

The dynamics of biomedical research organization in Brazil: the anatomy of a recent experience at the Oswaldo Cruz Foundation¹

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Abstract

Biomedical research has undergone changes in the last four decades which have affected the design of new scientific approaches, the study of diseases associated with pathogenic microorganisms and the development of new products and industrial production processes. Additionally, they have affected new methodologies for preventing, treating and diagnosing transmissible and non-transmissible diseases, particularly the neglected ones. By identifying such elements, can we state that Brazil is witnessing the emergence of a new form of organizing the processes of research and production of technical-scientific knowledge in health? We attempt to answer this question through an analysis of the local dynamics in using organization and scientific research coordination tools in a centenarian institution with a strong tradition in biomedical research in Brazil, namely the Oswaldo Cruz Foundation. We start by providing an analytical description of the Foundation between 2001 and 2003. This description comprises three sections which cover: the organization and institutional goals; fields of research; management and assessment methods regarding scientific research and technological development at Fiocruz; means of funding and assessment methods and the configuration and dynamics of cooperative networks. We conclude by making some final comments of a general and specific nature. This aims to make a contribution in order to help perfect the local organization process of scientific research targeting technological advancement in the field of Brazilian public health in an institution which has been playing a central role in formulating, implementing and assessing health policies in the country.

Keywords

qualitative analysis; biomedicine; Brazil; public research institution; procedures in organizing and coordinating scientific research

Introduction

Biomedical research has undergone changes internationally in its technoscientific² knowledge base in the past four decades (GAUDILLIÈRE, 2002; CLARKE et al., 2003; KEATING et al., 2003; BURRI et al., 2007; LOCK et al., 2008). Such changes cover the emergence of proteomics, genomics, bioinformatics and nanotechnology and its association with virology, bacteriology and parasitology. This association has affected the design of new scientific approaches and the study of diseases associated with pathogenic microorganisms (MOREL et al., 2007). The treatment and diagnosis of transmissible and non-transmissible diseases, particularly the neglected ones, in addition to new prevention methodologies, have contributed equally to the development of new products and industrial production processes (BUSS et al., 2005)³.

This period also stands out due to an increase in costs for organizing and maintaining research infrastructure. This was partly due to the diversity of tools for systematizing, managing and analyzing scientific information (SHORTLIFFE et al., 2006). At the same time, research activities suffered an upheaval caused by an increase in a set of organization and coordination procedures in producing technical-scientific knowledge. Among such procedures we have identified the following: i) intensification in scientific collaboration between research teams from different fields, institutions and countries (KATZ et al., 1995, 1997; CHOMPALOV et al., 1999; BEAVER, 2001; SHRUM et al., 2007; LARSEN, 2008); ii) propagation of coordination tools such as cooperative networks, multi-user equipment platforms and consortia (KEATING et al., 2003; SHRUM et al., 2007; CHOMPALOV et al., 1999; PIRRO et al., 2000; LONGO et al., 2000); iii) more encouragement to research in new fields of knowledge and topics or concentrating on specific technical goals (PIRRO et al., 2000; SHRUM et al., 2007; LARSEN, 2008); iv) diversification of technical-scientific knowledge production *loci* through the formation and presence of multi-disciplinary teams (D'AMOUR et al., 2005; LARSEN, 2008), as well as sources and means of funding for research and development (P&D) (SHINN et al., 2005), which resulted in growth and expansion of the inter-disciplinary areas (CUMMINGS et al., 2005).

Thus, what we have before us is a reconfiguration process of the shape of the main driving force of modern societies - sciences (KRIGE et al., 2003). However, we believe that this morphological reconfiguration acquires different characteristics, to which the following contribute: the field of research involved; the scientific subject(s) (SHINN et al., 2005); as well as the historical-social constitution of the countries and research institutions (SHINN et al., 2005). Therefore, it is necessary to investigate the dynamics of the biomedical research organization in different local contexts. This is especially true for countries which are relatively⁴ less developed such as Brazil, about which there are few studies. It is also necessary to conduct an investigation on the local dynamics because the Brazilian research environment has been under the impact of new arrangements between organization tools and procedures for the production of

technoscientific knowledge. Many tools are listed in the guidelines and action strategies of the National Policy for Science, Technology and Innovation (BRASIL, 2001a; 2006a, 2007a) and the National Policy for Science, Technology, Innovation and Health (BRASIL, 2005a, 2008a; GUIMARÃES, 2004, 2002; GUIMARAES et al., 2006). New Programs which encourage research in new fields of knowledge of biomedicine have proliferated in the last few years, all based on scientific collaboration and network coordination of activities (BRASIL, 2006b, 2008b). In addition to those actions, we can add a new set of statutory provisions which regulate research activities, especially the Innovation Act (number 10,973/04), the Biotechnology Act (number 11,460/07) and the Scientific Use of Animals Act (number 11,794/08) (BRASIL, 2004a, 2007b, 2008c). Research funding was also expanded and combined with induction to research in strategic fields (GUIMARÃES, 2004; GUIMARÃES, et al., 2006; BRASIL, 2007a, 2008a). All such actions were strongly influenced by the public policies drawn up by countries that perform strongly in biomedical scientific research and adopted by international bodies such as the Organization for Economic Co-operation and Development (OECD) (GODIN, 2005; MACHADO et al., 2007).

By identifying such elements, can we state that Brazil is witnessing the emergence of a new form in organizing the processes of research and production of technoscientific knowledge in health? In case this is true, how do these emerging processes manifest themselves in a country of continental dimensions, marked by regional differences and research institutions which were created in different social-historical contexts and whose configurations are unique?

The aim of this article is to analyze the local dynamics when using organization and scientific research coordination tools in biomedicine. We have chosen as the subject of our case study the experience of the Oswaldo Cruz Foundation because it is a centenarian institution with a strong tradition in research in the fields of biomedicine⁵. Additionally, because they initiated in 2002 an experiment to promote a Program (PDTIS) aimed at inducing and encouraging collaborative research to produce health inputs (medicine, vaccines and diagnostic inputs) and coordinate research in cooperative networks (TEIXEIRA et al., 2008b). Ever since 2001, the Oswaldo Cruz Foundation (BUSS et al., 2002; MOREL et al., 2007) has been redirecting its institutional policies for research and technological development. This aims to strengthen the technological and innovation components, introducing tools and procedures in line with the reconfiguration process of the shape of modern sciences, as briefly described before.

This article consists of three sections. After this brief introduction to the set of issues and formulation of questions for investigation, we start by making a few methodological remarks on techniques we used in gathering, systematizing and analyzing data and documents we consulted. We then make a brief analytical description of the Oswaldo Cruz Foundation's organizational structure. We highlight the institutional goals and management methods, as well as assessment of scientific research and

technological development. Such description will be limited to the period between 2001 and 2007, which corresponds to the implementation and consolidation of the Program for Technological Development of Health Inputs (PDTIS). In the third section, we continue this analytical description concentrating on the PDTIS. We discuss its goals and organizational structure, highlighting the processes of organizing and assessing cooperative networks and its means of funding. This effort will enable us to discuss the local dynamics of the Oswaldo Cruz Foundation using research organization and coordination tools. Here we highlight the features which comprise the cooperative networks model that emerged from the local reconstruction process by the research actors. We conclude by making some final comments of a general and specific nature on the organization of the Oswaldo Cruz Foundation and the cooperative networks model adopted by the Foundation. This aims to make a contribution in order to help perfect the local organization process of scientific research targeting technological advancement in an institution which has been playing a central role in formulating, implementing and assessing health policies in the country.

Research methodology

The qualitative study was conducted between the months of July 2006 and May 2008, based on different techniques (DENZIN et al., 2005), such as analysis of different documents, open, non-directed interviews and ethnographic observations of Program meetings (MACHADO, 2005; TEIXEIRA et al., 2006, 2008). Throughout the text, we will use the acronym Fiocruz when referring to the Oswaldo Cruz Foundation, while the Program for Technological Development of Health Inputs will be referred to as PDTIS. However, we will use aliases to refer to managers from Fiocruz and PDTIS, as well as PDTIS researchers who were interviewed. Prior to the interviews we agreed to keep identities secret. This was part of a trust agreement entered into by the interviewers / observers and interviewees/observed⁶.

The Program was launched in 2002. Thus, identification, gathering and analysis of documents were limited to the period between 2001 and 2007. We considered as a secondary source general Fiocruz documents which describe and assess its policies for research and technological development (Strategic Planning Documents, Activities Reports, Management Reports) and those specific of the PDTIS, in addition to documents about the national P&D policy and those which mention the health sector. Among the documents which are related to the P&D policy, we consulted the Innovation Act (number 10,973/04), the Biotechnology Act (number 11,460/07) and their respective executive orders, in addition to Reports from the *National Conferences on Science, Technology and Innovation* (2001) and on *Science and Technology in Health* (2004). Another source we consulted were the minutes of the *Chamber of Research Techniques and Technological Development*, coordinated by the Vice-presidency of Research and Technological Development of Fiocruz, from 2001 to 2005, a collegiate body of Fiocruz (BUSS et al., 2002).

As to the systematization and analysis of documents, we faced some difficulties arising from changes in the methodology used to gather and systematize data which resulted in the Activity and Management Reports from Fiocruz in the period analyzed. A goal we found particularly difficult to achieve here was the classification of priority diseases which were studied by Fiocruz. We intended to build a framework which featured the main diseases, since the PDTIS established a set of eleven priority diseases for project funding. However, up until 2005 the diseases were clustered in larger groups, such as "Emerging diseases" or "Inflammations caused by bacteria" (BRASIL, 2002a, p.10). After 2005, some diseases were separated (Malaria, Chagas disease), while others were not (Parasitic diseases) (BRASIL, 2006c, p.9). Still on data management, we verified that information regarding funds invested in research activities and in the PDTIS are presented in the Activity and Management Reports in Real. In order to facilitate the reader's comprehension, we have maintained all sums in Real and included between brackets the sum in dollars⁷. As for the boxes, we opted for keeping the real in the Portuguese version and make the conversion into dollars in the English language version.

When analyzing the fields of knowledge in which Fiocruz works, we have used the concept of "biomedicine" (GAUDILLIÈRE, 2002; KEATING et al., 2003) to encompass those fields which articulate biology, medicine, science, technology, innovation and routines. This concept expresses a hybridization process which has been taking place after World War II and that today is part of the vast world of biomedicine⁸. Thus, we were able to group under the concept of biomedicine the fields of clinical research, biological sciences and biosciences, all present in the Activities and Management Reports and in the institutional documents.

From the analysis of the Minutes of the Technical Chamber of Research and Technological Development and the PDTIS Launching Document, we drew up a preliminary list of research actors in order to conduct open, semi-structured interviews. Interviewees included: i) managers of bodies of Fiocruz's central administration and of research and production institutes involved in the preliminary discussions and the implementation of the PDTIS; ii) PDTIS managers, also comprising Cooperative Networks' coordinators; iii) PDTIS researchers, especially those who were in project management positions. As we analyzed a relatively long period (2001-2007) when compared to the term of office of public managers, which lasts four years, some actors have changed positions. Thus, the categories of former Fiocruz manager and former PDTIS manager appeared among the interviewees.

