

## **Inclusive innovation and policy mismatch in health care A Uruguayan local experience**

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### **Resumo/Resumen**

Health inequalities relate to exclusion situations in which the absence of new knowledge may cause deprivations. Simultaneously, innovation, as a solving problem process, has the potential capacity to search, find and articulate suitable answers to overcome particular forms of exclusion. However, context specific creative solutions resulting from continuous processes of interaction among individuals, organizations and different types of knowledge are more the exception than the rule. This article presents the results from a study on the social inclusive effect of particular innovation processes carried out at a public health care center in one of the poorest regions of Uruguay. It focuses on the organizational learning trajectory followed by the public hospital during the last twenty years. Research results show that the continuous improvement of the hospital care services can be explained by two fundamental reasons: i) the hospital's innovation receptive context to the incorporation of new health services and the development of medical devices; ii) the social entrepreneurship management style which is characteristic of the hospital. Most new services demand new technologies derived from existing local needs in a process of organizational change of the public hospital in articulation with several other organizations and supported by the local community over time. Nevertheless, articulation with public policies at the national level are not adequately resolved, therefore local capabilities remain hidden and the technologies developed encapsulated.

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## **I. INTRODUCTION**

Absence of knowledge and capacity to solve problems related to human health may cause deprivations and social exclusion. Creative solutions resulting from continuous processes of interaction among individuals, organizations and different types of knowledge are not always available in underdeveloped countries where exclusion situations abound. This chapter analyzes innovation processes carried out at a public hospital situated in one of the poorest regions for Uruguay. Unlike most health centers in Uruguay, the *Hospital de Tacuarembó* (HT) has managed to sustain a process of organizational growth to become a provider of increasingly varied and sophisticated health services.

The HT is a small hospital with a large geographical coverage in the northern region of Uruguay which shows, in general, lower quality of life and development indicators than the southern region. In this context, the public hospital plays a substantial role meeting the needs of mostly deprived population organizing available resources in a creative way. The study is based on the analysis of specific innovation experiences that shaped a learning path at the health center during the last twenty years.

Understanding inclusive innovation processes based on health innovation requires a broad approach, which allows for the integration of particular local characteristics shaping technological needs and national policies that facilitate or constrain innovation. In this regard, we analyze the innovation mechanism - the linkage between local health needs and the hospital organizational features - and how the national health and innovation policies may match and boost this mechanism. Policy lessons are derived from the case studied that could apply to other similar underdeveloped country contexts.

The health innovation process is embedded in other systemic processes - economic, social, political- which co-evolve. To study the health innovative experiences around the health care activities of the HT we followed a systemic approach analyzing the linkages of the health center with the local system and the broader institutional, socioeconomic and policy context. Accordingly, the research implied an inductive process starting at the comprehension of the local innovation dynamic and moving forward to articulations, strengths and barriers of the national system.

## **II. INNOVATION AND SOCIAL INCLUSION**

Persistent inequality reproduces everyday situations of social exclusion for wide

sectors of the world population. Social exclusion means “being excluded from social relations” (Sen 2000: 5) that can lead to deprivations which as well can drive to others in a sort of chain; social exclusion is relational by definition. Exclusion can be a constitutive part or an instrumental cause for those deprivations. The first being a direct cause of a capability deprivation; the second being a situation, apparently not harmful by itself, but that can lead to subsequent deprivations. Exclusion, and its derived deprivations, are a social phenomenon not an individual one. People in this situation are deprived of the capabilities to develop a full life and to share the opportunities that others in the same society enjoy. Therefore, relational deprivations may have constitutive or instrumental importance depending on historically situated contexts.

Social inequalities are reinforced by unequal conditions of generation, access and use of new technologies where knowledge has acquired the role of a power instrument (Arocena and Sutz 2003 and 2009, Soares and Cassiolato 2008). By this situation, underdevelopment today is characterized by a mutual interaction between high levels of inequality and limited knowledge endogenously generated (Arocena and Sutz 2009). Nevertheless, science, technology and innovation (STI) show a strong potential for improving social and economic dimensions beyond economic growth and enhanced competitiveness of particular economic sectors. Academic research and innovation may be powerful instruments for the reduction of particular inequalities, especially those related to poor living and social exclusion. STI can be targeted to produce impacts on improving living conditions by specific policies that conceive social inclusion as a STI goal. Special incentives are often needed for the promotion of more comprehensive and connected research and innovation agendas that could foster feasible solutions for social inequality derived problems (Bianco 2012).

