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INTRODUCTION

Social Studies of Science and Technology in Latin America: A Field in the Process of Consolidation

PABLO KREIMER

THE SOCIAL STUDIES of science and technology are relatively new in Latin America. The first reflections, in the 1960s and 1970s, were very promissory and they even gave place to the idea of a 'Latin American thought of science, technology and society'. Those works, written mainly by scientists and engineers, had a main political concern to find ways and instruments to develop scientific and technological knowledge locally, so that it could be suitable for the needs of the region. The objective of that generation, which was partially reached, consisted in making science and technology an object of public study, as a topic bound to a social and economic development strategy. Besides, there was an emphasis on the fact that science and technology are not neutral and universal, but that are processes with specific features according to the context in which they are introduced. Thus, as it was then said, there was a paradox: while the lesser developed countries try to produce scientific knowledge

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locally, they are subject to a dependence relationship of the knowledge—particularly technological—produced in industrialised countries.

One of the main achievements of this Latin American thought was the criticism of the linear model of innovation and the proposal of analytical instruments as ‘national project’, ‘social claim for S&T’, ‘implicit and explicit policy’, ‘technological styles’ and ‘technological packages’ (Dagnino et al. 1996). Represented by emblematic characters and real ‘fighters’, whose commitment to scientific and technological development exceeded intellectual concern, the field constituted a whole political-cultural practice. They were Oscar Varsavsky, Amílcar Herrera, Jorge Sábato, Máximo Halty and Marcel Roche, among others.

In some cases these studies anticipated problems that were to manifest many years later. The study by Sabato and Botana (1975) concerning relations between the government, industry and science and technology infrastructure is a good example. This scheme, properly updated and enriched, will constitute the basis of the model of the Triple Helix, highly successful since the 1990s. On the other hand, it is worthwhile mentioning the work done by Varsavsky (1969) on the role of science in peripheral countries, and the tension of local scientists turn between international integration and the application of useful knowledge for society, which led to the proposal of the concept of ‘scientific and technological development styles’. Over the past years these ideas have resurfaced in order to explain and account for these same tensions, although from outlooks that changed the analysis level to a more micro-sociological approach.

The strongly innovative feature of this generation could not be crystallized into the creation of real traditions, as I see it, due to two reasons. In the first place, because these ‘pioneers’ were not willing, with the partial exceptions of Herrera in Brazil and Roche in Venezuela, to place their reflections in institutions devoted to research and to the formation of young researchers. Second, because they propounded very important ideas; but these ideas were not supported by empirical works to supply them with more solidity and thus enable them to be sustained throughout time.

There are very few texts that analyse the development of social studies of science and technology in Latin America. In one of them, focusing exclusively on the studies about technology, Enrique Oteiza (1993) pointed out the difficulties that the study of technologies presented in comparison to the study of sciences. One is inclined to attribute this fact, among other reasons, to the late development of industrialisation in the region, and to

the fact that ‘the activities of generation and appropriation of technological knowledge are carried out in various and differentiated ambits of society, by multiple actors in heterogeneous institutions, while scientific research activities take place in highly specialized institutions, in considerably more delimited environments’ (Oteiza 1993: 13).

However, in spite of the evident difficulties for the social study of technology, studies on science did not have much development, either until the early 1990s, when Hebe Vessuri (1993) showed that certain professionalisation of the field of social studies of science was becoming visible. Traditionally, there have been

practising scientists who have written celebratory articles, obituaries and review articles that take a skewed view of their subject offering, more often more than not, biased accounts disguised as objective efforts to put the record straight. . . . However, a change has taken place in the last decade or so in the emergence of a small cadre of sociologists and historians of science who are professionally devoted, rather than occasionally recruited, to the social studies of science. (ibid.: 117)

Simultaneously, some historical studies, mostly oriented towards the study of particular disciplines or institutions, developed. A ‘traditional’ perspective prevailed in them, where knowledge and the social conditions of its production were presented as clearly differentiated spheres; that is to say, the classic division between the ‘internalist’ and ‘externalist’ approaches prevailed in this field well into the 1980s. Besides, there was some difficulty in understanding the development of science in the peripheral context of Latin America. Thus,

we face . . . the simple transfer of a Eurocentric historiography methodology, which turns out to be highly positivist, reductionist and non-historic when applied non-critically to the Latin American case. If the contextual essential differences are not taken into account, it is assumed that science is always affected by the same factors that are responsible for its dynamics. (Saldaña 1996: 21)

Over the last two decades of the twentieth century, the field of social studies of science and technology was extended in quantitative terms—more publications, more researchers, more instances of formation and training in human resources—as well as in qualitative terms—more subject diversity, the multiplication of the theoretical and methodological

approaches used, the research institutionalization and the training of human resources (Kreimer and Thomas 2004).

As the production increased, the border between the different approaches became more diffused. Although some watertight compartments are still kept—as, for example, the production within an internalist framework for the history of science—in broad outline, the dynamics of the Latin American science and technology studies field is characterised by the steady incorporation of new perspectives and, still, by the conceptual triangulation. Thus, many works incorporated concepts emerging from different theoretical matrixes in their analytical frames (one of the most common operations is the triangulation of elements coming from the sociology of science with conceptualisations of public policies or economics).