The interview script was structured initially based on the analysis of documents which were collected in the first three months of research. After carrying out the first exploratory interviews with managers and researchers, we reviewed the script and introduced questions regarding the Program's assessment process, the purchasing

process and the legal environment which regulates the purchase of inputs and equipment. The script included the following topics: educational background; connection to and field of work at Fiocruz; participation in PDTIS; level of knowledge of management methods in PDTIS (recruitment, monitoring, budget, purchasing). We carried out a total of 33 interviews of between 60 and 120 minutes. Some PDTIS and Fiocruz managers and former managers were interviewed twice. The interviews with the actors took place in the laboratories (researchers) and offices (managers). We worked from the assumption that the interviews should be carried out by at least two researchers and recorded by a digital device so we could explore as much as possible the issues in the interview script. This also enabled us to listen to, transcribe and have easier access to the recorded information. We used qualitative analysis *software* to manage such information - Atlas.TI. Although Atlas.TI is compatible with sound files in WAV format, we chose to work with text files only⁹. We believe the latter format favors shared analysis.

The information gathered through the interviews was complemented by observations of the annual meetings to assess the PDTIS, which took place between 2007 and 2008 and were organized by cooperative networks. We chose this procedure because literature on collaborative scientific research considers assessment meetings to be relevant coordination mechanisms when studying the dynamics of this type of research activity (CALLON et al., 1995; CHOMPALOV, 1999; CUMMINGS et al., 2005; SHRUM et al., 2007)¹⁰. We structured a protocol for the observation of meetings which covered the following aspects: a) the ways in which different Program coordination instances participated (network coordinators, project managers and technicians in charge); b) the ways in which consultants participated, focusing on the interaction with project managers and technicians in charge; c) level of appropriateness of the meeting dynamics by the participants; d) previous knowledge about the goals of projects being analyzed by assessors; and e) previous knowledge on the content of reports and assessment opinions by those assessing a new evaluation (TEIXEIRA et al., 2008, 2009).

When analyzing the PDTIS, we focused on describing cooperative networks taking into account the organization process, the assessment tools and the funding mechanisms. The Atlas.TI software helped us carry out a cross analysis between the information contained in the following documents: i) Fiocruz's Management and Activity Reports (2002-2007); ii) PDTIS launching document (BRASIL, 2002a); iii) interviews with Fiocruz and PDTIS managers, including Network coordinators; iv) scientific articles; v) two master's degree dissertations about science and technology management in health at Fiocruz, written by Fiocruz managers (PINHEIRO, 2004; BEZERRA, 2008).

For the purposes of this article, we will restrict our analytical description to the research and technological development activities. We must, however, clarify one

point. Research and technological development form a single unit in Fiocruz's institutional actions¹¹. However, in the Activity and Management Reports from the period we analyzed (2001-2007), each activity is treated as a sub-section of the chapter Research and Technological Development. We chose to maintain this division, starting our effort with research and then moving on to technological development

Scientific research at Fiocruz: institutional goals, management methods and assessment

As we stated in the Introduction, the PDTIS is part of a set of actions promoted by Fiocruz aiming to reorganize research on new technologies for the development of products and processes in the field of health inputs BRASIL, 2002a, b; BUSS et al., 2002, 2005, 2008). Such technologies should be developed and transferred, as a priority, to the two industrial plants (vaccines and medicines) run by Fiocruz. However, we need to know the structural features of Fiocruz from the late 1990's in the 20th century in order to understand the meanings associated with the internal reorganization process.

Fiocruz is a centennial public institution linked to the Brazilian Ministry of Health. It comprises fifteen Institutes distributed among six cities (Rio de Janeiro, Belo Horizonte, Curitiba, Salvador, Recife, and Manaus), which are situated in four different geographical regions in the country, although strongly concentrated in the Southeast (Box 1). Research and technological development activities focus on the field of biomedicine (clinical research, biological sciences and biosciences) and social and human sciences in health (Box 1), with an emphasis on studies on infectious/parasitic diseases (BRASIL, 2007c). In 2009, Fiocruz had 281 Research Groups registered with the National Council for Scientific and Technological Development (CNPq) database, of which 253 were in the field of biomedicine¹².

Box 1 - Institutes' research areas by geographical region¹³ - 2007

	Southeast	Northeast	North	South
Number of institutes per 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: BRASIL, 2007 c. Made by the authors.

Fiocruz's organizational structure comprises a Presidency (whose term of office is four years and who is appointed by the President of the Federative Republic of Brazil), four vice-presidencies (organized from the institutional programs defined in the Goals and Objectives Plan), as well as auxiliary agencies. Internally, Fiocruz's Institutes follow an organizational logic. They're divided into Departments in which there is a strong presence of scientific subjects. A new structure was approved in 2007. Its focus was the gradual extinction of the department division. There was encouragement to form more flexible structures (networks; equipment platforms; flexible laboratories); to reduce hierarchical levels and to group teams in laboratories conceived from research goals and themes (BUSS et al., 2002). It is worth highlighting that Fiocruz has a partial decentralization policy of its administrative processes (BEZERRA, 2008). This has some direct impact on research, such as the purchase made by Institutes of inputs and national and international equipment.

Scientific research and technological development are complemented by *non-degree graduate courses and master's and PhD courses* (Box 2). The expansion of teaching began in the second quarter of the 1990's decade. In 2001 there were eight graduate programs and in 2007 that number rose to thirteen. In 2007 four of the graduate programs achieved the highest level in Capes' (an agency of the Ministry of Education - MEC) Assessment System, of which the highest mark is seven.

The research, technological development and teaching activities of Fiocruz involve technical cooperation with universities, national and international research Centers and Institutions, such as the *Institut National de la Santé et de la Recherche Médicale* (INSERM), the *National Institutes of Health* (NIH) and the *Institut Pasteur*.

The Oswaldo Cruz Foundation runs two Institutes dedicated to the industrial production of medicines, vaccines and diagnostic inputs to basically cater for the programs coordinated by the Brazilian Ministry of Health.

Box 2 - Activity by geographical distribution and Institute number¹⁴ - 2007

Activity	Region			
	Southeast	Northeast	North	South
Research and Development	9	2	1	1
Teaching	11	2	1	-
Production	2	-	-	-

Source: BRASIL, 2007c.

Since 2001 Fiocruz's strategic planning sets as a priority to conduct research in fields and topics which are related to the needs of people who are highly vulnerable. It also takes into account articulation with actions and guidelines of the National Policy for Science and Technology, the National Policy for Science, Technology and Innovation in Health (MS) and the Pluriannual Plan of the Ministry of Health (BRASIL, 2001a, b, 2005a, b, 2006a, 2007a, 2008a).

The Activity Reports of 2001 and 2002 present graphs portraying the evolution in the number of ongoing projects, followed by a list of research theme areas without referring to Fiocruz's institutes and the amount of projects associated with each area. In 2003 and 2004 the Activity Reports do not show data on the number of ongoing projects, but they provide a list of theme areas. Once more this list establishes no connection with the institutes or number of projects by field. It is worth noting that the Activities Report of 2000 did provide data as to the number of ongoing projects in each Institute and already offered a list of research theme areas. We have not encountered a definition of theme area in any of the reports in the period we analyzed.

In 2005 we have identified a change in the methodology used to draw up the Reports, at least regarding research. Research activity in the Activity and Management Reports of 2005 was organized around a set of institutional research goals (BRASIL, 2005c, 2006c, 2007c). We did not identify in the Reports a definition for "institutional goals" and how they are different from those of the previous organization, that is, in research theme areas (BRASIL, 2005c). Additionally, there is no description of the methodology used to construct them and of the meaning ascribed to the expression "To generate knowledge about" which accompanies some of the goals.

After constructing institutional research goals, Fiocruz went from fifty-three fields of research in 2000 to fourteen goals in 2005. Those were expanded to twenty-four in 2006 and twenty-five in 2007 (BRASIL, 2000a, 2005c, 2006c, 2007c). This expansion, partly caused by the separation of objectives, was also not justified (Box 3).

Still in 2005, Fiocruz started implementing the Integrated System of Management Information (SIIG). Both SIIG and the institutional goals changed the way in which research information is systematized and presented. Until 2004, the Reports made reference to "Research Projects". In 2005, there is no information in the Reports about the number of ongoing projects. In 2006 and 2007 they start using the designation "registered projects" (BRASIL, 2000a, 2001c, 2002b, 2003a, 2004b).

Box 3 - Institutional research goals

Institutional goal	Year		
	2005	2006	2007
To generate knowledge about biology, pathology, agent-host interaction, prevention and control of endemic diseases	2005	-	-
To generate knowledge about the genetics, biochemistry and molecular biology of physiopathological processes	2005	-	-
To generate knowledge about human Viroses: pathogenesis, immune response, epidemiology, etc.	2005	-	-
To generate knowledge about Immunity and inflammation	2005	-	-
To generate knowledge about pathology, epidemiology, prevention and control of non-transmissible diseases	2005	-	-
Clinical and pathological knowledge in patients with infectious diseases	2005	-	-
To generate knowledge about the environment, ecology and health	2005	-	-
To generate clinical and pathological knowledge about pregnant women, children and teenagers with high complexity illnesses	2005	-	-
To generate knowledge about the biology, pathogeny, transmission, epidemiology, prevention and control of mycobacterioses	2005	-	-
To generate knowledge about the biology, immunology and epidemiology of infectious/parasitic diseases	2005	-	-
To generate knowledge about other parasitic diseases	-	2006	2007
To generate knowledge about Chagas Disease	-	2006	2007
To generate knowledge about Leishmaniasis	-	2006	2007
To generate knowledge about Teaching in sciences and health	-	2006	-
To generate knowledge about biological, epidemiological and social Aspects of STDs/AIDS	2005	2006	2007
To generate knowledge about basic physiology, physiopathology and immunology mechanisms	-	2006	-
To generate knowledge about health Policies, planning, management and assessment in health	2005	2006	2007
To generate knowledge about health and the environment, employee health and human ecology	2005	2006	2007
To generate knowledge about human Viroses and rickettsioses		2006	2007
To generate knowledge about social Sciences in public health and science and technology	2005	2006	2007
To generate knowledge about non-transmissible Diseases	-	2006	2007
To generate knowledge about therapeutic Actions, pharmaceuticals and/or medicines	-	2006	2007
To generate knowledge about Vigilance in Health	-	2006	
To generate knowledge about Schistosomiasis	-	2006	2007
To generate knowledge about Tuberculosis	-	2006	2007
To generate knowledge about Malaria	-	2006	2007
Assessing technologies in Public Health	-	2006	2007
Geographical categorization of the health/sickness process	-	2006	2007
To generate knowledge about Hansen disease	-	2006	2007
To generate knowledge about health Economics	-	2006	2007
To generate knowledge about Paleopathology and paleoparasitology	-	2006	2007
Field of food, nutrition and health	-	2006	2007
To generate knowledge about Sanitary vigilance	-	-	2007
Encouraging Research projects	-	-	2007
To generate knowledge about bacterial and fungal Diseases	-	-	2007
To generate knowledge about health education and teaching sciences and health	-	-	2007

Source: BRASIL, 2005 c, 2006 c, 2007 c

Based on the data gathered from the Activity Reports of 2001, 2006 and 2007, we produced Box 4.