The relation between knowledge, innovation and social inclusion has gained increased attention in the specialized literature being analyzed from several points of view. Approaches like “bottom of the pyramid” (Prahalad and Hart 2002), “pro-poor innovation” (Ramani 2008), “grassroot innovation” (Gupta 2000), “appropriate technology” (Schumacher 1973), among others, focus on the role of knowledge for social inclusion or in reverting social inequalities. All of them attribute different roles to formal and lay knowledge, to the market and the people, to the firms and the governments.

Our own stand point is that innovations involve continuous interactions among

different actors who share learning spaces in which creativity and problem solving abilities reinforce each other (Lundvall 1992, Sutz 1997, Arocena and Sutz 2003) and can be applied to reduce particular inequalities in developing contexts. Knowledge can contribute in a direct way to revert social exclusion situations via specific research and innovation oriented to social inclusion problems. These are conceived as those that severely affect the quality of life of particular groups in a population, at both material and symbolic levels, representing disadvantages to individuals that come to be excluded from the opportunities available to others (Alzugaray et al. 2011). According to this idea, social inclusion problems may involve unmet needs associated with employment, education and training, environmental pollution, habitat and housing, physical and mental health, violence, poverty, among others, for which knowledge from combined disciplines can contribute creative solutions (Bianco et al. 2010).

A systemic behavior among actors is central for the success of research and innovation for social inclusion. Therefore, the community, the State, academic actors, the production sector and the health care system, each has an important role to play. The existence of a social demand (community), the explicit will to implement the ought-to-be solutions (State), scientific and/or technical capabilities to search for new knowledge (academic actors) and the ability to produce the solution (production sector) are key in this perspective (Alzugaray et al. 2012). Accordingly, we refer to inclusive innovation as a social process requiring specific activities for knowledge generation and articulation purposefully oriented to tackle particular problems of social exclusion. With Gras (2012) we state that resulting inclusive innovations lead to solutions that contribute to reducing social exclusion and deprivation of capacities (constituent and instrumental) suffered by the least favored sectors of a population. The main differences with other types of innovation are that social demands or needs (explicit or implicit) originate the search for creative solutions and that social objectives are at least as important as economic ones.

#### *Health care, innovation and social inclusion*

Most health inequalities configure social exclusion situations. Health equity is a central consideration of many authors dealing with social inclusion issues given its constitutive role in the development of a life with dignity (Anand 2004, Braveman and

Gruskin 2003, Culyer and Wagstaff 1993, Sen 2004, Wilkinson 1996). In this regard, Sen highlights the significance of health as one of the most important conditions of life and the relevance of health equity for social justice: *“The penalty of illness may not be confined to the loss of well-being only, but also includes one’s lack of freedom to do what one sees as one’s agency responsibilities and commitments. Health and survival are central to the understanding not only of the quality of one’s life, but also for one’s ability to do what one has reason to want to do”* (Sen 2004: 28).

A person’s health status has both intrinsic and instrumental value constituting a basic capability to function as an agent. Individual as well as group inequalities in health *“are thus closely tied to inequalities in the most basic freedoms and opportunities that people can enjoy”* (Anand 2004: 16). Health, understood as a configuration of a diversity of factors, can be the main obstacle to social inclusion or a fundamental vehicle to promote it.

Health equity is not circumscribed to the ill-health processes; instead it is usually conceived as a multidimensional phenomenon. This involves not only the numerous biological determinants over which a person has no control, but also other sets of factors such as lifestyle, social and community influences, and living and working conditions (Dahlgren and Whitehead 1991). Therefore, health equity is intertwined *“with the larger issue of fairness and justice in social arrangements, including economic allocations, paying appropriate attention to the role of health in human life and freedom”* (Sen 2004: 21). Health inequalities become materially relevant when they arise from a lack of economic policy, social reform or political engagement. Indeed, health inequalities that affect particular social groups suggest *“that they derive from social rather than natural (e.g. genetic) factors—and may thus be avoidable through public intervention”* (Anand 2004: 19).