Unlike the previous period, which was characterised by a production marked by the individual initiatives, it is possible to register in the 1980s and the 1990s a strong tendency towards institutionalisation and, in particular, to the ‘academisation’ of research activities. A great part of the production is linked to research groups located in universities, in unities and programmes explicitly connected with the theme. In many cases these units are associated to postgraduate formation programmes (Kreimer and Thomas 2004).

Two complementary movements, apparently paradoxical, were produced during these years. On the one hand the emergence and the ‘reception’ of the different constructivist approaches generated a disciplinary diffusion, where knowledge as an object goes through the studies of science as well as of those centred in technology. This turns out to be particularly relevant, for example, in the works focused on the study of knowledge networks, as well as the highly influential perspective of the Triple Helix. On the other hand, and as an important academic institutionalisation of the field was produced, the disciplinary formations originated in the social sciences beginning to prevail over ‘amateur’ researchers in engineering or in the sciences, and they started to reaffirm their own disciplinary perspectives, their own theories and their own research methods.

The production of works on sociology and history of science and technology was developed during the 1980s and the 1990s parallel to the diffusion in the region of new concepts of constructivist sociology. Its adoption gave place to a quite large number of projects and research programmes on an empirical basis. In face of the general production of the previous stage—and sometimes in the form of an essay—during the last two decades, preference is granted to theoretical methodological approaches based

on *fieldwork*: case studies, diverse interview techniques, reconstruction of nets of actors, socio-institutional analysis and ethnomethodological studies (Kreimer and Thomas 2004).

In the history of science, not only was an orientation towards a social history of science, operated by historians such as Juan José Saldaña in Mexico or Marcos Cueto in Peru, registered. The incidence of the constructivist trend was also evident in the local production, analogously to what happened at an international level in the 1980s, when the emergence of a 'new' sociology of knowledge decisively affected part of the research in science history, as has been pointed out by Dominique Pestre (1995), among others.

The studies about innovation were perhaps the main subject developed in the STS field during the 1990s, and it originated a huge number of publications, generated from the most diverse perspectives: economics, political sciences, philosophy and sociology. From case and sector studies to data gathering and systematisation of standards, the most diverse methodological approaches were displayed. Obviously, a significant part of the works responded to the disciplinary matrix 'economy of the technological change'. But given the pervasiveness of the topic, the standard discourse as well as the empirical analysis of scientific and technological activities was impregnated with the concern about 'local innovation'.

Today we face a much richer and dynamic panorama in the social studies of science and technology, with an advantageous crossing of a variety of disciplines, conceptual approaches, and definition of research objects. In fact, in the last regional meeting (ESOCITE VI) held in Colombia in April 2006 papers coming from disciplines such as history, politics, sociology, economics, anthropology or education were presented, and the problems veered from relations among science, technology and democracy, dynamics analysis and socio-technical nets, to gender problems or a reflexive approach to the field itself.

However, if we had to establish some axes that prevail in Latin America in a, say, transversal way, they would be, on one hand, a concern about understanding the dynamics of knowledge production in the *particular context of the region*. That is, trying to capture the specific (social, political, economic, cultural) features of this part of the world, identifying regularities and differences not only at an intra-regional level, but also in relation to central countries. This has given rise to an abundant—although certainly insufficient—production of empirical material of very good quality. On the other hand, and increasingly, Latin American scholars are oriented to understanding STS dynamics in terms of the uses that

locally produced knowledge can offer to a region (a set of different societies) that continues to have an important part of its population in a situation of poverty (extreme, in some cases). In this sense it is possible to observe an interesting juxtaposition of political concerns, historic research and the analysis of present societies in order to understand the correlation of problems, and, at the same time, to contribute ideas to the public debate about the role of science and technology in these societies.

Seven articles presented in this special issue, as seen from the editor's perspective, represent a certain degree of multi-disciplinarity, and at the same time reflect a sense of 'underdevelopment' in the maturity of the perspectives of STS research in Latin America. There are articles about field development or research projects from a perspective close to the social and political history of science (Texera Arnal; and Hurtado de Mendoza and Vara); industrial dynamics of innovation and organisational context in certain sectors (Figueiredo, Vedovello and Martelotte; and Pirela); sociology of the production and the use of scientific knowledge (Kreimer and Zabala); and the problems implied in the public understanding of science (Vaccarezza).

From the historical perspective, two articles deal with different disciplinary and national fields, both emerging from the relation established among institutional, cultural and political aspects: 'Government and University: The Emergence of Academic Biology in Venezuela', (Yolanda Texera Arnal) and 'Experimental Physics in Argentina and Brazil' (Diego Hurtado de Mendoza and Ana Maria Vara). Texera Arnal's reading of documents and sources observes a period of political and cultural modernisation, which is the context in which the institutionalisation of biology took place in the Universidad Central de Venezuela after almost three decades of dictatorship. Furthermore, it is pointed out that it is precisely the modernisation process that accounted for the creation of the School of Sciences in Venezuela. As the author analyses the institutional dimensions, she focuses on the way in which the 'school of biology' (named School of Sciences until 1957) was attached to the new Faculty of Sciences created in 1958.