Box 4 - Number of research projects per year

Year	Number of Research Projects
1997	1120
1998	1153
1999	1340
2000	1385
2001	1421
2002	1601
2003	*
2004	*
2005	*
2006	898
2007	1415

Source: BRASIL, 2001b, 2006c, 2007c. Made by the authors.

(*) Data not available.

From the 2006 Report, the information “registered projects” becomes associated with “institutional research goals” (BRASIL, 2006c, 2007c).

The Activity and Management Reports we consulted make no reference to the methodology used in correlating the registered projects to the institutional goals. The association between “registered project” and “institutional research goals” seems to be made by Fiocruz’s Institutes when feeding the SIIG or by the Planning Board (Diplan). The latter manages the SIIG and is responsible for the technical execution of the Activity and Management Reports. We conclude that the process occurs in the following order: i) the project starts in an Institute (with or without external funding); ii) the project is registered with the SIIG; iii) the project is associated with an institutional research objective.

In the lack of a conceptual definition, it is possible to organize the institutional research goals of Fiocruz (Box 3) in different ways. One can organize them according to the study of diseases (to generate knowledge about Malaria), to health public policies (To generate knowledge about health economics), to subjects, approaches or fields of knowledge (To generate knowledge about basic aspects of physiology, physiopathology and immunology). We propose to divide them into biomedicine and social and human sciences in health (KEATING et al., 2003). Then, we offer some information which aims to offer a rough picture of the number of projects associated with the institutional research goals.

In 2006 we associated thirteen of the twenty-two institutional goals of Fiocruz with the field of biomedicine. The projects registered under institutional goals that we associated with biomedicine achieved the number

of five hundred and seventy-one projects out of eight hundred and ninety-eight. The goal which counts the largest number of registered projects is “To generate knowledge about bacterial and fungal diseases” with a total of seventy-five projects and fifty-one articles in indexed periodicals.

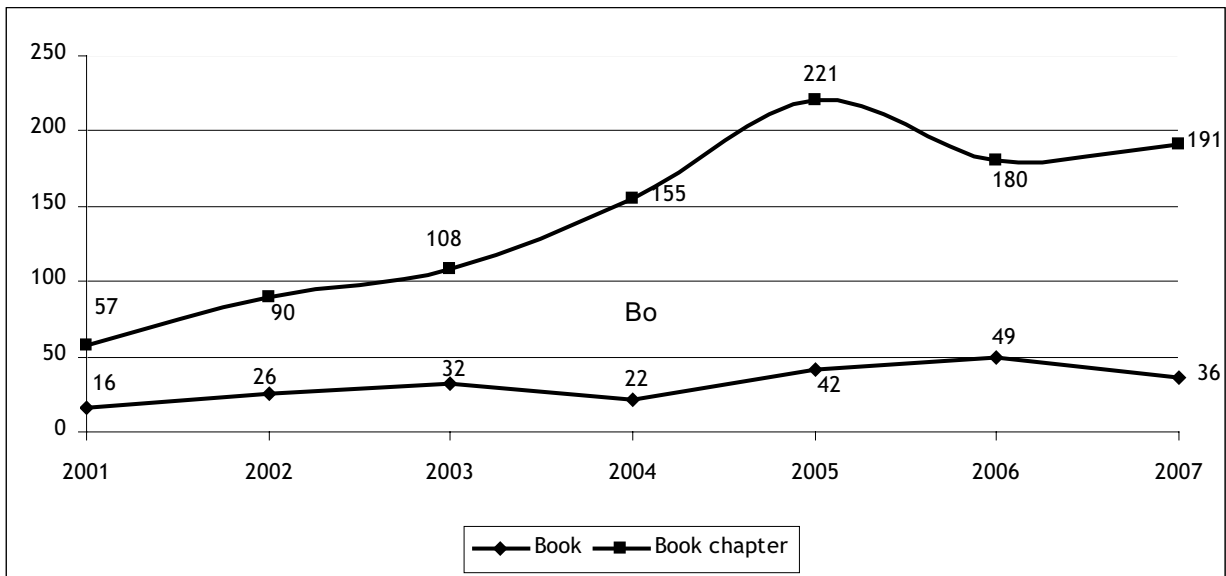
In 2007 we associated thirteen of the twenty-five institutional goals to biomedical research. In this subgroup, the one hundred and fifty projects registered under the goal “To generate knowledge about Leishmaniasis” stand out (BRASIL, 2007c). We counted seven hundred and fifty-one projects associated with biomedicine in 2007, of a total one thousand four hundred and fifteen projects registered with Fiocruz. However, in 2007 the goal which counts the largest number of registered projects is “To generate knowledge about health education and teaching sciences and health”, with one hundred and sixty-nine projects (BRASIL, 2007c).

To complement the picture of institutional goals and research management, it is worth emphasizing that the Activities and Management Reports in the period we analyzed do not offer information on the state of collaborative scientific research between Fiocruz’s institutes.

The productivity of research carried out at Fiocruz is measured by the following indicators: articles published in indexed scientific periodicals; articles published in non-indexed periodicals; books published; chapters in books; publications in scientific events; investment in research and development (P&D) (VELHO, 1999; GODIN, 2005). However, between 2001 and 2007 the data regarding the investments in research and technological development were disbanded in the activities and, above all, in the management reports.

The reports consulted make no distinction between the articles published in national and international periodicals. Nor do they distinguish or identify the bibliographic database in which the published articles are indexed and which are considered to be a priority by Fiocruz in terms of assessing productivity. The Activity and Management Reports from the analyzed period (2001-2007) present historic series about the production of articles in non-indexed periodicals, books published, chapters of books and publications in scientific events (Figure 1).

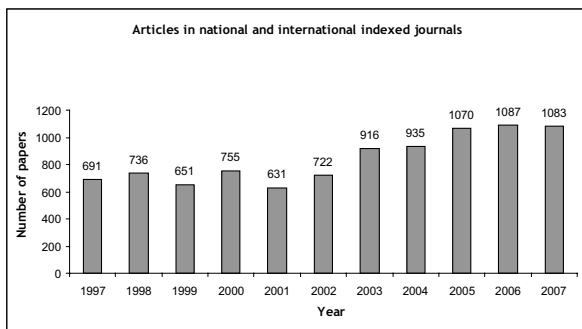
However, we have observed something worth noticing. The indicator “published articles in indexed periodicals” is the only one which is already detailed in terms of institutional research goals from 2005 (BRASIL, 2005c). In 2006 and 2007 the same indicator is associated with the number of registered projects and to the institutional research goals (BRASIL, 2006c; 2007c). Thus, for analysis purposes, we will focus on the indicator “published articles in indexed periodicals.” In order to facilitate the description of research activity and its methods of assessment, we will cover the years of 2006 and 2007 only. The Reports of those years associate the indicator articles with the institutional goals and the registered projects.



Source: BRASIL, 2007c

Figure 1 - Published chapters in books, Fiocruz, 2001-2007.

Between 2001 and 2007 (Figure 2), the number of articles published in national and international periodicals indexed in several bases counted one thousand three hundred and fifty-nine articles (BRASIL, 2007c; 2007d).



Source: BRASIL, 2007c

Figure 2 - Articles in national and international indexed journals.

We associated with biomedicine a total of 688 articles published in indexed periodicals in 2006. This means that in that year the biomedical publications corresponded to 63% of the total number of indexed articles (BRASIL, 2006c). In that year the goal “To generate knowledge about Chagas Disease” (with 66 registered projects) presented the largest number of articles in indexed scientific periodicals¹⁵, that is, 108 that year.

In 2007, the number of articles published in indexed periodicals and associated by us with biomedicine was 598 articles. This number represents a little less than 60% of the total amount of articles published in indexed periodicals that year (BRASIL, 2007c).

In the same year, among the goals related to biomedicine, the one which presented the largest amount of articles in indexed periodicals was the institutional goal “To generate knowledge about leishmaniasis”, with 110 (for 150 registered projects).

Still in 2007, it is worth mentioning that an institutional goal we have associated with the field “research on social and human sciences in health” presented the largest number of articles in indexed scientific periodicals, counting 117 titles. The institutional goal is “Health and the environment, employee health and human ecology”, which in that same year had 169 registered projects (BRASIL, 2007c).

The funding for research in Fiocruz comes from three sources: the Federal Government’s budget; funding arising from the sales of vaccine and medicines; funds raised from agencies which encourage scientific research. The funding from the Federal Government’s budget depends on approval by the National Congress (House of Representatives and Senate). The Congress must approve the budget proposed by the executive branch (Presidency of the Republic). Internal negotiations to allocate the budget start after the Congress’ approval and transfer of funds to Fiocruz. Negotiations take place between the Boards of Fiocruz’s institutes, the Planning Board and the Vice-presidency for Industrial Development. The budget is managed by each Institute in a decentralized way, as well as resources and procedures for national and international purchasing of equipment and inputs.

However, we have also identified changes in the methodology used to draw up the Reports and to gather the data regarding investments. Thus, in 2002 the Program¹⁶ was “Research and Technological Development”

(P&D) (BRASIL, 2002b, c). In the 2003, the aggregation of investments in P&D remains, but the data regarding research in the institutes located in Belo Horizonte, Recife and Salvador were disbanded (BRASIL, 2003b)¹⁷. From 2004, “Research and Technological Development” appear as separate actions (BRASIL, 2004c, 2005d, 2006d, 2007d). And from 2005, “Technological Development” is accompanied by “Innovation”.

The sums corresponding to investment in research went from R\$ 41 million (US\$ 12.5 million) in 2002 to R\$ 74 million (US\$ 39 million) in 2007 (BRASIL, 2002b; 2007c). Some years stand out due to the scale of investment. In 2005 R\$ 76.9 million (US\$ 32 million) were invested in research activity. In 2006 the investment in “Research” amounted to R\$ 66 million (US\$ 30.5 million).

The Activity Report for 2006 accounted for an average investment of R\$ 43 thousand (US\$ 20 thousand) per research project (BRASIL, 2006c). This sum rises to R\$ 52 thousand (US\$ 27.6 thousand) per project carried out in 2007 (BRASIL, 2007c). However, due to the diversity of research in Fiocruz in terms of fields of knowledge, goals and subject matters (Box 3), the methodology used to achieve the data was not made explicit. This data (average investment per research project) does not appear in Reports for other years of the period analyzed (2002-2007).

Building a timeline, which would be ideal for us to show the evolution of investment in research, becomes compromised by changes in methodology and presentation methods in the Activity and Management Reports in the period between 2000 and 2007. Consequently, we have chosen not to do it. In any case, funds directed to research in Fiocruz have increased throughout the period we analyzed.

The Technological Development and Innovation in Health action was incorporated into Fiocruz’s strategic planning in 2005 (BRASIL, 2005c, d). We can observe changes in the way the data regarding “Technological Development” were presented during the period analyzed. In 2001 and 2002 the data regarding different projects, indexed and non-indexed publications, are not aggregated, although in the 2002 Report “Technological Development” stands out more, due to the launch of PDTIS in that same year (BRASIL, 2002b).