Furthermore, most health inequalities can be addressed as knowledge inequalities because they originate in problems which remain without answers. Knowledge based inequalities on the basis of unequal social structures tend to augment (Tilly 2005) as exemplified by 10/90 health research gap described by the Global Forum for Health Research (Currat et al. 1999). According to this notion, only 10% of global health research focuses on the health problems of 90% of the world’s population resulting in a huge misallocation of resources that increases the disequilibrium between rich and poor. Poverty diseases that have remained neglected from health research, cheaper

or nonexistent vaccines or medicines and suitable health technologies for low resource contexts restrain the capacities of millions of people in less developed regions for the development of dignified lives. Ultimately, these situations relate to exclusion circumstances in which the absence of knowledge causes a capability deprivation, while at the same time knowledge may have the potential capacity to search for and find viable answers to overcome exclusion.

In any health system, technology is a central resource. Worldwide, modern technology produces an overwhelming abundance of medical devices at a rate that soon makes the latest equipment obsolete. For this reason, acquisition of new technology and update of medical equipment has become a continuous concern for health care centers. However, most medical technology innovation is targeted at high resources systems in developed countries. According to the World Health Organization (2010), fascination with technology and aggressive marketing are important barriers to rational choosing of medical equipment, especially in underdeveloped countries where information and trained staff for proper assessment may not be available. It should be obvious that medical devices need to be appropriate for the context in which they are intended; they are most useful when they are procured in a rational way, responding to needs and ensuring that they are used as effectively as possible to best improve health. On the contrary, *“almost all devices present in developing countries have been designed for use in industrialized countries. Up to three quarters of these devices do not function in their new settings and remain unused”* (WHO 2010: xi).

Current trends in medical innovation involve miniaturization of devices, increasing use of robots especially in surgical procedures and convergence of different disciplines (biological sciences, nanotechnology, material sciences) for technology development, among others. While the potential effects of medical innovations on health care systems are strong, according to the WHO (2010) cost-effectiveness and real need of several new technologies might be questionable. Especially for developing countries settings, multidisciplinary teams, appropriate infrastructure, maintenance and quality control requirements as well as reliance on non medical technology (power sources and spare parts when equipments break) may constitute obstacles for the successful integration of new technology in resource scarce health systems. There lies the importance of an adequate combination of cutting edge technology with local equipment design and implementation.

### **III. URUGUAY'S HEALTH AND STI RECENT POLICIES**

Since 2007, the Uruguayan health care sector has been substantially transformed by the creation of the National Health Integrated System (NHIS). Changes involve the general orientation of health care, its institutions and their articulations, the funding mechanisms and the impact on the regulation of health technology.

Previous to the reform, the public health sector provided health services to the population who did not have the resources to pay for the services of private institutions. These, in turn, directed their services to medium and higher income sectors as well as workers included in the social security system. The system was highly unequal regarding financial resources between public and private sectors resulting in highly different service quality and conditions. In addition, the system was mainly focused on health centers and in complex procedures rather than on prevention and early treatments (Setaro 2010).

The new health care system was implemented on the basis of the general principles of equity in the access to health services (emphasizing primary health and prevention) and social participation (involving both public and private sub sectors). The emergent NHIS includes all the inhabitants of the territory on a solidarity basis meaning that "persons of higher income and lower (sickness) risks transfer resources to people of low or no income and greater risks or to the institutions focusing on these social groups" (OPS 2009: 10).

In the new system, the Ministry of Public Health (MSP) is the governing body delegating its authority in a public health director in each of the 19 departments in which the Uruguayan territory is divided. In turn, the Administration of State Health Services (ASSE), created in 2007, must provide integral health assistance (promotion, prevention, early diagnosis and treatment, recovery, rehabilitation and palliative care) to the population without insurance and to those with insurance who choose to be treated in public hospitals.

The funding of the NHIS is possible through a national fund composed by a substantial financial contribution from the State, complemented by contributions from public and private employers, workers and retirees. This fund should guarantee universal and integral coverage, meaning that the whole population is included for all kinds of treatments and procedures.

The new health system also involves policy development for medical technology and drugs as well as further regulation and control. Within the NHIS, State regulation of technology is established with major equipment adoption being approved by the MSP on the basis of a rational use of technological resources. Additionally, this Ministry is in charge of organizing a compulsory registration of all major equipment used for diagnostic and therapeutic purposes in health institutions. Registration and technical surveillance are accomplished through the Department of Technology Assessment, which conducted in 2011 the first Census of Medical Equipment. The Census showed that major equipment tends to be geographically concentrated in Uruguay's capital (Montevideo) and mostly on the private sub sector.

The rationale of health technology policy is to organize investments (mainly in large equipment and highly specialized methods) according to available resources, population health needs, and territorial distribution. But although technology has received renewed attention, the expenditure on this field is still low. Actually, the importance of technological related issues in the whole system is comparatively insignificant considering health's expenditure on science and technology in the overall nation's budget and as a percentage of the domestic product, as shown in the table.

