biological problems with the growth reference currently recommended for international use,” and they “discovered” that “Recent research conducted by WHO shows that the growth pattern of healthy breastfed infants differs significantly from the current international reference” ([WHO 1999, 1](#)). The study then focused on several contexts: Brazil, Ghana, Norway, Oman, USA, India and China.<sup>12</sup>

In the WHO case, it is easy to see that “situated” knowledge formerly produced in a central context must be contrasted not only with “other” kinds of (non-Western) knowledge, but with Western science conducted in peripheral regions.

The aforementioned questions—and many more could be asked—tell us about multiple yet interconnected spaces, and these relationships necessarily affect the various actors participating in them, including, of course, those located in hegemonic contexts. So why should they be studied from the point of view of a single context rather than forming part of a broader agenda?

Moreover, it seems reasonable not to take a step backward and find ourselves—via globalization—facing new “universalist” expressions. But this does not mean that we should not pay due attention to the global dimensions that often determine asymmetric relationships. Whether we call them mobile centers and peripheries, or whatever terminology we choose, we cannot ignore these relations.

### **Conclusion: A Double Peripherality?**

Throughout the text we have tried to show that there is an STS research agenda in Latin America that moves between two types of tensions: on the one hand, STS studies produced in mainstream centers, which have

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<sup>12</sup> For an example of import regulations in the field of GMOs in a developing context, see the beautiful analysis conducted by Aniket Aga ([2021](#)) in India.

historically been engaged—since the end of the 1970s—in studying situated knowledge, but only oriented towards observing the situated knowledge of “Western science,” that is, science in Euro–America. And postcolonial STS studies focused—often ethnographically—on knowledge in peripheral or non–hegemonic contexts, in order to highlight what mainstream works had not observed: i.e., “other” forms of knowledge that appeared as subaltern, marginalized or simply ignored, such as traditional knowledge, knowledge about the use of plants, “non–Western” forms of medicine, and so on. They also focused on the relations between this ignored knowledge and Western science, as “trading zones” or spaces for the exchange of knowledge.

Between these two currents, however, studies on the development of Western science in peripheral contexts, and its processes of integration, negotiation, subordination, search for autonomy, its relations with actors in local societies, etc. attracted very little interest, in general, from the STS mainstream community. Nonetheless, as Latin American scholars have shown in several studies, the development of science in peripheral contexts is one of the components in the development of globalized science, and this for several reasons: (a) the change of scale had as a consequence, that scientists from semi–peripheral countries have been usually recruited to perform certain types of tasks (mostly technical activities or collecting data, but rarely theoretical production) within large research consortia. These practices show the emergence of a new kind of international division of scientific labor ([Feld and Kreimer 2019](#)); (b) the dynamics of scientific migrations turned the reception of scientists from peripheral regions into a fundamental resource for the development of vast research programs in the most dynamic Euro–American laboratories; (c) the changing character of globalized science shows that regions that appeared as marginal until a few years ago, can become hegemonic in some specific fields (such as the emblematic cases of China and, partially, India); (d) the globalization of problems and their ways of conceiving them makes it necessary to create sites of observation, specific knowledge, gateways and mediations where the role of scientists from peripheral regions is essential.<sup>13</sup>

Thus, paradoxically, a substantial part of STS problems is relatively ignored, or delegated to STS scholars in peripheral regions. However, those who study these issues are located in a situation of double peripherality: on the one hand, the peripherality of the objects they study, since they are not perceived as highly relevant by mainstream STS centers—including the most prestigious journals in the field, where the presence of these issues is very low. On the other hand, because those who study these topics also occupy, within the field itself, a relatively subaltern position. In a way, the character of subordinate integration that we observed, for example, for the cases of molecular biology ([Kreimer 2010, 2019](#)), tropical diseases ([Kreimer 2022a](#)), or climate research ([Feld and Kreimer 2019](#)) is reproduced here.

To conclude, it would be useful to remember the proposal of Law and Lin,

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<sup>13</sup> For instance, Luciano Levin et al. ([2021](#)) show, for the case of Chagas disease, how a disease specific to tropical contexts becomes an object of global research, and the role Latin American scientists play in this process.

if we do succeed, then we will have created a plurality of intersecting STSs and sensibilities, and we will be able to say that we have undone the provincialism of STS ([2017, 22](#)).

But this can only happen on the condition that these intersections can explain that Western science is something more complex than what happens in hegemonic countries and that, just as we have been able to observe the encounters between Western science and other forms of knowledge, we can observe its globalized dynamics, which implies considering different situated localizations, both in central and non-hegemonic contexts, as well as the relationships between the two.

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### Data Availability

Data published in this paper for can be accessed in STS Infrastructures at:  
<https://n2t.net/ark:/81416/p4988f>.