In 2003 we noticed a change. From that year, the indicators for scientific articles published in indexed, non-indexed periodicals and other bibliographical indicators, as well as the number of research projects appear only in the sub-item dedicated to research. The technological development activities stand out more, with more emphasis to induction projects promoted by Fiocruz (BRASIL, 2003a). In 2003 and 2004, the number of PDTIS projects per Network stands out (BRASIL, 2003a, 2004b).

In 2005 we have identified a new change in methodology (perhaps related to the implementation of the SIIG). Thus, in that year the Report informs that there were two hundred and forty-four ongoing technological development projects in the production Institutes. Thirty-six of them were immunobiological and two hundred

and eight related to medicines. It also adds information on PDTIS projects per Network (BRASIL, 2005c, d).

In 2006 the Activities Report counted two hundred and sixty-six registered projects with investments of R\$ 48 million (US\$ 22 million). In the following year, the Activities Report informed that there were seventy-eight registered projects with investments of R\$ 52 million (US\$ 27 million) (BRASIL, 2007c).

In 2006 and 2007, the data regarding technological development projects were no longer associated with the production Institutes. Therefore, there are two hundred and seventy-six projects recorded in the 2006 Report. In 2007 the number of technological development projects was seventy-eight. In both years there are references to PDTIS projects organized by Network. However, we were unable to conclude whether the total technological development project number includes or not PDTIS projects in 2006 and 2007 (BRASIL, 2006c, 2007c).

The 2007 Management Report highlights that Fiocruz still struggles with the definitions of “inputs”, “developed products”, “methods” and “developed processes” (BRASIL, 2007d, p.44). This generates problems when processing data with the Institutes. On the other hand, the Reports generally do not make it possible to identify among registered projects those belonging to the production Institutes and those concerning the PDTIS. Another aspect which has not been clarified by the documents we consulted is whether the total amount of investment in the action “Technological Development and Innovation” includes or not institutional investments in the PDTIS.

The Activity and Management Reports from the analyzed period do not associate the technological development projects with the research theme areas or with the institutional research goals. We have not identified the creation of specific institutional goals for technological development projects.

As for investment in technological development, we will limit ourselves to the data connected with the period 2005-2007. This is because the sub-items which are related to the projects and programs to encourage technological development were better structured in such reports.

In 2005, R\$ 4.8 million (US\$ 2 million) were invested in “Technological Development and Innovation” (BRASIL 2005d). In 2006 the investment in “Technological Development” was of R\$ 31.5 million (US\$ 14 million) (BRASIL, 2006d).

In 2006 the Activities Report calculates investments of R\$ 48 million (US\$ 22 million). While in 2007 they reached the number of R\$ 52 million (US\$ 27.6 million) (BRASIL, 2007c, d).

The 2007 Activities Report indicates that from the R\$ 204 million (US\$ 108 million) invested by FIOCRUZ in the Science, Technology and Innovation in Health Program¹⁸, R\$ 131 million (US\$ 69.9 million) were destined to activities which we associated with the field of biomedicine (14%) (BRASIL, 2007c). In that year, Fiocruz’s expenditures summed R\$ 948 million (US\$ 504 million), while the entire Institutional Pro-

gram of Science, Technology and Innovation in Health consumed R\$ 204 million (US\$ 108 million) (21.5%) (BRASIL, 2007d).

An analytical description of Fiocruz's organization would not be sufficiently wide if it did not include the information on filed and allowed patents in Brazil and abroad (Box 5). As to that indicator, it is worth highlighting that until 2004 the Activity Reports had a chapter covering technology management (BRASIL, 2000a, 2001c, 2002b, 2003a, 2004b). In 2005 the information on patents was diluted in the chapter referring to programmed action on "Technological Development and Innovation" (BRASIL, 2005c). Back in 2006 and 2007 there was no information on patents in the institution's Activity Reports (BRASIL, 2006c; 2007c).

Box 5 - Filed and allowed patents

Brazil		Abroad	
Patents deposited	Patents granted	Patents deposited	Patents granted
13	3	5	3
4	0	19	2
2	3	29	3
3	0	10	7
13	1	2	6
*	*	*	*
33	*	24	*
*	*	*	*
68	7	89	21

Source: BRASIL, 2000a, 2001c, 2002b, 2003a, 2004b, 2005c, 2006c, 2007c.

Made by the authors.

(*) Data not available.

Program for technological development of health inputs

As we had previously defined in the introduction, the PDTIS' description will be made based on three essential aspects for the purposes of this article: a) goals and organizational structure; b) the Cooperative Networks' organization and assessment process; and c) means of funding.

Goals and organizational structure

The PDTIS was launched in 2002. Its goal is to "encourage applied research and the technological development of products and processes which produce and impact on public health and controlling infectious/ parasitic diseases, such as vaccines, diagnostic kits, pharmaceuticals, medicines and products to control vectors (BRASIL, 2007d, p. 3). The 2001-2004 Activities Report highlights the Program's performance in perfecting the

inputs already produced by both Fiocruz production Institutes (BRASIL, 2004b, p.15).

There was an early option for the cooperative network coordination model, which appeared in the first discussions of the program in 2001 (BRASIL, 2001c). In general terms, the institutional documents justify the adoption of the cooperative networks coordination model through the "maximization of experiences and optimization of human and financial resources" (BRASIL, 2004b, p.15). The 2007 Activities Report complements this purpose when it highlights the promotion and articulation of multi-disciplines, in addition to "motivating researchers to work cooperatively around common goals and similar technologies" (BRASIL, 2007c, p.13). Another argument in the documents is the fact that the cooperative networks allow collaboration "between participants in a non-competitive way" and simultaneous technological research initiatives in "any of the predicted steps in technological development" of health inputs (BRASIL, 2002a, p.5). The horizontal feature of the organization and of labor relationships in network scientific collaborations also contributed to its adoption. The PDTIS structuring and implementation stage corresponds to the moment in which a new structure for Fiocruz was under discussion (BRASIL, 2006e). The arguments in favor of the adoption of structures which were more flexible and more equal in the institutes were heatedly debated.

More recently, the official documents list among the PDTIS' goals "to be an agent for change in the institution's culture by bridging the gap between applied research, the production of health inputs and the institutional technological management" (BRASIL, 2007c, p.12). Despite the importance which was attributed to this goal, the institutional documents lack depth as to the definition of culture and the process of cultural change promoted by the Program. From the interviews carried out with some Managers and Network Coordinators, it is possible to place this process in a more general picture of change in the relations between science, technology and society, observed in different research contexts such as the United Kingdom (WHELAN, 2000), Canada (SMITH, 2000), Australia (SMITH, 2003), New Zealand (CARTER et al., 1997) and France (CALLON et al., 1998). Some interviews also allow us to relate it to changes in the production processes of scientific knowledge. Especially those arising from the introduction of multi-user equipment and with the intensification for the adoption of Good Laboratory Procedures (TEIXEIRA et al., 2002), the Biosecurity guidelines and the use of animals in laboratories (MACHADO et al., unpub. data).

"I have strong criticism against [the model] in which each person's in their separate lab, with their separate funding. You buy equipment when your colleague in the lab next door has the same equipment. (...) you get out of the lab and go to the Department and realize that everybody does the same thing and everyone has the same equipment. I can't create anything new in this structure, because innovation is a complex system and a multi-disciplinary one. (Interview with Eunice, Fiocruz Manager)

Other statements correlate these changes with some features of the PDTIS, such as the assessment and project monitoring systems and persuading people to carry out collaborative research, both new until then in Fiocruz research environment.

PDTIS was very important because it introduced changes in the institution. It's a program designed to induce research. Induced research was not tolerated here in the eighties. I have experienced that, you haven't. At that time, I would go to many meetings to support the view "research for research's sake" After the PDTIS, I no longer believe that. (Interview with Aquiles, Fiocruz Manager)

PDTIS is linked to Fiocruz's Vice-presidency for Research and Technological Development (VPPDT). The Program's organizational structure comprises a General Coordination Office, a General Management Office and Management Offices in the areas of budget, purchasing and intellectual property. The organizational structure is complemented by the four Cooperative Networks' coordination offices which are part of the PDTIS' structure, in addition to a collegiate body (Management Center) which comprises the coordination and management offices and three Fiocruz researchers who work as consultants.

All of the PDTIS' organizational structure and, consequently, its management are located in Rio de Janeiro's campus. Box 6 presents the distribution of projects among Fiocruz's campuses. In this distribution we adopted the criteria chosen by the Program's Coordination which considers the project to be linked to the project manager's scientific unit. It is worth noting that, although there is an apparent geographical dispersion, it is counteracted by a strong concentration of projects and coordination and management instances in the campus located in Rio de Janeiro, in the Southeast of the country.

Box 6 - Number of projects per cooperative network and per region - 2006

		Region				Total
		Southeast	Northeast	North	South	
Rio de Janeiro	Belo Horizonte	Recife	Salvador	Manaus	Curitiba	
8	1	0	0	0	0	9
12	2	1	1	1	2	19
14	1	0	2	0	0	17
12	2	1	0	0	0	15
46	6	2	3	1	2	60

Source: PDTIS data. Made by the authors.
(Available at: <http://www.pdtis.fiocruz.br/>. Access in: Jan. 2007)

Until the first semester of 2007, the list of active projects organized per Cooperative Network was available at PDTIS' website for public consultation (<http://www.pdtis.fiocruz.br/>). In addition to the project's title

and Network, the list named the project Managers and the Technicians in charge. With the implementation of a PDTIS management system via WEB, such information was moved to a restricted area in its website (CAMPOS et al., 2008). On the other hand, as we stated previously, Fiocruz's Activity Reports incorporated data regarding PDTIS projects from 2003. However, they only informed the number of active projects per Cooperative Network, without mentioning the Institute to which the manager is linked, the theme or even the project's title (BRASIL, 2005c, 2006c, 2007c). The VPPDT Activity Report, which has a chapter on PDTIS (BRASIL, 2006f), does not offer any list with names of active projects either, only the total number per Network.

Cooperative networks

Organization process

PDTIS is structured around three strategic areas: Pro-inputs, Functional Genomics, Biological and Triage Models. The four cooperative networks - Applied Genomics and Proteomics, Diagnostic Inputs, Medicines and Vaccines - were built from those areas (BRASIL, 2002a).

The proposals which are selected to integrate one of PDTIS' Cooperative Networks should also include, as a priority, the following infectious/parasitic diseases: tuberculosis, Leprosy, Aids, dengue and yellow fever, malaria, viral infections (respiratory and others), hepatitis, bacterial infections, Chagas disease, leishmaniasis, filariasis, leptospirosis (BRASIL, 2002a). Such diseases were chosen because the Ministry of Health believes they have an impact on national public health (GUIMARÃES et al., 2004; BRASIL, 2005a; MOREL et al., 2005). This choice also demonstrates that the Program was conceived according to the World Health Organization's (WHO) policy. The WHO has a policy to encourage research on diseases neglected by the pharmaceutical industry and for which there are no efficient and effective strategies and inputs in terms of control and treatment. Another factor is Fiocruz's tradition in infectious/parasitic diseases research (MOREL et al., 2005, 2007).