Uruguay Public Health Budget 2011		
	% of nation's	% of
Health care	8.75%	2.12
Government of health	0.32%	0.08
Health promotion	0.05%	0.01
Health science and technology	0.06%	0.02
Total		9.19%
	2.23%	

\* Shows the percentage of each item in the whole national budget. Source: OPP-AGEV (2012)

A process of increase in the value attributed to science, technology and innovation within the national political agenda triggered new changes inspired by an impulse to promote national development through STI, due to its contribution to economic growth, competitiveness and social inclusion (Bianchi et al. 2013). Accordingly, since 2005 Uruguay has been implementing an institutional reform in the field of STI. The legal framework has been changed, organizations were created and the competencies of the ones that already existed were modified. Also, there was a significant government budget increase for STI activities.

One of the main institutional changes implemented was the creation of a



Cabinet of Innovation (GMI)<sup>5</sup>, which was charged with the identification of priority areas for the promotion of research, technological development and innovation. GMI priorities included health and pharmaceutical fields. These priorities were included in the general objectives stated on the National Strategic Plan for Science, Technology and Innovation (PENCTI). PENCTI compiles a set of guiding principles and objectives for STI policy. In general, the need to aim for equity and social inclusion through STI is stated and health related issues, in particular, are highlighted as key points to be prioritized by policies (Poder Ejecutivo 2010).

#### **IV. HOSPITAL DE TACUAREMBÓ: A KNOWLEDGE RECEPTIVE ORGANIZATION**

The process of innovation in the *Hospital de Tacuarembó* can be understood as the creative search for suitable solutions to local health care problems on the basis of indigenous innovation dynamics. The HT is not a research or a high tech clinical hospital. Therefore, innovation activities carried out there do not constitute radical innovations, nor relate to a continuous search for the acquisition of brand new technology available worldwide. Instead, the main characteristics of the innovation process relate to the organizational receptive context that characterizes the management style of the HT as a provider of complex services.

The HT is a small health center providing varied services. It has 83 inpatient beds distributed in regular care, intensive care and children intensive care. The health center also provides ambulatory care services for different medical procedures. All services are sustained by a staff of 154 physicians, 215 nursing and other health technical positions, and 132 administrative and service positions. The global budget of the HT was around 18.6 millions (American dollars) in 2011. The distribution among budget items shows an overwhelming 97% of the expenditure devoted to operational expenses (operating costs, supplies and, especially, salaries), while investments have a marginal weight (3%). This distribution is consistent with that of the national health budget where over 95% accounts for operational expenses (MSP 2008). With these resources, the HT serves not only the population of the department of Tacuarembó but also that of its neighboring departments, covering health needs of more than 350,000 people (PAHO, 2002) in a relatively large territory with disperse population.<sup>6</sup> The health care system in Uruguay is mainly integrated by public and private non-profit institutions. After the health reform there has been a massive move from public to private sector. However, Tacuarembó and most northern departments show a major people's preference for public institutions in the local health system. At present, 54% of the health sector users of Tacuarembó are covered by the public services, while the proportion for the southern region is inverse.

### *Innovation experiences*

There are several approaches to study innovation in hospitals. Following Djellal y Gallouj (2005), we identified a notion that proved to be suitable for the study of innovation experiences in a hospital like the HT. These authors surveyed the literature on innovation issues in hospitals and stressed that technologist approaches prevail. These approaches conceive the hospital in different ways: as a "production function", as a "set of technological and bio-pharmacological capacities," as "data-processing machines;" all of them offering interesting points of departure for the analysis of the innovation process. Nevertheless, as these authors highlight, the characteristics of the hospital as an organization calls for a comprehensive approach to overcome technologist reductionism. They propose an approach that conceives hospitals as "providers of complex services and healthcare system hubs." Inspired by this approach, we will present a comprehensive analysis of several factors -mainly organizational rather than technological- intended to show how during the last twenty years the HT has gradually become a provider of increasingly varied and sophisticated health services.

During the last two decades, the HT has grown as an organization, its facilities were expanded and new services were incorporated. This transformation was marked by an organizational management style continuously open to new endeavors that demanded different kinds of innovation. This receptive behavior is only possible through an intensive interaction with other organizations and agents, which operate as sources of technological opportunities or mediators of health care needs. Indeed, the HT has been in permanent contact with national and international partners, as well as it is deeply inserted into the local community<sup>7</sup>.

