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*** Researches in progress**

The use of technology platforms and its implications in the organization of biomedical research: a preliminary analysis of the experience at FIOCRUZ

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Abstract
In recent decades, biomedical research institutions in different countries have implemented new devices to coordinate research activity. Among the devices described in the literature one can find technology platforms, which are usually associated with collaborative research and the coordination of intensive use of large and highly complex multi-user equipment.
In Brazil, the emergence of technology platforms dates back to the 1980s. More recently, there are platforms related to the reorganization processes of research institutions. This also applies to the Oswaldo Cruz Foundation, which established technology platforms as part of its strategy to foster scientific research on technologies very likely to be adopted by the Unified Health System. The intent is to provide technological services to laboratories involved in this kind of studies.
The purpose of this study is to analyze the use of the "technology platform" device by the Oswaldo Cruz Foundation, emphasizing the possible implications of the adoption of this device and method of organizing the production process of science in biomedicine. This article describes the preliminary results of the study, which employs a qualitative approach based on the use of non-directive open-ended interviews, document analysis and ethnographic observation of situations.

Keywords:
Technology Platforms; Biomedicine; Science Production Processes; Public Research Institutions, Oswaldo Cruz Foundation

In recent decades, scientific research institutions in the field of biomedicine in different countries have implemented new devices to coordinate research activity. In general, they are associated with collaborative scientific research and the adoption of more flexible and transverse structures (TEIXEIRA *et al*., 2009a). Among the devices described in the literature one can find technology platforms which are used to acquire, maintain and coordinate the large-scale use of large multiplayer equipment.

In Brazil, the emergence of technology platforms dates back to the 1980s, particularly to the experience of the National Council for Scientific and Technological Development (CNPq). Recently, there are platforms associated with research institutions' reorganization processes. However, there is little systematic knowledge about the use of such devices in public institutions which conduct research nationwide.

In order to understand and analyze the use of the device known as "technology platform" and how it possibly relates to the way scientific knowledge is produced and organized in the field of biomedicine, we have recently started to conduct a study entitled "Technology Platforms and changes in the way to organize and produce techno- scientific knowledge in a health research institution". The goal of such study is to analyze the relationship between the process of organizing the research and producing techno-scientific knowledge in biomedical research laboratories with the use of a device to coordinate experimental research (Technology Platform). We will analyze the experience of the Oswaldo Cruz Foundation (Fiocruz) while organizing and using Technology Platforms. The article describes the development of this research to date; therefore, it presents the preliminary findings.

The study of technology platforms is part of a research program being developed by the authors of this article over the last four years. The goal of the article is to analyze the functionality of coordination devices and the infrastructure of biomedical research, the types of socio-technical relations raised and their effects on the production of new knowledge, technical objects and fields of scientific research. Previous results on the use(s) of cooperative networks have motivated the current issue.

The study of Platforms shares principles, propositions and concerns of the field of Science and Technology Studies (STS), and the influence of different socio-anthropological approaches - symbolic interaction (BECKER *et al.*, 1990), ethnomethodology (LYNCH, 1993) and grounded theory (CLARKE *et al*., 1992). The analysis and (re)construction of an approach referenced by empirical data and by the local environment will consider the local institutional dynamics, political relations, situational factors and economic orders, legislation, local cultural practices, conceptual frameworks, techniques and scientific instruments which are suitable to each area of research.

Studies on the use of technology platforms in other geographic and institutional spaces are clues to identify local differences (CAMBROSIO *et al.*, 2006) that contribute to the description and analysis of the characteristics encompassed by the technological platforms installed at Fiocruz.

We adopted two basic premises to structure and develop this study: 1) the organization of the research activity is intrinsically related to the production of technical and scientific knowledge; changes in any one of the poles can influence the dynamics of others; 2) the systematic study of the instruments and various dimensions of the (re)ordering process of geographically situated institutions is key to understanding the differences and confluences between the proposed models and the models performed by actors subjected to real situations (LAW, 1994).