### References

- Aga, Aniket. [2021](#). *Genetically Modified Democracy: Transgenic Crops in Contemporary India*. Yale Agrarian Studies. New York: Yale University Press.
- Alam, M. Anis. [1978](#). “Science and Imperialism: What is Science” *Race & Class* 19(3): 239–251.  
<https://doi.org/10.1177/030639687801900302>.
- Allen, Jim. [1967](#). “The Technology of Colonial Expansion.” *Industrial Archaeology* 4(2): 111–137.
- Anderson, Warwick. [2002](#). “Introduction: Postcolonial Technoscience.” *Social Studies of Science* 32(5–6): 643–658.  
<https://doi.org/10.1177/030631270203200502>.
- . [2018](#). “Remembering the Spread of Western Science.” *Historical Records of Australian Science* 29(2): 73–81.  
<https://doi.org/10.1071/HR17027>.
- Barratt-Brown, Michael. [1963](#). *After Imperialism*. London: Heinemann.



- Basalla, George. 1967. "The Spread of Western Science: A Three-Stage Model Describes the Introduction of Modern Science into any Non-European Nation." *Science* 156(3775): 611–622.  
<https://doi.org/10.1126/science.156.3775.611>.
- Bloor, David. 1976. *Knowledge and Social Imagery*. London: Routledge.
- Bourdieu, Pierre. 1976. "Le champ scientifique." [The Scientific Field] *Actes de la Recherche en Sciences Sociales* 2(2–3): 88–104.
- Callon, Michel, and Bruno Latour, eds. 1991. *La science telle qu'elle se fait. Anthologie de la sociologie des sciences de langue anglaise* [Science in the Making. Anthology of the Sociology of Sciences of English Language]. Paris: La Découverte.
- Cardoso, Fernando H., and Enzo Faletto. 1969. *Dependencia y desarrollo en América Latina* [Dependency and Development in Latin America]. Buenos Aires: Siglo XXI.
- Collins, Harry M. 1981. "What is TRASP?: The Radical Programme as a Methodological Imperative." *Philosophy of the Social Sciences* 11(2): 215–224.  
<https://doi.org/10.1177/004839318101100207>.
- Cozzens, Susan, Ravtosh Bal, Elena Berger, Dhanaraj Thakur, et al. 2011. "Changing Roles for the Global South in International Collaborative Learning." *International Journal of Institutions and Economics* 3(3): 445–466.
- Díaz, Elena, Yolanda Texera, and Hebe Vessuri. 1983. *La ciencia periférica: ciencia y sociedad en Venezuela* [Peripheral Science: Science and Society in Venezuela]. Caracas: Monte Avila.
- Feld, Adriana. 2015. *Ciencia y política(s) en la Argentina, 1943–1983* [Science and Politics/Policies in Argentina, 1943–1983]. Buenos Aires: Editorial de la Universidad Nacional de Quilmes.
- Feld, Adriana, and Pablo Kreimer. 2012. "La Science en Débat en Amérique Latine: Perspectives 'Radicales' au Début des Années 1970 en Argentine." [Science as a Matter of Public Debate in Latin America: 'Radical' Perspectives in the Early Seventies in Argentina] *Revue d'Anthropologie des Connaissances* 6(2): 273–302.  
<https://doi.org/10.3917/rac.016.0029>.
- . 2019. "Scientific Co-Operation and Centre-Periphery Relations: Attitudes and Interests of European and Latin American Scientists." *Tapuya: Latin American Science, Technology and Society* 2(1): 149–175.  
<https://doi.org/10.1080/25729861.2019.1636620>.
- Fu, Daiwie. 2007. "How Far Can East Asian STS Go? A Position Paper." *East Asian Science, Technology and Society: An International Journal* 1(1): 1–14.  
<https://doi.org/10.1215/s12280-007-9000-y>.
- Gaillard, Jacques F. 1994. "North-South Research Partnership: Is Collaboration Possible between Unequal Partners?" *Knowledge and Policy* 7(2): 31–63.  
<https://doi.org/10.1007/BF02692761>.
- Galison, Peter. 1999. "Trading Zone: Coordinating Action and Belief (abridged 1998)." In *The Science Studies Reader*, edited by Mario Biagioli, 137–160. New York and London: Routledge.
- González Casanova, Pablo. 1969. *Sociología de la explotación* [Sociology of Exploitation]. Buenos Aires: Siglo XXI.