<sup>5</sup> Integrated by the Ministry of Agriculture, the Ministry of Industry, the Ministry of Economy, the Ministry of Education and the Office of Planning and Budget. The participation of the Ministry of Public Health was granted on 2011.

<sup>6</sup> The model of care implemented at the HT resembles a three level pyramid. At its base there is a first level of care decentralized in the Development Office of Primary Health (DAPS, managing its own resources from both the HT and the Departmental Government of *Tacuarembó*), which operates health centers and a network of 70 rural and urban clinics. This office also carries out health promotion and prevention actions. The second level involves basic hospitalization, and the third level includes neurosurgical services, intensive care units for both adults and children, and a Human Milk Bank (Gómez et al. 2008: 135).

<sup>7</sup> There is a network of formal and informal ties around the Hospital which contributes to its effectiveness in meeting local health needs. The community plays an important role in supporting the Hospital, even in economic terms. Local collective action played a fundamental part in the acquisition of equipment and the renovation of the HT facilities

A process of organizational improvement conducted by the Hospital's management team has been marked by a receptive attitude to the incorporation of new health care services, many of which demand new technologies and/or creative processes for the development of known technologies in a cheaper or more suitable way for the context. In this sense, the experiences studied constitute examples of innovation under scarcity conditions (Srinivas and Sutz 2008) meaning the need to develop a practical solution with lack of sufficient or adequate infrastructure, equipment, institutional support, trained people, and/or money. Often, the solution needed requires building a known device by replacing their components and, eventually, improving its performance. Complying with this notion, two specific experiences related to the development of medical devices at the HT have the additional potential to produce a social inclusive effect: the human milk pasteurizer and the neuronavigation system. Both derive from existing local needs -in an implicit or explicit way-, which were picked up as technological demands by the organizational dynamics of the HT.

Two main lessons can be derived from these innovation processes. First, they show that there are agents with innovative capabilities that are able to conduct successful innovation processes that impact on the local social and economic fabric. However, these capabilities tend to remain hidden<sup>8</sup> or inactive. In fact, they are triggered as the result of several informal relationships or bottom up entrepreneurial behavior in the context of an organization of improved quality healthcare. Further, no policy tools are available for the promotion and development of these capabilities. Second, both innovation results have remained encapsulated. Despite the fact that both artifacts resulted from innovative circuits with the participation of different relevant actors, the prototypes are restricted to the context of a single implementation. This is a known failure of innovation activities in Uruguay, where the diffusion process is often blocked for several factors (Sutz 1996). One of the main barriers to innovation diffusion is the weak innovation demand, from both market and government.

<sup>8</sup> We use the word “hidden” to refer to innovation and especially to innovation capabilities that exist in a specific local or national context, but they are partially or not exploited because they are not perceived neither by the national policy nor by other actors. In this sense, although with differences, the use of the term is similar to the expression “hidden innovation” as innovation activities that are not considered by traditional STI policies or classic STI statistics (Hicks and Katz 1996).

As Arocena and Sutz (2005) highlight, this is one of the main characteristics of underdevelopment in the last decades, where knowledge demand fails to motorize innovative processes, and when these processes occur, they cannot overcome an almost testimonial effect.

*a) Human milk pasteurizer*

The first Uruguayan human milk bank outside the capital city was established in 2004. The bank was created in an attempt to reduce newborn mortality rate as well as deaths caused by transfer of newborns to the capital city, 400 km away, for special treatments. Accordingly, this initiative followed the implementation of a Child Intensive Care Unit created in 1998.

Human milk banks supply donors' mother milk to babies that, for varied reasons, cannot be breastfed. Human milk provides nutrient and immunological components that cannot be replicated by formula milk. Donor mothers' milk is encouraged as an alternative where own mother's milk is not available (OMS, 2003). However, donated milk cannot be administered to newborns without performing adequate safety procedures. Screening and pasteurizing donated human milk ensures the absence of infection and disease. Pasteurization is the procedure that eliminates bacteria while retaining most milk's beneficial components.