Leishmaniasis, Malaria, Tuberculosis and Hansen disease are explicitly listed among Fiocruz's institutional research goals since 2006. However, the study of those diseases mingles with Fiocruz's history and that of its research Institutes (AZEVEDO et al., 2002). Paradoxically, we have not found a precise record of how many researchers / research teams work on studying those diseases, aiming to reach these institutional goals. Therefore, we were unable to establish a correlation between Fiocruz's researchers and research teams who had worked previously on PDTIS' induced fields and themes, and those who effectively manage PDTIS projects. However, we have produced the following box using the data available in the 2006 Activity Report (BRASIL, 2006c) and the list of PDTIS active projects per Cooperative Network (http://www.pdtis.fiocruz.br. Access in: Jan. 2007).

Box 7 - Number of registered projects listed by diseases - 2006

Disease	Projects			
	Fiocruz		PDTIS	
	Absolute number	Relative number (%)	Absolute number	Relative number (%)
Chagas disease	61	6,8	3	4,9
Schistosomiasis	29	3,2	2	6,9
Leishmaniasis	61	6,8	5	8,2
Leprosy	7	0,8	-	-
Malária	22	2,4	5	22,7
Tuberculosis	27	3,0	5	18,5
Total	207	23,1	20	9,7

Source: BRASIL, 2006 c. Made by the authors. PDTIS data. (Available at: <http://www.pdtis.fiocruz.br>. Access in: Jan. 2007)

In 2002 the PDTIS' General Coordination Office invited *senior* Fiocruz researchers to present new projects or partial results of ongoing projects in four *Workshops*. The *Workshops* were structured around technological development of vaccines, medicines, genomics and proteomics, in addition to diagnostic inputs. Themes which gave rise to the Program's four Cooperative Networks (BRASIL, 2002a).

The invitations were preceded by the elaboration of an inventory of researchers who had projects registered under PDTIS induced fields. To that end, the VPPDT and General Coordination Office used summaries of theses, reports from students in research scholarship programs at Fiocruz, in addition to the Annals of Fiocruz Research Biennial conference. It is worth remembering that in 2002 the Activity and Management Reports did not list the fifty-four theme areas with projects registered with the Planning Board (BRASIL, 2002b, c). However, although the data from Box 7 includes only six of the main diseases, they still help to measure the amount of scientific knowledge generated by Fiocruz on neglected diseases (MOREL et al., 2005, 2007). The following interview illustrates the effort and the organization which came next.

"Scientific initiation, the Biennial and the theses (...). I had an overview of research in Fiocruz. And that was how the first idea for the workshop [was born]. And the researchers (.) were invited. (...) We started a [very] interesting process. We (...) gathered all the researchers (..) who wanted to present their work. (..) We left there with a vision of the path we should follow. Indeed, [we had] a competent critical mass (...) who was fragmented" (Interview with Eunice, Fiocruz Manager)

After the presentations, the General Coordination Office published four notices for the submission of Letters of Intent to the cooperative networks (BRASIL, 2002a). The letters requested concise information on the goal, a description of the proposing researcher and his team's previous experience with the theme; a description of the infra-structure already available at the laboratory; a description of the needs in terms of equipment, inputs, research assistants and funding (BRASIL, 2002a; PINHEIRO, 2004).

The notices established the research themes that were favored by the Program (BRASIL, 2002a). The submission of projects in different development stages was also encouraged. The ongoing projects could be funded or not by national or international funding agencies. This process occurred between the months of April (*workshop*) and May (Letters of Intent). The Letters of Intent were sent to a Consultative Committee for analysis. The committee consisted of Fiocruz and external researchers. The analysis focused on the proposal's conformity with the notice and the Cooperative Network (PINHEIRO, 2004). The Letters, together with the Consultative Committee's opinion, were then subjected to a second analysis stage, now conducted by PDTIS' Management Center. The Networks were created at that stage, with the proposition to join projects. Although proposing researchers did send Letters to a specific Cooperative Network, the Management Center had the autonomy to propose changes. The implementation of projects occurred in June (Box 8 and Figure 3), after the Project Manager signed a Commitment Letter (BRASIL, 2002a).

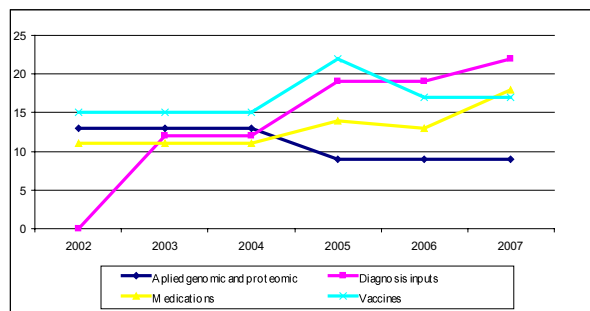
The Diagnostic Inputs Network was launched immediately after that (2003), with 12 projects (BRASIL, 2004b). In 2006 the PDTIS published a second notice for the Vaccines, Diagnostic Inputs and Medicines Cooperative Networks. In 2007 all four PDTIS Cooperative Networks together counted 66 projects (Box 8; Figure 3) (BRASIL, 2006c, 2007c).

Box 8 - Number of projects per cooperative network (2002-2007)

Network	Year					
	2002	2003	2004	2005	2006	2007
Applied genomic and proteomic	13	13	13	9	9	9
Diagnosis inputs	0	12	12	19	19	22
Medications	11	11	11	14	13	18
Vaccines	15	15	15	22	17	17
Total	39	51	51	64	58	66

Source: BRASIL, 2002b, 2003a, 2004b, 2005c, 2006c, 2007c. Made by the authors.

In practical terms, as some of the interviewees have clarified, the cooperative networks are made up of individual research projects.



Source: BRASIL, 2002 b, 2003a, 2004b, 2005c, 2006c, 2007c.

Made by the authors.

Figure 3 - Number of projects per cooperative network (2002-2007).

This issue about the networks, about how we interact and exchange information (...) it really depends. (...) the networks were initially formed [by] the people. In fact, the Vice-presidency required that projects be submitted. Everyone submitted a project. Some people hadn't even actually met before. (...) What they did [the Program's Coordination] was this: they sent them to *ad hoc* researchers who made suggestions. "This project here, it can work with this other one. Let's set up this network." Some people got along, they managed to actually form a team and they started to function well. Others didn't. Others kept working (...) on their own and things were stuck (Interview with Gabriela, PDTIS Researcher)

The [ideal] vision was to [gather] a group from immunology and set up a project with many researchers. (...) But the project didn't move forward. It was a project with people from here, Rio de Janeiro, people from Minas Gerais, from Bahia, highly qualified. (...) each one went their own way. Conclusion: we terminated the project. We tried to use whatever we had that was interesting and split everything into three new projects. (Interview with Mauricio, PDTIS researcher and manager)

The research team is structured by the proposing researcher. After he formally signs the Commitment Agreement¹⁹, he becomes project Manager. Generally, the project Manager is also the Head of laboratories in the Institutes linked to Fiocruz. Each project has a technician in charge. By running checks on the list of active projects available in PDTIS' website in 2006 (<http://www.pdtis.fiocruz.br/>), we verified that in some cases the technicians in charge are not from the same laboratory as the Manager. Throughout the interviews we came to the conclusion that some technicians in charge were appointed by the Management Center during the selection process. Gabriela's and Mauricio's interviews suggest that PDTIS' General Coordination Office and the Network Coordinators proposed the inclusion of researchers and technicians in PDTIS' research teams.

Assessment process

A feature of PDTIS which was highlighted by many interviewees is related to the projects' assessment process. For some interviewees

(...) what changed, more than anything, was the work logic. Because (...) although it happened only once a year, (the) assessment process was being perfected along the way. For other researchers, authorizing a project to develop medicines is big news. And that was a great learning process. So, I see some researchers I've known for many years and (who) worked looking for the blue butterfly²⁰ and now (...) whether they like it or not, whether they're happy or not, with all the criticism they got, but having absorbed this culture of how it feels to work in a straight line, keeping your focus on a product, right there in the end. (Interview with Gabriela, PDTIS researcher).

Indeed, the Program maintains two assessment processes, selection and monitoring. The first was already described in the previous item. We will analyze the second one below.

Project monitoring occurs by way of annual PDTIS assessment meetings. They are organized by Cooperative Network and follow a schedule which is published in the beginning of each year. In addition to the Management Center, the following also join the meetings: external consultants, VPPDT managers or guest managers from Fiocruz institutes. During the observation of assessment meetings, we noticed that managers from Fiocruz's production Institutes joined the 2007 and 2008 Diagnostic Inputs Network meetings as guests.

The assessments use two tools: the projects' activity reports and the consultants' opinions. Prior to every meeting, the project managers send the monitoring reports through the Program's *website*. The programs have a pre-defined form, with information on stages and goals achieved, partial results obtained and a description of the next stages.

The monitoring meetings with each manager last between 15 and 20 minutes. The following points are covered: goals, methodology, team, main techniques, objectives, stages finished, partial results and activity schedule for the next 12 months. After the presentation, the consultants begin their questioning and make suggestions at the end. However, some elements of that process went through changes during the period from 2004 to 2007. According to some researchers who were interviewed, the presentation plan was not made public previously in the first meetings. We also identified in the interviews that the assessment criteria used by the PDTIS were not immediately understood by the researchers. The statements transcribed below summarize the researchers' assessment of their participation in the ongoing project. The second one highlights a few elements present in the PDTIS assessment, different from the processes coordinated by national agencies that support scientific research.

I don't know if it was hard to understand what the PDTIS was and (...) the logic of the projects that were in the PDTIS. We went through a learning period, because we had a view which was too academic when it came to preparing the presentations. And that wasn't really what was expected. It was much more objective: "I did this, this happened and that didn't." (Interview with Vítor, PDTIS researcher)

I don't think it follows the CNPq model. I think you have to know what development is, know all the tools you need to generate a product, which are different from basic research. To know all the assessment criteria for you to follow the development stages. One thing that basic research doesn't do is to establish goals and change stages. To me, that's technological development. (...) this creates a demand for documentation and assessment, which is a big problem for the Institution. The researcher is not used to being assessed. So, people are not used to hearing: "look, what you're doing is great, but there are some aspects of it which are wrong." You've got to have a different view. (Interview with Helena, PDTIS researcher)

(...) researchers, in theory, when they enter the PDTIS they have to abandon a little the idea of [producing] *papers* and think more about the product. This is a government policy. But there's another side that needs further clarification. It's the issue of where your project is going (...) in Fiocruz. (...) some project managers think that their job is to generate knowledge, to make the innovation process, to prove the principle and from then on the project would change hands. (Interview with Mauricio, PDTIS researcher and manager)

Until 2007 the Managers and Technicians in Charge used to watch the consultants' analysis of all projects in their Network. From 2007 the consultants, Network Coordinators, the General Coordination Office and the PDTIS' General Management started meeting separately with each project's Manager and Technician in charge. However, during the observation period we noticed that the Technicians in charge did not always participate.