- Gunder Frank, André. 1965. *Capitalismo y subdesarrollo en América Latina* [Capitalism and Underdevelopment in Latin America]. Buenos Aires: Editorial Signos.
- Halperin Donghi, Tulio. 1969. *Historia contemporánea de América Latina*. Madrid: Alianza.
- Harding, Sandra. 1998. *Is Science Multicultural? Postcolonialisms, Feminisms, and Epistemologies*. Bloomington: Indiana University Press.
- Harding, Sandra, ed. 2011. *The Postcolonial Science and Technology Studies Reader*. Durham, NC: Duke University Press.
- Harding, Sandra. 2016. "Latin American Decolonial Social Studies of Scientific Knowledge: Alliances and Tensions." *Science, Technology, & Human Values* 41(6): 1063–1087.  
<https://doi.org/10.1177/0162243916656465>.
- Herrera, Amílcar O. 1971. *Ciencia y política en América Latina* [Science and Politics in Latin America]. Buenos Aires: Siglo XXI.
- Hess, David J., and Scott Frickel. 2014. "Introduction: Fields of Knowledge and Theory Traditions in the Sociology of Science." In *Fields of Knowledge: Science, Politics and Publics in the Neoliberal Age*, edited by Scott Frickel and David J. Hess, 1–30. Political Power and Social Theory. Bingley, England: Emerald Group Publishing.  
<https://doi.org/10.1108/S0198-871920140000027001>.
- Kreimer, Pablo. 1997. "Understanding Scientific Research on the Periphery: Towards a New Sociological Approach?" *EASST Review* 17(4): 13–21.
- . 2010. *Ciencia y periferia. Nacimiento, muerte y resurrección de la biología molecular en la Argentina. Aspectos sociales, políticos y cognitivos* [Science and Periphery. Birth, Death and Resurrection of Molecular Biology in Argentina. Social, Political and Cognitive Aspects]. Buenos Aires: EUDEBA.
- . 2016a. *Contra viento y marea. Emergencia y desarrollo de campos científicos en la periferia: Argentina, segunda mitad del siglo XX* [Against All Odds. Emergence and Development of Scientific Fields in the Periphery: Argentina, Second Half of the 20th Century]. Buenos Aires: CLACSO.
- . 2016b. "Co-Producing Social Problems and Scientific Knowledge. Chagas Disease and the Dynamics of Research Fields in Latin America." In *The Local Configuration of New Research Fields. On Regional and National Diversity*, edited by Martina Merz and Philippe Sormani, 173–190. *Sociology of the Sciences Yearbook*, Volume 29. Cham: Springer.  
[https://doi.org/10.1007/978-3-319-22683-5\\_10](https://doi.org/10.1007/978-3-319-22683-5_10).
- . 2019. *Science and Society in Latin America: Peripheral Modernities*. New York: Routledge/Taylor & Francis.
- . 2022a. "Techno-Scientific Promises, Disciplinary Fields, and Social Issues in Peripheral Contexts." *Science as Culture* 31(2): 1–26.  
<https://doi.org/10.1080/09505431.2022.2101918>.
- . 2022b. "Constructivist Paradoxes Part I: Critical Thoughts about Provincializing, Globalizing, and Localizing STS from a Non-Hegemonic Perspective." *Engaging Science, Technology and Society* 8(2): 159–175.  
<https://doi.org/10.17351/ests2022.1109>.
- . 2022c. *Latin American STS Agendas: Main Bibliographic References*. *Engaging Science, Technology, and Society*. STS Infrastructures (Platform for Experimental Collaborative Ethnography), last modified