The creation of a pasteurizer developed from the scratch in response to a concrete demand from the HT was charged to a local technician from a small dairy industry called *Nutrísima*. A personal relationship between the HT Director and one of the owners of *Nutrísima* was fundamental for the successful development of the human milk pasteurizer. The owner, a dairy technician, trained himself through the Internet on the fundamentals of human milk pasteurization after receiving the request from the hospitals' Director for the development of a pasteurization device. The technician succeeded in assembling a pasteurizer in less than a month with components found at a regular spare parts store at a third of the cost (US\$ 4,000-5,000) of commercial equipment. The components include an electric heater from a domestic frying machine that warms the water in which milk containers are immersed, the windshield wiper motor of a car that continuously shakes the milk containers, a dishwasher water pump for hot water and another pump from a washing machine for cold water. To end pasteurization, milk needs to be abruptly cooled using a refrigerator's compressor and coil. In consideration of the human bank needs and information provided by HT medical staff, the size of the pasteurizer was calculated to fit enough glass jars containing milk to feed a newborn during a month.

The local pasteurizer adds precision to other known devices. The automatic mechanism provided by the windshield wiper motor substitutes the most popular method of a manual shaking

water bath minimizing the chances of human error. Also, a thermal memory (a chip) controlled by software reports temperature readings every minute instead of being controlled by humans using manual thermometers. The most sophisticated component is a programmable controller (PLC) with 30 functions for the automatic procedures that was implemented by a programmer drawing on the experience from milk packaging machines in Nutrísima. The whole artifact is assembled in a stainless still box. The pasteurizer requires minimum training to be successfully operated by milk bank's specialists. Maintenance twice a year is performed by hospital's personnel trained by Nutrísima.

In 2009, a second larger pasteurizer accommodating up to 5lts of milk was developed enhancing the cooling function by incorporating a cold water bank. In the new equipment, the PLC includes a function to cool water at 3°C and keep the temperature until the pasteurizer is manually turned off.

Nutrísima funded the development of the first pasteurizer as a contribution to the HT. The second one was partially funded by the HT with Nutrísima paying for the technicians' labor. The total cost of the second pasteurizer was U\$S 4,800. Using alternatively both pasteurizers the hospital's milk bank provides maternal milk to every baby that cannot be breastfed at HT and at the private hospital in Tacuarembó.

The development of this device involved the search for a practical solution that required building a known artifact by replacing their components and, in this case, improving its performance. The final artifact is developed based on locally available technical knowledge arriving at a suitable technical artifact that is cheaper than the imported equipment. In this sense, the local pasteurizer is a suitable solution designed in accordance to the context in which it would be used and which combines medical, informatics and dairy related knowledge.

The effects from the implementation of the local pasteurizer in the HT are twofold. Regarding the health center and its social environment, the establishment of the milk bank is intended to change not only the medical practice by avoiding the use of formula milk but also the promotion of a culture of breastfeeding and milk donation in the local community. In this sense, organizational innovation in hospitals involves attempts to modernize and improve healthcare provision including, as in this case, the establishment of new types of clinics with special purposes (Djellal and Gallouj 2007). Regarding the beneficiaries of the innovation, social inclusion effects from the implementation of the human milk bank are self evident given the fact that the provision of donated milk to ill and/or preterm babies can make the

difference between a healthy child and an ill or even dead one.

*b) Neuronavigation*

The neuronavigation system of the *Hospital de Tacuarembó* was developed by the Image Treatment Group (GTI) of the School of Engineering at the public university, in a joint venture with neurosurgeons of the university hospital (School of Medicine, *Universidad de la República*) and the HT.

According to neurosurgery experts, the neuronavigator is a surgical device which can facilitate or improve brain surgery. This device is used only in coordinated brain surgeries, not being used for emergency operations. The current prototype introduced image-guided neurosurgery, a technology by which a set of images are used to guide surgical procedures, in a way that allows the neurosurgeon to “navigate through the images and get feedback from the position he is touching on the patient”. During a surgical procedure, “the surgeon touches the patient with a tracked tool and visualizes on the computer screen the images of the paraclinical studies, from different perspectives refreshed in real time by the position of that tool” (Carbajal et al, 2010: 1).

The starting point for the cooperation process was an informal tie between a physician, chair of the Neurosurgery Department at the School of Medicine, and an engineer, chair of the Department of Electrical Engineering of the School of Engineering. Informal ties are a way to trigger the generation of knowledge that operates almost by accident. However, it is a relatively common form of linkage in a context where there are few formal mechanisms to promote relations between users and producers of technology. The final prototype was developed in 2010, and it is currently used for the practice of surgery at two public hospitals. The prototype developed by the multidisciplinary team of engineers and health professionals had the financial support of ASSE and the *Universidad de la República*.