We used a qualitative approach that will resort to socio-anthropological techniques (unstructured open interviews and participant observation) to describe the phenomenon being studied, and associated them with the documents and analysis of scientific output during the specified period. The aim is to discover and describe the institutional sociopolitical environment. It should be noted that the selected experience is an ongoing process, hence some of its characteristics may change during the development of the study. The advantage of a qualitative approach is that it allows changes in direction depending on the data collected and analyzed at different stages of field research. Thus, we see the theoretical framework as a momentary release of the cognitive scope of the problems explored by the researcher (BECKER, 1998). Moreover, we sought an approach that does not isolate "factors" or limits itself to the analysis of causal relations.

The set of studies we developed have extensively used the contributions by Peter Keating and Alberto Cambrosio. Besides the studies on platforms, we have highlighted the concept of biomedicine, which was employed to denote the process of articulation between biology, medicine, science, technology, innovation and technical routines that began after World War II

(KEATING *et al*., 2003). In Brazil, Biomedicine encompasses groups and research institutions involved with the fields of Health Sciences and Biological Sciences.
We will now turn to the description of the research environment in which the platforms were implemented.

Fiocruz is a century-old public institution under the Ministry of Health of Brazil; it consists of fifteen institutes located in six cities (Rio de Janeiro, Belo Horizonte, Curitiba, Salvador, Recife and Manaus), most of which are in the southeast region (Table 1). In 2008, new institutes started to be implemented in other Brazilian regions and in Africa. Research and technological development activities focus mainly on the fields of biomedicine (clinical research, life sciences, biosciences) and social sciences and humanities in health (Table 1), with emphasis on the study of infectious and parasitic diseases (BRASIL, 2007). In 2009, Fiocruz had 281 research groups registered on the database of the National Council for Scientific and Technological Development (CNPq), 253 of which were in the field of biomedicine (BRASIL, 2009).

Table 1: Field of research of Institutes by geographical region – 2009

	Southeast	**Northeast**	**North**	**South**
Number of institutes by geographical region	9	2	1	1
Field of research by geographical region				
Biomedicine	5	2	1	1
Social and Human Sciences in Health	6	-	1	-

Source: Brazil, 2009. Provided by authors.

The organizational structure of Fiocruz is composed of a President, four Vice-Presidents, and advisory bodies. Prior to the organizational restructuring that started in 2007, most institutes had a department and disciplinary matrix. Then they were changed into more flexible structures (networks, platforms, flexible laboratories). The number of hierarchical levels was reduced, and groups were aggregated in laboratories which were established with regard to specific research objects and topics (TEIXEIRA *et al*., 2009a). Scientific research and technological development are complemented by teaching in graduate and *latu sensu and stricto sensu* programs and by producing medicines, vaccines and diagnostic supplies to meet the programs coordinated by the Brazilian Ministry of Health (Table 2).

Table 2: Activity by geographical region and number of institutes - 2009

Activity	**Region**			
	Southeast	**Northeast**	**North**	**South**
Research & Development	9	2	1	1
Teaching	11	2	1	-
Output	2	-	-	-

Source: Brazil, 2009. Provided by authors.

Research activity is funded with Fiocruz's own resources from the budget of the national treasury, and they are complemented with individual funding obtained from national and international research-funding agencies, with resources from institutional funding programs

administered by the Financier of Studies and Projects (FINEP) and, more recently, by programs of Brazil's National Bank for Economic and Social Development (BNDES).

Although Fiocruz conducts clinical research, and maintains health care units as well as a network of reference laboratories, its biomedical research activity focuses on producing certified knowledge to advance a particular academic field (TEIXEIRA *et al.,*, 2009 a; b). Despite its organizational restructuring, however, scientific research at Fiocruz is still organized around individual research projects which are developed within laboratories ordered from a disciplinary matrix to produce certified knowledge and publish scientific articles. The results of research activity are recorded and evaluated after the publication of scientific articles and books, as well as researchers' participation in national and international conferences (BRASIL, 2007; TEIXEIRA *et al.,*, 2009a). Between 2001 and 2008, 7611 articles were published in Brazilian and international journals indexed in various databases (Brasil, 2009).