- December 30, 2022. Accessed December 31, 2022.  
<https://n2t.net/ark:/81416/p4988f>.
- Kreimer, Pablo, and Manuel Lugones. 2002. "Rowing Against the Tide: Emergence and Consolidation of Molecular Biology in Argentina, 1960–90." *Science, Technology and Society* 7(2): 285–311.  
<https://doi.org/10.1177/097172180200700204>.
- Kreimer, Pablo, and Hebe Vessuri. 2017. "Latin American Science, Technology, and Society: A Historical and Reflexive Approach." *Tapuya: Latin American Science, Technology and Society* 1(1): 17–37.  
<http://dx.doi.org/10.1080/25729861.2017.1368622>.
- Kuhn, Thomas S. 1962. *The Structure of Scientific Revolutions*. Chicago: The University of Chicago Press.
- Lander, Edgardo. 1993. *La colonialidad del saber: eurocentrismo y ciencias sociales. Perspectivas latinoamericanas* [The Coloniality of Knowledge: Eurocentrism and Social Sciences. Latin American Perspectives]. Buenos Aires: CLACSO.
- Lave, Rebecca. 2012. *Fields and Streams: Stream Restoration, Neoliberalism, and the Future of Environmental Science*. Athens, GA: University of Georgia Press.
- Law, John, and Wen-Yuan Lin. 2017. "Provincializing STS: Postcoloniality, Symmetry, and Method." *East Asian Science, Technology and Society: An International Journal* 11(2): 211–227.  
<https://doi.org/10.1215/18752160-3823859>.
- Lemaine, Gérard. 1980. "Science normale et science hypernormale. Les stratégies de différenciation et les stratégies conservatrices dans la science." [Normal Science and Hyper-normal Science: The Strategies of Differentiation and the Conservative Strategies in Science] *Revue française de sociologie* 21(4): 499–527.
- Levin, Luciano, Pablo Jensen, and Pablo Kreimer. 2016. "Does Size Matter? The Multipolar International Landscape of Nanoscience." *PLOS ONE* 11(12): 1–12.  
<https://doi.org/10.1371/journal.pone.0166914>.
- Levin, Luciano G., Pablo Kreimer, and Pablo Jensen. 2021. "Chagas Disease across Contexts: Scientific Knowledge in a Globalized World." *Medical Anthropology* 40(6): 572–589.  
<https://doi.org/10.1080/01459740.2021.1946805>.
- Liaudat, Santiago. 2021. *Stevia. Conocimiento, propiedad intelectual y acumulación de capital* [Stevia. Knowledge, Intellectual Property and Capital Accumulation]. First Edition. Foreword by Mariano Zukerfeld. Buenos Aires: Prometeo.
- MacLeod, Roy M. 1980. "On Visiting the 'Moving Metropolis': Reflections on the Architecture of Imperial Science." *Historical Records of Australian Science* 5(3): 1–16.  
<https://doi.org/10.1071/HR9820530001>.
- . 2000. "Introduction" to *Nature and Empire: Science and the Colonial Enterprise*, edited by Roy M. MacLeod, *Osiris* (15): 1–13.  
<https://www.jstor.org/stable/301937>.
- Marini, Ruy M. [1973] 2008. "Dialéctica de la dependencia." [The Dialectic of Dependency] In *América Latina, Dependencia y Globalización* [Latin America, Dependency and Globalization], anthology of texts by Ruy M. Marini, presented by Carlos E. Martins, 107–150. Second Edition (Revised). Buenos Aires and Bogotá: CLACSO–Siglo del Hombre Editores.

- National Science Foundation (NSF). [1981](#). *The 5-Year Outlook on Science and Technology*. Washington: National Science Foundation.
- Prebisch, Raúl. [1950](#). “Crecimiento, desequilibrio y disparidades: interpretación del proceso de desarrollo económico.” [Growth, Imbalance and Disparities: Interpretation of the Process of Economic Development] In *Estudio Económico de América Latina 1949*, 3–89. Santiago de Chile: ECLAC. <http://hdl.handle.net/11362/1110>.
- Pyenson, Lewis. [1985](#). *Cultural Imperialism and Exact Sciences: German Expansion Overseas, 1900–1930*. New York: Peter Lang.
- . [1993](#). *Civilizing Mission: Exact Sciences and French Overseas Expansion, 1830–1940*. Baltimore, MD and London: Johns Hopkins University Press.
- Rostow, Walt W. [1960](#). *The Stages of Economic Growth. A Non-Communist Manifesto*. London: Cambridge University Press.
- Seth, Sanjay, Leela Gandhi, and Michael Dutton. [1998](#). “Postcolonial Studies: A Beginning. . .” *Postcolonial Studies* 1(1): 7–11. <https://doi.org/10.1080/13688799890200>.
- Shils, Edward A. [1961](#). “Centre and Periphery.” In *The Logic of Personal Knowledge: Essays Presented to Michael Polanyi on his Seventieth Birthday, 11<sup>th</sup> March 1961*, edited by the Polanyi Festschrift Committee, 117–130. London: Routledge.
- Shrum, Wesley, Joel Genuth, and Ivan Chompalov. [2007](#). *Structures of Scientific Collaboration*. Cambridge, MA: The MIT Press.
- Stepan, Nancy. [1976](#). *Beginnings of Brazilian Science: Oswaldo Cruz, Medical Research and Policy, 1890–1920*. New York: Science History Publications.
- Varsavsky, Oscar. [1969](#). *Ciencia, política, cientificismo* [Science, Politics and Scientism]. Buenos Aires: Centro Editor de América Latina.
- Wagner, Caroline S. [2005](#). “Six Case Studies of International Collaboration in Science.” *Scientometrics* 62(1): 3–26. <https://doi.org/10.1007/s11192-005-0001-0>.
- World Health Organization (WHO). [1999](#). *Implementation of Resolutions and Decisions: Infant and Young Child Nutrition: the WHO Multicentre Growth Reference Study*. Submitted to the Executive Board for Information, November 16, 1999. Geneva: WHO. <https://apps.who.int/iris/handle/10665/79006>.