The Uruguayan neuronavigator is useful for a certain type of surgery, in which it is not possible to know the exact point where the operation should be performed by just looking at the surface of the brain. In these cases, knowing the direction in which the surgeon must perform the incision is not an insignificant detail since intervening in the brain can easily damage healthy areas. Therefore, with a device that indicates exactly in which direction the doctor should act and how deep he should proceed, means a major step forward. This allows to practice surgeries that were not previously done because of the high risk involved as well as to perform surgeries at lower risks.

Due to the high costs of acquiring neuronavigation equipment on the international market for the Uruguayan health system, neuronavigation had been never applied before in the country. That is why the two prototypes developed by the GTI introduced the technique for the first time in Uruguay, allowing patients of the public sector to gain access to this technology that was of common use worldwide.

### *Hospital management as social entrepreneurship*

We develop the argument that the innovation experiences of the HT result from an organizational process based on continuous improvement oriented to incorporate new services. That process is characterized by a strong internal leadership highly receptive to the external opportunities and massively supported by the local community.

Since 1992, the HT has had the same director, who recruited a management team highly committed to the institutional objectives. As outlined before, we infer that the innovation trajectory of the HT was determined by an organizational context, which in turn has been signed by the style of management developed by the HT directorate.

In that sense, the HT may represent a virtuous process between management improvement and technological innovation. The management improvement is a kind of organizational innovation that, in this specific case could be characterized as social entrepreneurial activities oriented to offer improved health care services.

Social entrepreneurship may relate to individual characteristics and/or organizational features. Among the first, it is worth remembering the basic notion of entrepreneur coined by Schumpeter (1934). In Schumpeter's view, actions of entrepreneurs relate to a search to obtain social recognition and not necessarily pecuniary reward. Schumpeter stressed that the entrepreneur acts moved by several subjective reasons such as: the will to conquer and succeed for the sake of success itself; the joy of creation, of getting things done, to change for the joy of changing.

Schumpeter's classic ideas help to understand the entrepreneurial leadership that governs the HT. They emphasize the high relevance of several non economic motivations for entrepreneurial behavior and the leadership vocation of entrepreneurs. Also relevant are the specific leadership characteristics within organizations such as a health center. Prabhu (1999) emphasized the relevance of social entrepreneurial leaders, as innovative managers that act in organizations that offer a social service and promote social change as their main objectives.

Individual characteristics of entrepreneurial leaders relate to the main features of the concept of social entrepreneurial activity at organizational levels. Deed (2001: 4) points out that social entrepreneurial activity has three basic characteristics: i) “the recognition and (exploitation) of new opportunities to serve (the social) mission”; ii) “engaging in a process of (...) innovation”; and iii) “acting (...) without being limited by resources currently in hand”. Peredo and Mclean (2005) add a new dimension related to tolerance to risk.

All these dimensions are suitable to describe and analyze the characteristics of the HT and the management of its directorate. As mentioned before, the HT is an organization open to the opportunities that the context offers regarding innovations and changes that contribute to the organization’s growth. Furthermore, the management style developed by the directorate is highly tolerant to the risk. Actually, this attitude can be identified in the way investment is managed at the HT on the basis of a frequent *fait accompli* policy. During the last years, the hospital has expanded its facilities introducing new services, adding new operating rooms, sterile rooms and intensive care units. In order to put into operation these facilities and provide the new services that they allow, the HT, as any hospital in the country, requires the authorization of the Ministry of Public Health. This regulation aims to ensure a rational investment of resources that the country allocates to health care as well as an adequate distribution of them in the national territory.

However, it is widely perceived that the implementation of this regulation is too bureaucratic, and it ends up being a barrier to the initiatives from hospitals. In this regard, an innovative organization such as the HT not always finds its way within the current regulatory framework. Nevertheless, being tolerant to risk and not willing to be restricted by resource constraints, the HT management team has looked for alternative ways in order to foster organizational growths. In this situation, the HT faces two possible alternatives. It can wait for health authority approval for every new investment therefore slowing organizational growth, or it can take the risk to initiate investments and thus use the ongoing process in order to push for further funding. This dilemma reveals a disarticulation between national and local objectives informing about the potential conflict which can turn into a barrier for the achievement of health care goals.