Hurtado de Mendoza and Vara's article in turn adopt a comparative perspective in order to analyse the main similarities and differences between the paths followed by experimental physics in Argentina and Brazil in the creation of the possibilities for purchasing and constructing 'big machines'. These authors also pay special attention to how the local shifting political frameworks impacted on the projects under study. This aspect is important, insofar as both processes analysed have taken place

during authoritarian regimes. In the case of Argentina, they analyse the circumstances that surrounded the TANDAR project, a heavy ion accelerator, from its conception, in the mid-1970s during a short democratic lapse, to its impulsion once the dictatorship had already been established after March of 1976. In that context, the National Commission of Atomic Energy (CNEA) appeared as the 'natural' institutional space to develop the project. Unlike the case of Argentina, where the local scientific community played a secondary role, in Brazil, in spite of the military government, an amnesty favoured the return of the exiled scientists. In 1979 the much-respected Brazilian physicist José Leite Lopes reintroduced the issue of 'big science' in Brazil. Thus, in that sense, the authors show the contrast between both processes, since the Synchrotron Project was finally established in Campinas, with an active participation of the local scientific community, together with a more complex network of actors and institutions.

Pablo Kreimer and Juan Pablo Zabala ('Chagas Disease in Argentina') explore the relation between social problems and knowledge problems from a sociological perspective. In other words, they examine the possibilities and limitations of scientific knowledge as a factor of social development in peripheral societies. In order to do so, they submit to discussion the notion of 'relevance', which supposes that knowledge production can result from a genuine strategy to approach and solve social problems. To illustrate this, they analyse the case of Chagas disease, an endemic illness that affects all countries of Latin America. They show, from different analytical perspectives, how social problems themselves are often 'constituted' as such by scientific knowledge itself and by the actors that produce it and re-signify it in the public arena. Thus, they arrive at the conclusion that the processes of knowledge production as well as its social use, and the approach of social problems examined, are reshaped—denaturalised—when the complex web of actors that give a meaning to those processes are reconstructed.

Taking into consideration the dynamics of industrial innovation, Paulo N. Figueiredo, Conceição Vedovello and Marcela C. Martelotte ('Firms and Innovation System Supporting Organisations: An Empirical Study of Knowledge-centred Links in Brazil') challenge current generalisations that are based on macro-level official data which assume that companies are involved in technical activities only to take advantage of tax benefits. In contrast, the authors propose fieldwork to allow examining empirical evidence relative to firm-level technological capabilities and supporting

organisations of the innovation system on much more solid bases. Therefore, they analyse, from a perspective that is close to the national systems of innovation, the Industrial Pole of Manaus (northern Brazil) and, to the contrary of the aforesaid generalisations, they can show that in empirical work there is a variety of types and levels of capabilities for diverse technological functions. Thus, within that diversity, there are spaces with innovation dynamics and organisational bonds that are ready to provide and apt to perform, locally, the initiatives and procedures adopted at the national level concerning science, technology and innovation activities.

Arnoldo Pirela ('Entrepreneurial Behaviour and Institutional Change: The Dynamics of Building Industry Alliances in Venezuela') analyses the background of the state oil company of Venezuela, PDVESA, when it undertook, a decade ago, the so-called 'Oil Opening', a plan that sought to incorporate very important investments in order to act as a locomotive for the development of several sectors. The 'neo-liberal' policy of 'Oil Opening', was followed by a 'nationalist and anti-imperialist leftist revolution'. His analysis takes into account the political, economic and cultural dimensions that were present throughout this process. The analysis turns out to be relevant insofar as oil is the key productive activity of that country. The author analyses the behaviour of the company by observing the conflicts that originated, the changes in the chart of the organisation, and the alliances that emerged during that period. The author points out that the cross-sectional sector of national private firms, supplier of goods and services to the oil industry, could not be established in the company, which implied an important obstacle to consolidate a successful project, especially in terms of competitiveness.

Finally, Leonardo Silvio Vaccarezza ('The Public Perception of Science and Technology in a Periphery Society') analyses some indicators of the assessment made by the public in Argentina regarding science and technology in the context of a lesser relative institutionalisation compared to the developed central contexts. The analysis is based on information coming from a survey made in the year 2002 in the Gran Buenos Aires urban conglomerate, which reproduces some internationally used indicators. Taking into account the limitations of the quantitative analysis to approach very sensitive topics, the author considers issues such as the favourable/unfavourable opinions regarding science and technology, and he observes the predominance of favourable opinions (three quarters of the total), although the expectations in the solutions that knowledge can contribute are moderate. Vaccarezza analyses this relation between the

assessment and expectations with regard to S&T in terms of an ambivalence: he submits to a discussion of the positive relation between education and assessment of science and technology, observing that for many indicators the higher level of education or knowledge does not imply a more positive assessment of science, but quite to the contrary. Actually, in contexts of high interaction with the world of knowledge (universities), the assessments of science tend to be more critical.

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