Some Managers we interviewed approved of the new methodology. They emphasized that they had more time to improve communication with the consultants and more privacy. Others mentioned they felt uncomfortable with discussing their projects in front of all the other Project Managers and, in some cases, the Technicians in Charge. A recurrent theme in the interviews is that, in the methodology used previously, other Managers and/or Technicians in Charge did not usually participate actively in the projects' discussion. Each team participated only when their project was under discussion. None of the Managers and Network Coordinators mentioned using strategies to encourage more participation from all present. On the other hand, as Managers and Technicians in Charge do not have access to all technical reports, they had little information on the other projects in their Network.

The assessment is interesting, but it's not interesting the way they did it in both times I participated. They pay the consultants a lot of money and nobody adds much. Why? Because we made a presentation in front of a table full of people, in 15 to 20 minutes (...) it's not an assessment that can really give direction to the project being evaluated. (Interview with Rosa, PDTIS researcher)

(...) another thing that's also changed in PDTIS' logic, which I found particularly good, was the discussion of the project separately. (...) first we had the project discussion and we had 10 minutes to present it. Then the

assessors spoke. That, in my understanding, was bad. Why? If the assessor suddenly had to be harsh when evaluating a project, he did it in a couple of moments and in others, he didn't do the same thing (...) Last year I had an individual assessment. (...) I felt that the assessors were more comfortable saying things and I felt more comfortable too to answer questions, to communicate. It was the *workshop* I liked the best. (Interview with Vítor, PDTIS researcher)

However, the Applied Genomics and Proteomics Network kept the previous arrangement, at least until 2007. We observed that Network's 2007 meeting. The following are a few points which confirm the previous statements and which we would like to highlight: a) even though everyone's presence was not only allowed but encouraged, some Managers were absent; b) some Managers and Technicians in Charge left as soon as the discussion about their projects was over, and only one Manager took part in all discussions; c) only the team spoke while the external Consultant analyzed the project; d) the Platforms Network Coordination, who was responsible for managing much of the equipment used by the projects under discussion, did not take part in the entire meeting.

Therefore, the progress of projects allocated in a specific Network is assessed in the meetings. There is not a real assessment of the Network. At most it expresses the sum of individual projects' assessments. Although the individual discussion contributes more to the projects' development, it increased the focus on the project (individually) and on the manager and his team's work. The collective dimension of the network remains absent.

From 2005 the PDTIS' Coordination Office introduced a second stage to the projects' assessment process. The goal was to establish which projects were to be a priority among those in the portfolio of projects funded by the PDTIS. Thus, this assessment, after the annual project assessment meeting, results in a ranking of projects according their level of priority (BEZERRA, 2008). The PDTIS' Management Center established the following variables for scoring purposes: i) Impact on Health; ii) Technological Impact; iii) Technical Progress; iv) Economic Impact. The dimension "Technological Impact" lists under its sub items "Technological protection" (BEZERRA, 2008). In Box 9 we describe the scores and their correlation with priority levels, according to a table organized by Bezerra (2008). Box 10 offers an overview of the ranking of active projects in 2006 from the data obtained from the PDTIS' site in January 2007.

Box 9 - Score and priority level

Priority	Scores
1	>300
2	200 > 300
Awaiting definition	150 < 200
3	< 150

Source: BEZERRA, 2008.

Box 10 - Number of projects versus cooperative networks versus priority level

Network	Priority			
	Level 1	Level 2	Level 3	Being defined (*)
Genomic and proteomic	2	6	-	1
Insumos Diagnósticos	6	9	-	7
Medications	5	13	-	-
Vaccines	4	11	-	2
Total	17	39	0	10

Source: PDTIS data. Made by the authors.

(Available at <http://www.pdtis.fiocruz.br/> access in January 2007)

(*) The PDTIS does not define “awaiting definition.”

The project’s organization according to priority levels should guide the decision of maintaining or excluding the project from PDTIS’ portfolio. It should also guide the Network Coordination’s actions in terms of adopting new management strategies of an individual project, as well as budget analysis. We will go back to this point later. For now it is important to bear in mind that this analysis is also focused on the individual project and

not on its relationship with the network (management). However, there is an important difference regarding project monitoring. When monitoring the individual projects, the focus of the analysis is on the technoscientific aspect. In the second stage, the focus shifts to the relationship between the individual project and PDTIS’ more general goal, that is, to generate new technologies. Still, the focus is nevertheless on the individual project, on the managers’ actions and on the results. We have not identified in the documents we analyzed and in the interviews we conducted the existence of an assessment which took into account the research and development process in connection with management. That is, an analysis which is able to confront the results found with the Networks’ management.

To finish the chapter on PDTIS assessment, we highlight the number of patents per Cooperative Network (Box 11). Actually, “patent applications” and “patents allowed” are not part of the criteria for assessing the progress of PDTIS projects. At least we did not encounter any reference to such criteria during the assessment meeting observations or the interviews. They are possibly more connected to the stage in which the priority of projects is assessed. Nevertheless, the Activity Reports refer to “patent applications” and the “patents allowed” per PDTIS project. The 2004 Activity Report (BRIL, 2004b), when referring to the topic, adds the following box (Box 11).

Box 11 - Number of patents per cooperative networks – 2004

Network	Patents requested				Patents granted			
	Brazil		Abroad		Brazil		Abroad	
	No of projects	No of requests	Nº of projects	Nº of requests	Nº of projects	No of patents	No of projects	No of patents
Medicaments	3	5	2	4	-	-	1	1
Vaccines	2	8	3	37	1	1	2	19
Diagnostic inputs	4	4	2	7	-	-	-	-
Total	9	17	7	48	1	1	3	20

Source: Brasil 2004 b.

It is worth noting that Box 11 reinforces a PDTIS feature previously mentioned, that is, the incorporation of projects in different development stages. PDTIS started operating in 2002. Therefore, in order to have this number of patents allowed two years later (2004), PDTIS incorporated projects which had already filed for patents.

Means of funding

PDTIS is fully funded by Fiocruz. To that end, it uses two sources of funding: those from the Federal Government’s budget and revenue obtained from the sale of vaccines and medicines. However, some projects rely on complementary funding through research *grants*. The 2006 notices to select proposals established among the criteria for project assessment whether they had external funding

or not. At the time the Project was launched, Fiocruz’s Presidency planned to allocate 8 million Reais a year (US\$ 3,346,580.21) to PDTIS funding (BRASIL, 2005c, p.11). In practical terms, it was not viable to determine a fixed sum. That was because Fiocruz’s budget is subject to the annual federal budget proposal (drawn up by the Executive branch), which depends on the National Congress’ approval (House of Representatives and the Senate). Thus, Fiocruz’s budget undergoes variations (for more or less) each year.

Only the 2004 and 2005 Activity Reports informed the sums invested by Fiocruz in PDTIS (BRASIL, 2004b, 2005c). Therefore, we resorted to other sources of data. In Box 12, produced from PDTIS data and systematized by Bezerra (BEZERRA, 2008), we present the investment actually made by Fiocruz in PDTIS from 2002 to 2005.

Box 12 - PDTIS investment profile per network (2002-2005)

Network	Annual investment			
	2002	2003	2004	2005
Diagnosis	-	266.515	3.101.980	302.134
Genomic and Proteomic	-	2.220.818	603.603	1.098.533
Medicamentos	-	1.243.293	1.346.530	1.211.729
Vaccines	-	3.534.888	1.528.143	744.046
Infra-structure	1.040.000	2.240.487	3.883.744	4.589.558
Total	1.040.000	9.506.000	10.464.000	7.946.000
US\$ 1,00				
Network	Annual investment			
	2002	2003	2004	2005
Diagnosis	-	90.427	1.024.838	126.390
Genomic and Proteomic	-	74.922	199.419	459.541
Medicamentos	-	421.841	444.869	506.893
Vaccines	-	1.199.365	504.871	311.251
Infra-structure	318.121	760.183	1.283.119	1.919.915
Total	318.121	2.546.738	3.457.116	3.323.991

Source: BEZERRA, 2008. Made by the authors.

According to Bezerra (2008), PDTIS invested approximately 40 million reais (US\$ 21 million) between 2002 and 2007. In the chapter on PDTIS in VPPDT's Activity Report (BRASIL, 2006f), the investment was of approximately 4 million reais (US\$ 1 million) in 2006. Unfortunately, we were unable to find out the sum invested in 2007²¹ before the end of the field research. It is important to consider, nevertheless, that such sums do not include investment in hiring researchers, research assistants and technicians. In addition to Fiocruz civil servants, PDTIS relies on an additional work force hired through research scholarship programs maintained by Fiocruz and national support agencies. The 2004 Activity Report mentions that forty-eight researchers and technicians were hired through grants of research scholarships (BRASIL, 2004b). Further on, the same Report informs that PDTIS obtained thirty-two scholarships from the RHAEC/CNPq Program²² (BRASIL, 2004b). We found other information regarding the year of 2006. In 2006 thirteen visiting researcher scholarships were

implemented (BRASIL, 2006f). The amount of funding invested in PDTIS also does not include basic expenses with laboratory maintenance, such as utilities (water, electricity, gas and telephone bills).

The implementation effectively began in 2002, because we had an approved budget of three million reais [US\$917,655.70] for 2002. (...) The first network implemented was medicines, because it was more structured at that moment (...). So we started buying the products, racing against the clock, because we had to execute a three million reais budget in less than three months. That's not easy when you didn't actually have the current four networks in the Program structured and organized. (Interview with Cássio, PDTIS manager)

The PDTIS' budget execution, as well as all of Fiocruz's, obeyed the public federal legislation on purchasing procedures (Act number 8666/93) and public accounting (Act number 4320/64). Meeting the demands of Act number 8666/93 causes delays in the purchasing schedule of research inputs and equipment (VIANA et

al., 2007). Perhaps that is one of the reasons why the information about investments in 2002 in Box 12 contradicts the decision to start purchasing equipment and inputs through the Medicines Network, according to the statement above. In his statement, Manager Cássio complements his remarks on the difficulties he faces by making the following assertion:

What happens is that the [Federal Government's] budget never comes when it's supposed to. Just to give you an idea, this year [2007] the budget was (...) approved in May, Fiocruz was authorized to have it in June and the money effectively got here in July. So you've lost six months of work with a purely administrative issue. (Interview with Cássio, PDTIS manager)

Throughout the analysis of the interviews, we have identified three features of the funding which help understand the local reconstruction process of the Cooperative Network model by PDTIS.

The first one refers to the Program's management, more specifically the Cooperative Network's position as a tool in the Program's management. The *PDTIS Management Guide* (BRASIL, 2003c, 2004d) defines that the Management Center is accountable for approving the projects' budget proposal, in addition to making inspections of its execution later. In the interviews conducted with the Network Coordinators, this responsibility seems to have been shifted to the General Coordination Office. There is, therefore, a centralized coordination. The Network Coordinators analyze the requests, they are consulted as to possible cuts, but the final decision is made by the General Coordinator. He is the main interlocutor of the budget management and of Fiocruz's agencies responsible for its budget-financial management. The Project Managers we interviewed did not have a clear understanding of the criteria used, as well as the interactions between the different instances to discuss budgets.