## **V. MAIN LESSONS: TWO POLICY MISMATCHES**

In the case of Uruguay and the experience of medical innovations described, there has been a successful combination of opportunity, available knowledge and resources to satisfy local demands. However, both medical equipments analyzed are circumscribed to the particular territory in which they were developed even though they are potentially useful for other similar contexts. While the local dynamic has promoted the innovative and inclusive activities of the HT, linkages with the broader system and the public policies involved have not been straightforward. Two mismatches account for the encapsulation of these technologies which for the most part remain restricted to the HT.

### *First mismatch: unintended local effects of national policy*

As described before, the Uruguayan health care sector is organized in the NIHS under the general orientation of solidarity funding, integral health assistance and public-private articulations. Health technology has received renewed attention especially regarding the regulation and control of medical equipment incorporation into health centers. Specifically regarding technology for pathologies requiring diagnostic equipment and highly specialized treatments, the Public Health Ministry at the national level will authorize technology adoption on the basis of available scientific information, the need for their use in medical institutions and the rationality of their location and operation favoring the acquisition of new technology in the public sub sector. In this regard, there is little room for local initiatives beyond organized investments planned in accordance to the epidemiological map of Uruguay and available resources. While strengthening central control mechanisms reinforces the rationality of the system regarding the incorporation of technological innovations (for efficiency criteria in the context of limited resources), technology incorporation will be oriented towards nationwide epidemiological targets or those with a major territorial anchorage. This approach could constrain and even block innovation processes as the one that is taking place in the HT, which is not necessarily based on the ability to generate widespread technological applications.

The development of the neuronavigation system, installed at the HT before the rationalization policy took place, may serve as an example. If the current criteria would have ruled, due to the characteristics of neurological surgery (non massive) and Tacuarembó's demographic characteristics, the techno-surveillance national authority probably would not have authorized the installation of a neuronavigator at that hospital. This in turn could have an

undesired effect, restricting highly complex and less invasive medical procedures for users of scarce resources living outside the capital city. For this reason, it is necessary to analyze health policies not only from the criterion of equal access to health care but also from the possible effects on the development or inhibition of innovations in health and its impact on social inclusion.

*Second mismatch: disarticulation between national health policy and STI policy*

Technology policy in the new health system is oriented to improve the allocative efficiency and to promote equity, but it is not intended to be a pro innovation policy itself. Despite recent improvements in STI related institutions, increased budget for research and development activities and the importance of health issues in the STI agenda, there is no specific organization involved in the promotion of innovation in health care. In fact, the importance of technological related issues is comparatively insignificant within the public health budget. Perhaps, the main failure in the general policy design is the mismatch between both health and STI policies, resulting in a sort of technological regulation policy conducted by the Ministry of Public Health and an absence of health innovation policy.

During PENCTI's elaboration, it was noted that the strategies in health innovation should be articulated with the objectives of the NHIS and the needs identified by health policy, to ensure the development of synergies in the sector and therefore achieve an effective STI contribution to health system reform (Bianchi and Snoeck 2009). Following Mugabe (2005) these authors recall that the weakness in incorporating innovation issues into health policy is one of the main constraints identified for innovation in health in developing countries. However, while certain objectives of PENCTI relate to health policies, effective coordination at the institutional level between the NHIS and institutions of the STI system is not adequately resolved.

New health policy considers the promotion of health scientific research in coordination with relevant organizations, and policy development for medical technology and drugs as well as further regulation and control. In this regard, a Health Fund was created in 2009 with the aim of supporting “R&D projects in Public Health and Human Medicine which results provide some degree of applicability to the national reality” (ANII 2009). Competitive grants were allocated to 12 proposals, but after its first call the Health Fund was discontinued. In a way, the experience of this instrument created for the promotion of R+D+I in health shows some of the

barriers for the implementation of health policies with an innovation component.

In sum, these lessons are useful to think about the challenges faced by an inclusive innovation policy, beyond local successful innovation experiences. Clearly, spontaneous bottom-up experiences are very important and arguably richer than a top down detailed plan. Nevertheless, policy efforts are useful tools that could contribute to make hidden capabilities visible or to activate existing capabilities for previously known problems. In this regard, the experience of the *Hospital de Tacuarembó* shows some hardly replicable features. A management style signed by openness and receptiveness is intertwined with the specific experience of the HT and it is strongly defined by tacit components rather than explicit policy decisions. Policy design for the promotion of this kind of experiences might be extremely complex, especially in Uruguay where a systemic view of policies is only incipient. Instead, it is feasible to implement coordinated efforts that at least do not inhibit this type of innovation experiences. Furthermore, when they emerge, policies should be flexible enough to promote them.

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