Over the past ten years, theses that relate the fragility of the national productive base in health care with the low innovative capacity of public and private producers have gained momentum in the health sector. Among the consequences is the high dependence on imports of scientific knowledge-intensive products. Reversing this situation would require, among other things, greater coordination among the particular policies within the health, industrial and science and technology fields, resulting in incentives to research and develop technologies aligned with the health needs of vulnerable populations (GADELHA, 2008; BUSS *et al*., 2008, 2005; BRASIL, 2007). This latter strategy is the forthcoming guidance from the World Health Organization (WHO), which recommends increased investment in research by the least developed countries on diseases neglected by the global pharmaceutical industry.

Thus, Fiocruz has been reorganizing its institutional policy for research and technological development since 2001 (BUSS *et al*., 2005, 2008). The objective is to prioritize research on technologies which are very likely to be used by both domestic producers of health products and health services (BRASIL, 2007). In this sense, Fiocruz has implemented the following initiatives: Program for Technological Development of Health Products (PDTIS); Program for Technological Development in Public Health (PDTSP), Center for Technological Development in Health (CDTS), the restructuring of the Division for Technology Management (GESTEC) and the structuring of Technology Platforms (TEIXEIRA *et al.,* 2009a).

The introduction of technology platforms in the organization is consistent with Fiocruz's Center for Technological Development in Health (CDTS) and, more particularly, the technical infrastructure of the Program for Technological Development of Health Products (PDTIS).

Technology Platforms were established in 2004, as a result of the first evaluations of projects supported by PDTIS, and the consolidation of PDTIS itself. Thus, the PDTIS management team mapped the technical expertise in the operation of multi-user equipment, the techniques available on the molecule database available at Fiocruz, and the new requirements for meeting the demands of projects supported by the Program. PDTIS uses co-operative networks as an organization device (TEIXEIRA *et al*., 2009a, b). The same device was adopted for Technology Platforms. Thus, Fiocruz has a network of Technology Platforms through PDTIS.

Currently, the Network of Technology Platforms consists of 12 Platforms, subdivided into 39 sub-units, spread over five of the six campuses of Fiocruz. While conducting the exploratory study, we found that 22 sub-units (56%) are installed on the campus of Rio de Janeiro, where the Oswaldo Cruz Institute (IOC) hosts 9 platforms (75% of the total number) within 17 sub-units.

The Technology Platforms have been installed in Fiocruz research laboratories, which have expertise in testing and some technical ability to perform a higher volume of analysis. The Technology Platforms will share the physical space, the head of the laboratory and most of the

research team of the laboratories in which they are located. Fiocruz invested in improving the physical facilities by acquiring more modern equipment which allow for greater processing of samples and also expanded its technical team.

The Platform is a space for experiments that require high level of technical and scientific expertise. So far, we have divided the platforms into two subgroups as regards experiments' properties. The first group contains the assays organized around an intensive multi-user equipment, such as the Platform for Proteomics / sub-unit of Mass Spectrometry, while the second group is comprised of those that require the use of one or more specialized techniques that may or may not require the combination of several instruments - for example, the Platform of Bioassays/Dengue subunit.

The use of platforms observes a scale of priority, namely: a) projects supported by PDTIS have the highest priority; b) other institutional projects of Fiocruz; c) projects developed by Fiocruz's institutional partners . We have not gathered information about demand and how it is distributed among the three types of projects (PDTIS, institutional projects, projects developed by partners).

Platforms are designed, therefore, to carry out a specialist trial test aligned with very specific work organization logics - the provision of technology services for research laboratories in the biomedical field. The document *Consulting the scientific community of Fiocruz on the use of Technology Platforms* (BRASIL, 2004) reads: "These technology platforms should aim, by means of concentration of technology, to provide services to research developed by Fiocruz and other research and development institutions in Brazil and also from abroad, on occasion" (BRASIL, 2004).

During the exploratory study, we identified the following situation: although some laboratories already used to carry out tests for other research teams, these tests were associated with the scientific collaboration among laboratories. Performing an experiment was part of a chain of personal relationships generally established between the heads of two given laboratories, for example. The test was part of a network of relationships involving the sale of reagents, equipment loan, co-authorship of scientific articles, citations, and in many cases, co-orientations of graduate theses (KATZ *et al*., 1997).