The other two features refer to the budget's operation. The PDTIS' budget execution happens in two fronts: part of it is centralized and the other is decentralized. Therefore, after the budget's approval the PDTIS' budget management transfers part of the funding to the Fiocruz Institute to which the project manager is linked.

And that's when we started discussing how the budget should be effectively implemented, whether centralized or decentralized. We weren't able to decentralize in 2002 because it was the end of the year already (...). In 2003 I proposed to decentralize at least part of those funds for the Institutes, since each one has the specific authority to purchase their inputs and equipment; and to centralize that which was easier to purchase in a large scale, because then it's a large amount of money to negotiate with your suppliers. You can even check if you're duplicating or not some equipment or specific inputs. (Interview with Cássio, PDTIS manager)

Usually the equipment is purchased by the Vice-presidency, by PDTIS itself. (...) Input materials can be purchased by them or by us (at the Institute). If we make the purchase here, I just have to feed in the PDTIS system the total sum of what I want to purchase. Then I feed in the total sum and send a table listing everything

I'm going to buy. Then I don't have to give these details, (...) if I want an antibody, which one is it, brand, and price. (Interview with Rosa, PDTIS researcher)

Researcher Rosa's statement is interesting because it demonstrates how managers and technicians in charge put into practice the flexibility of purchasing in a centralized or decentralized way. For researchers, the calculation involves assessing the time spent filling out a PDTIS purchase sheet. In other words, if the items they want are in their Institute's registry and, therefore, do not require more details, they always chose to make a decentralized purchase. Another factor brought up by researchers was the estimated time to receive the input.

They created something really interesting here [Bio-Manguinhos]²³, (...) a purchasing center for the development. So, I have an agility the PDTIS doesn't have. (...) many times (...) I had to go there because after I don't know how long they (PDTIS) decided to buy some inputs. I'd already bought everything. So I went over there with my list and I said: "look, you don't have to buy that, I've already bought it". (Interview with Helena, PDTIS researcher)

Finally, the third feature is particularly important when analyzing the local Network model. The process of analyzing the budget proposal, the granting of funding and execution control is structured according to projects. The data regarding investment per Cooperative Network are obtained through the sum of investments in each project. From 2005 the approval of funding amounts per project should also include the priority level. In her interview, researcher Barbara summarizes the interpretation of part of the project managers in the following words:

If the project's been ranked three, you know you're not getting the same funding next year as you would if it had been ranked two. You know that indirectly. (Interview with Barbara, PDTIS researcher)

However, other statements demonstrate that the levels of priority still do not work as a criterion for analysis and approval of project budgets.

(...) since 2004 when there was the first assessment and the approved (...) methodology was that projects with priority one would really get more budget or more support from the PDTIS program. That didn't happen. In 2005, the same thing. Once again you put all eighty projects in the same bag (...). So, you lose track of the purpose of this assessment. (Interview with Cássio, PDTIS manager)

A recurrent issue in researcher and manager interviews is maintaining the funding capacity considering the number of projects per Cooperative Network. On that subject, we have selected parts of some interviews.

What we invest in development in the PDTIS is too small, it's too little. I support even increasing that investment, maybe even reducing the number of projects, selecting those that are making technical progress and giving them money so they can move forward. Most projects have been showing they're about basic research, where others already have better results. Of course they

get equipment, they get other investments. But today what's being given out is about sixty, sixty thousand a year. The worst thing is that some manage not to spend that money. They have money left and give it back. (Interview with Mauricio, PDTIS researcher and manager)

Guilherme and Gabriela complement this statement highlighting that the Program has created the tools, but it keeps a large number of projects considering the goal to develop new inputs.

You have to acknowledge that the PDTIS doesn't fully fund anything. It's a criticism I'm making, but it's a positive one. Because here (at the Institute), two or three years ago, we had almost fifty projects in our portfolio. Today we have twenty-five. We cut back. And the PDTIS set up a similar project analysis structure, but, for example, their prioritization is not being put into practice. You have a project that is considered to be priority one and has less money than other projects that are priority two. So, there isn't a division like this: this project really is promising, so let's invest one hundred per cent in it (...). This doesn't exist. I don't even know if they would have a lot of money for this. (Interview with Guilherme, PDTIS researcher)

A network that starts out with twenty projects that want to develop medicines, it's going to distribute crumbs.

In the end, one gets a hundred thousand, another gets two hundred thousand. It doesn't work. You publish a notice and choose three projects in a network which has twenty or thirty. We'll focus PDTIS funding in those three. I think that (...) we'd have an institutional breakdown. That's why I think there's a lot of things we can't speed up because of lack of funding. But there's a lack of funding because it's pulverized. (Interview with Gabriela, PDTIS researcher).

When analyzing the PDTIS' investment profile in the Vaccines Cooperative Network, Bezerra (2008) reaffirms manager Cássio's and researcher Guilherme's statements regarding the use of levels of priority as one of the criteria in assessing the project's continuity in PDTIS' portfolio (Box 13). As an example, the total investment in project B (R\$ 103,051.10 / US\$ 43,108.76), ranked P1, is lower than the sum allocated to project E (R\$ 1,285,736.34 / US\$ 537,852.47) during the same period. Bezerra also highlights that the PDTIS invested R\$ 1,402,173.00 (US\$ 586,560.55) in the four projects ranked P1. However, the investments in two projects ranked P2 alone (E and F) totaled R\$ 2,015,904.77 (US\$ 843,298.38)²⁴. Bezerra (2008) does not elaborate on the reasons for this inversion. He highlights that the investment needs to reach the goals of the thirteen projects in the Vaccines Network were not analyzed.

Box 13 - Financial investment in the vaccines cooperative network projects (2002-2005)

Project	Year				Total	Level of priority
	2002	2003	2004	2005		
A	-	217.480	-	81.235	298.715	2
B	-	75.028	5.603	22.420	103.051	1
C	-	160.573	125.306	45.482	331.361	2
D	22.199	265.176	40.380	15.500	321.056	2
E	-	881.512	370.645	33.579	1.285.736	2
F	-	531.204	198.965	-	730.168	2
G	-	144.485	91.227	-	235.711	2
H	-	152.953	13.700	153.297	319.949	1
I	-	86.978	50.000	128.271	265.249	2
J	-	52.204	95.957	141.600	295.761	1
K	-	451.089	99.256	-	550.345	2
L	-	331.422	229.327	122.663	683.412	2
M	-	45.184	8.364	-	53.548	2
Total	22.199	3.395.288	1.328.731	744.046	5.474.065	-
US\$ 1,00						
Project	Year				Total	Level of priority
	2002	2003	2004	2005		
A	-	73.790	-	33.982	124.959	2
B	-	25.457	1.851	9.379	43.109	1
C	-	54.481	41.399	19.026	138.616	2
D	6.790	89.971	13.341	6.484	134.305	2

E	-	299.091	122.454	14.047	537.852	2
F	-	180.234	65.734	-	305.446	2
G	-	49.023	30.140	-	98.603	2
H	-	51.896	4.526	64.128	133.842	1
I	-	29.511	16.519	53.659	110.960	2
J	-	17.713	31.703	59.234	123.724	1
K	-	153.052	32.793	-	230.221, 87	2
L	-	112.449	75.766	51.312	285.886	2
M	-	15.331	2.763	-	22.400	2
Total	6.790	1.151.997	438.989	311.251	2.059.703	-

Source: BEZERRA, 2008. Made by the authors.

Conclusion

We attempted to gather elements throughout this article to answer the question which interests us, that is, finding out if Brazil is witnessing the emergence of a new form in organizing the processes of research and production of technoscientific knowledge in health, particularly in the field of biomedicine. However, considering the empirical range of this question, we favored the investigation of recent experiences in an institution in the health field, the Oswaldo Cruz Foundation. In this case, the experience refers to the organization of a program to encourage technological research on health inputs. As we could see, PDTIS combines tools and some identified features with new organization methods and production of technoscientific knowledge in biomedicine, among which we highlight the use of cooperative networks as a coordination tool (CHOMPALOV et al., 1999; KEATING et al., 2003; SHRUM et al., 2007). In favoring Fiocruz's experience in organizing and managing the PDTIS, we consider that analyzing the local reconstruction of organization methods in both processes of researching and producing technoscientific knowledge in health might help us find answers to our main question (KRIGE et al., 2003; SHINN et al., 2005). Therefore, we try to understand how the program model to induce technological research, combined with the adoption of cooperative networks, was rebuilt locally. To that end, it was necessary to describe the research environment in which PDTIS was conceived, implemented and consolidated (SHINN et al., 2005).

Finally, in conclusion, we will make some comments of a general and specific nature. This aims to make a contribution in order to help perfect the local organization process of scientific research targeting technological advancement in the field of Brazilian public health in an institution which has been playing a central role in formulating, implementing and assessing health policies in the country.

In that sense, as we can see from the previous description, Fiocruz is a complex organization. It is a one hun-

dred and ten year old institution which comprises fifteen Institutes, spread throughout four different geographical regions in Brazil. The following are features of this complex organizational environment: spreading of funds throughout different institutional goals; little tradition in inducing research, above all on strategic themes in the health production sector, such as health inputs; low capacity in assessment; little tradition in sharing equipment; hesitant tradition in research management and low capacity in planning and defining strategic fields. Additionally, we have not gathered sufficient elements in the Activities and Management Reports in the period analyzed (2001-2007) to support that intra-institutional collaboration is intense and spread throughout the several Institutes.

From the analysis of the documents and interviews, we notice that the PDTIS' organization is part of a restructuring effort made by Fiocruz, of which the following are also a part: i) the revision of theme areas and elaboration of institutional goals; ii) creation of the SIIG system; iii) elaboration of a project registry; iv) the association of projects with institutional goals; and v) conceiving, implementing and consolidating the PDTIS. From 2005 Fiocruz seems to be investing in research management, associating this with the concepts of strategic planning (BRASIL, 2007e). However, this process has not been concluded; it is still happening. Perhaps this explains the constant changes in systematization, management and information analysis methodologies in Fiocruz's Activity and Management Reports.

Some tools selected by the PDTIS and widely used in countries with high-performance institutes in biomedicine, such as networks, multi-user equipment, collaborative research and induction, have faced difficulties in a hostile environment. Local reconstruction entails, therefore, hybridizing models. In other words, the tools were reconstructed from their association with methods and procedures already in use and incorporated to the actors' (researchers, technicians and managers) daily routine and to the Institution's research management. But what is the evidence of this hybridization?

The most obvious is the fact that the PDTIS has adopted network coordination while keeping the processes of project selection, monitoring and funding focused on the individual project and not on the network. We consider that this structural feature of the Program expresses the survival (in the Program) of the classic model of individual scientific research. We have not identified other features that specialized literature associate with this coordination method in the network model rebuilt and used by the Program (D'AMOUR et al., 2005; CUMMINGS et al., 2005; LARSEN, 2008). For example, the networks were not structured around one or two projects, around which the research teams could gather to work on different stages or activities in the same project. The projects were not built according to the scientific collaboration logic, which entails cooperative work and establishing goals and objectives which two or more teams share. The projects are not a result of collaborative work whose development requires, necessarily, a network production organization. Once again, we ascribe this feature, partly, to the validated institutional procedures in organizing the production of scientific knowledge. We have not found strong evidence of encouragement or importance to scientific collaboration between institutes in the reports. On the other hand, the fact that PDTIS has selected ongoing projects in different stages of development resulted in the absorption of scientific collaboration which already existed. This also means that the PDTIS incorporated research teams from different laboratories and Institutes, each with their own collaboration network and their own established research procedures and management.

The analysis of the empirical research material enables us to consider that the PDTIS established some turning points regarding research management in Fiocruz. The PDTIS has united projects and teams spread throughout the 15 Institutes in a single coordination. It has established objectives, goals and favored, for the first time in FIOCRUZ history, induction to research on health inputs. The Program built a system for selecting and monitoring projects. It introduced the concept of "multi-user equipment." It has also achieved the construction of a project ranking system aiming to associate it with budget request approval.

Nevertheless, in spite of those qualities, the previous description demonstrates that those tools were only partially introduced and implemented. One example is submitting budget approval to reaching goals and the project's priority level. According to data provided by Bezerra (2008), especially those in Box 13, and to the interviews, this was not implemented. This non-implementation might be understood from the perspective of the process established to negotiate Fiocruz's budget, which takes into account another set of factors. Another relevant point to be considered is the significant weight of research productivity, which is measured by articles, books, participation in events for obtaining *grants* from national and international agencies which encourage research. Therefore, the Program built the tool, conducted a priority analysis, but was unable to implement it fully.

Nevertheless, the dynamics and structural elements of the PDTIS networks enable us to emphasize a feature of the hybridization (or local reconstruction) we have witnessed. When it happens, we no longer have the previous model. At the same time, we no longer have the new proposed model either, which was initially shifted from other institutional environments. We face something different, with a unique configuration. However, mapping the path followed by PDTIS managers in creating a concept for and managing the Program is difficult. For the most part, such difficulty can be explained by the fact that we have not managed to identify references to scientific studies on the use of networks or collaborative scientific research initiatives in the institutional documents and articles published by the managers (BUSS et al., 2002, 2005) The only exception is Pinheiro's (2004) dissertation, which presents a review of literature on cooperative networks and the management of programs to induce technological research. There are also few texts produced by the managers themselves analyzing the PDTIS experience over these past seven years. Similarly, the lack of concepts for the tools introduced in the last 7 years, such as "institutional research goals", also make it difficult to map and later analyze the path followed by managers in rebuilding the process which Fiocruz has gone through.

Finally, we must answer the central question: do PDTIS and other elements described throughout the article enable us to reach the conclusion that Brazil, from its national biomedical research institutions, is going through a change in the methods used to produce scientific knowledge?

We consider that changes in the production method entail deep and extensive transformations in the managing methods to produce and circulate technoscientific knowledge. Such transformations result from changes in: formation and management of research teams; the way in which research goals are constructed; the criteria in selecting projects; establishment of scientific collaboration; the way in which results are circulated and published; implementation and consolidation of new experimental work and management routines; the construction of a new method to assess the production process of knowledge produced. We have not identified such deep changes arising from the implementation and consolidation of the PDTIS. On the contrary, we aimed to emphasize that some tools implemented by the Program's Coordination were not fully used. One of the reasons was the complexity of the process of construction and implementation of new scientific and management work routines, especially regarding assessment. On the other hand, the PDTIS is a limited experience which involves a limited number of projects considering the diversity and, above all, the number of projects developed by Fiocruz's institutes in the field of biomedicine. The research teams who took part in the Program remain linked to their original Institutes. They work on other projects and are assessed through processes and tools which have long been established in the Institution. Such processes and tools are largely used by the national and

international agencies which encourage research. They favor the production of articles in periodicals indexed in the main bibliographic databases in the field of biomedicine. Considering Fiocruz's centennial history, the seven year period is also too short for deep, wide and consistent changes to produce new routines. Such routines would actually represent a new way of producing technoscientific knowledge and be different from the previous ones. Routines that can be used gradually by research teams in the field of biomedicine, but outside the PDTIS. This will require enormous articulation between different research management segments and a consensus in terms of concepts, goals and objectives.

In light of the analysis carried out in the Activities and Management Reports, we suggest the implementation of a "National Information System on Fiocruz's Scientific Research", to be hosted by Fiocruz's *homepage*. However, in order to avoid differences in the management of research themes and their description by the 15 Institutes, it will be necessary to establish guidelines for the themes and their corresponding terminologies. This would avoid the indiscriminate use of expressions such as "theme axes", "theme areas", "strategic axes", "strategic areas" and "strategic theme areas." Nevertheless this single terminology should have a connection with those used by national agencies who encourage research, by national programs, by national legislation (BRASIL, 2008c, 2007b, 2004a), as well as by federal and state Universities. The latter two represent the significant majority of Fiocruz's national partnerships. It would be important that this single terminology be defined in "program lines", which is important to induce the grouping of projects which have similar themes into programs. Program lines then could be subdivided into "theme areas", which could be distributed alphabetically. As a general suggestion, we consider that the following guidelines regarding theme areas should be applied by all institutes: i) All research actions should be classified according to a theme area. However, because a large number of actions can be related to more than one area, the information system should register the "main theme area" and "complementary theme area" classifications. ii) The classification's goal is systematization. This will favor the development of studies and reports in Fiocruz's national scientific production from theme groups, as well as the articulation of individuals or research teams who work on the same theme area. iii) The names for theme areas should be proposed aiming to make the field of work as wide as possible. iv) The names for theme areas should be identical, to be used regionally and nationally according to a list to be elaborated. When there is no absolute correspondence between theme areas and a project's goal, it is possible to choose that which thematically is the closest. The aim is always to establish regional, national and international parameters. The information system should also allow registering a second theme area as "complementary". Those classifications may be revised periodically. The changes would always become effective in the year following the proposal for change. The institutes will keep the System updated *online*:

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Notes

1. This article presents results from two research projects funded by the National Council for Scientific and Technological Development, namely: "Science, technology and innovation in health: a social anthropological analysis of Fiocruz's C&T&I policy" [Collective Health Committee - Project number 474612/2006-6]; "Cooperative Networks and Innovation in Public Health - a case study of the social, collective and local construction process of the *Recombinant Vaccines and DNA* Network of the Oswaldo Cruz Foundation" [Human and Social Sciences Committee - Project number 401047/2006-7]. In addition to the project entitled "Innovation and Cooperative networks - social anthropological study of the technological management tool in a program for the technological development of health inputs", funded by the Carlos Chagas Filho Foundation to Support Research in the State of Rio de Janeiro [APQ1- E-26/ 170.745 /2007]. All projects were concluded in 2008.

2. We use the terms technosciences and technoscientific in the meanings ascribed by Latour (2000) and Callon (1989), who express a single process of technifying science and scientifying technology, without using a hyphen.

3. We use the terms proposed by the World Health Organization (WHO) and Doctors Without Borders (Morel e ali, 2005) to classify **the diseases** as *global* (occurring in all countries), *neglected diseases* (more prevalent in relatively less developed countries) and the *most neglected diseases* (exclusive from relatively less developed or developing countries). This classification encompasses the political, economic and social context in order to analyze the level of development and the epidemiologic setting, as opposed to previous classifications which were based solely on the division center / north - outskirts /south.

4. This term is used here instead of the one used traditionally in sociological analyses - *underdeveloped countries* -, as a way to avoid using a single parameter to measure advancement in the development process of several modern societies. This draws attention to its *relative* feature - by comparison with other countries - and not the *absolute*.

5. Fiocruz carries out research in the clinical fields, biological sciences and biosciences. According to Keating and Cambrosio's proposition (2003), we believe they can be regarded as covering the greater field of biomedicine.

6. In order to facilitate the research actor's stance and their statement in the situation under investigation, we will name between the brackets the alias and position of the interviewee after the transcripts. We have divided the interviewees into four categories: A - manager and

former manager at Fiocruz (presidency and agencies linked to central management); B - manager and former manager at Fiocruz's Research or Production Institute; C - manager or former manager at PDTIS; D - PDTIS researcher. We interviewed some actors which fit into two categories. For example, they are PDTIS managers and also take part in a given project as researchers. In that case, we have mentioned both connections.

7. We have established July as the reference month for converting into dollars the amounts of funds invested in research activity between the years of 2000 and 2007. We have used the exchange rates adopted by Brazil's Central Bank, available from the URL <http://www.bcb.gov.br/> (access: 25 Apr. 2009).

8. We interpret this vast world of biomedicine in terms of heterogeneous configurations of research which are culturally situated in the interface between Biology, Medicine, public policies, regulations and health industrial activities aimed at studying the human diseases, their environmental and eco-epidemiological factors - all aiming to find their cause, prevention, diagnostic and treatment.

9. Because of the technical specifications of Altas.ti, the texts must be in *Word* format.

10. As the PDTIS aimed to stimulate scientific collaboration when it adopted the network coordination model, we used specialized literature on collaborative scientific research as a source.

11. Innovation appears in the reports throughout the period analyzed. However, it was incorporated as an action for strategic Planning at Fiocruz in 2005.

12. CNPq has maintained a database (Research Groups Directory) since 1992 containing information on active research groups in Brazil. The information is permanently updated and every two years CNPq promotes a census of Research Groups. It is possible to search the current database at the following URL: <http://dgp.cnpq.br/buscaoperacional/>

13. There are institutes which work in both areas.

14. There are institutes which cover all areas, or at least two. More recently, for example, the production Institutes have started offering degree and non-degree graduate courses. The former is offered together with a research-teaching Institute.

15. We will return to the indexation issue later. This refers to indexation in national and international bibliographic databases.

16. Program is the way in which research, technological development and teaching activities are named in Fiocruz's Quadri-annual Plans and, consequently, also in the Reports;

17. We would like to remind readers that the SIIG was only implemented in 2005.

18. Since 2002 the Brazilian government has organized its budget in PPA. Each institution must also organize their own PPA.

19. The Commitment Agreement marks the formal commencement of the project in PDTIS' portfolio.

20. The researcher uses a metaphor to refer, somewhat ironically, to researchers who are not accustomed to technological research projects which have well established goals, objectives, a schedule and results.

21. We did not find data to elaborate a timeline of institutional PDTIS investments in Fiocruz's Activity and Management Reports from 2002 to 2007. In some years, such as 2007, the amounts are aggregated with investments in program action "Technological Development and Innovation in Health." Thus, we resorted to Bezerra's data (2008), who used the PDTIS' Coordination database. For clarity purposes, we added the totals only.

22. The Training program for Human Resources in Strategic Areas (RHAE) grants scholarships for technological development projects carried out as partnerships between research institutions and public and/or private industries. It is managed by the National Council for Scientific and Technological Development (CNPq), an agency linked to the Ministry of Science and Technology (MCT).

23. As in footnote xiii, FIOCRUZ's production Institutes have a technological development department

24. For calculation purposes, we used the exchange rate from 2005 (2.3905 Real/Brazil = 1 Dollar/USA) - source: Brazil's Central Bank available at the URL <http://www.bcb.gov.br/> (access: 25 Apr. 2009).

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