We believe that Technology Platforms reposition the act of running specialized tests, removing it from the chain of scientific collaborations and inserting it into the dynamics of technological services. This offset can potentially have implications for the organization of the laboratory because the provision of technological services implies a unique organization of laboratory space, asserting some aspects and requirements of scientific work. The physical space has to be expanded or rearranged to house the equipment. Instead of the temporary presence of doctoral students and research fellows who specialize in running a test as a requirement of their theses and scholarship reports, laboratories should have a regularly employed technician in charge. This professional is to be responsible for standardizing the tests, updating the documentation, storing samples correctly and writing reports. The requests, previously restricted to the network of collaborators and anchored in personal relations, are not governed by criteria that apply to all platforms at Fiocruz. Theses deadlines or the impending submission of an article for publication are not to dictate the priority of activity flow. Therefore, testing cannot be regulated solely either by the dynamics of ongoing research projects at the laboratory that houses the platform, or by theses under development. Hence, the head of the laboratory has no control over the activities. The completion of the tests must also occur under appropriate conditions of good laboratory practice, with certified, calibrated equipment operated by a fully-trained proven technical team.

The value of tests in scientific collaboration is measured by the ability to establish collaborations or strengthen the technical and scientific credibility of the laboratory among peers. The cost is diluted in the general budget of the laboratory whose resources consist of

funding from Fiocruz and also from development agencies. When providing services, technical and scientific capacity becomes an exchange value, implying a price and influencing the estimation of costs.

Relevant changes also occur in the laboratories using the services of the Platforms. The fact that the facilities are concentrated in specialized spaces implies that other research laboratories forgo the investment made in equipment and / or in the technical expertise to use it. This changes the dynamics of research organization and financing, focusing on both a given individual project and the laboratory that holds the scientific expertise to develop it. The service involves a division of labor among laboratories, as distinct from the one practiced in collaborative scientific research. The Platform is a space not completely controlled by the head of the laboratory or by senior researchers in his/her team. The loss of control has an immediate impact on the research laboratory. Tests of platforms that require services have to be planned and requested in advance. Hence, planning and monitoring the implementation schedule of the experiments are stricter. The samples sent should follow the Standard Operating Procedures (SOP) set by platforms, which may differ from those practiced by the research team.

The core issue of this study is to understand the use of the device "Technology Platform" in a specific and delimited science-producing location - Fiocruz - and its relations with the organization processes of research and techno-scientific knowledge production. We do not have evidence yet to support the literature which considers platforms as a strategic element to enhance and accelerate data processing. However, the evidence gathered so far allows us to identify certain characteristics and relationships associated with Fiocruz's platforms.

Regarding the characterization of the platforms, we consider that: a) they create a new space dedicated to experimental testing; b) they are governed by the logic of the provision of technological services; c) they introduce a new organizational logic and therefore a new set of practices and controls; d) they stand out as a highly inter-laboratory space for experimental testing as well as for collective use and management. We also feel that the choice of this device is associated with the national policy for health research. Thus, it is a crucial activity to map, describe and analyze discrepancies between the new set of practices and controls and those employed by laboratories.

When we focus on the research laboratories that make use of technology services of Platforms, we envision two divisions in the process of knowledge production: a) one between the experimental phase of the research (some tests are performed in research laboratories and others are moved to the Platform), and b) one between the experimental phase and the phase of interpretation of results (the platform forwards the report, which will be interpreted and collided with results of other tests performed in research laboratories).

By systematizing the data gathered to date, we indicate two fronts that should guide the unfolding of the current study. First, we associate the use of "technology platform" with interactions between this device and the local forms of organizing research. But in preliminary research we did not consider differences in the pattern of organization of the Institutes of Fiocruz. Thus, in addition to identifying and describing possible differences, we need to analyze whether they are significant enough to alter the relationship between platforms and their users. Nor did we state the possible relationships between the objects of research, knowledge areas and scientific research objectives of each user laboratory. Therefore, we need to analyze the position of these elements in the dynamic platform - the laboratory.

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