Innovation Systems and Inclusive Development: Some evidence based on empirical work

Paper Submitted to the International Workshop and Journal Special Issue on "New Models of Innovation for Development"
4-5 July 2013
Manchester University, Manchester, UK

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1. Introduction:

The beginning of the twenty-first century has been marked by concomitant crisis and rising challenges, which combines a severe world economic and financial crisis and the threat of an ecological catastrophe menacing the survival of humankind. Concurrently, in spite of the huge technological advances achieved concerning the human capacity to provide adequate material living conditions to the world population, increasing inequalities spread starvation, violence and despair around the globe.

Two factors are absolutely central to the world crisis and its persistence. First, there is a profound hypertrophy of financial assets and markets. Secondly, a sharp inequality in income distribution has increased at the heart of the system. This later trend is partially offset by policies in a few emerging countries (e.g. Brazil), but the deepness of current problems bring us back to previous surges of inequality in history associated to major structural changes. The difference is that now the inequality problem acquired a global dimension, spreading beyond national borders.

Most of the available explanation of such increase in inequality attributes it to either globalization or technological change or to a combination of both (Storper 2000; Reinert, 2004). The profound social effects of these changes have placed the question of inequality back onto the political agenda. Issues related to combating social marginalization and promoting inclusive development start appearing as part of the agendas of research and innovation as an explicit goal concurrently with conventional objectives of promoting business competitiveness (Arocena and Sutz, 2012). As social inclusion was not a focus of the agenda for a long period, it is pressing to foster new analytical and normative frameworks capable to improve the understanding of how to lead research and innovation to cope with social priorities.

The focus of this paper is based on this background and motivation. It is sited on the results of the Research on Innovation Systems and Social Inclusion Project (RISSI Project), which gathered researchers from Brazil, India, China, South Africa and Uruguay[1]. The research aimed at contributing to unfold innovation systems that move

[1] The RISSI Project consolidates a new phase of the BRICS Project - Comparative Study of the National Innovation Systems of BRICS. The later is rooted in a larger research effort on BRICS national innovation

towards inclusive development, opening up the possibility for policies that may promote development alternatives which normatively aspire towards greater sustainability and social inclusion.

Methodologically the RISSI Project departs from the Local Innovative and Productive Systems (LIPS) approach (Lastres and Cassiolato 2005; Cassiolato, Matos and Lastres, 2008) that is based on the broad conceptual framework of national innovation system (Freeman, 1987; Lundvall, 1988) and on the Latin American literature on development and structural change (Fanjzilber, 1989). Based on the research preliminary results, the paper aims at presenting and discussing empirical evidence and analysis of some experiences in the five countries regarding inclusive development at local level. The analysis comprises different health innovative systems covering the informal economy, micro and small enterprises and other local-scale actors, including 'living pharmacies', low-cost medical equipment; traditional Ayurveda medicine, among others.

It is suggested that LIPS framework allows improving the visibility of social-inclusive innovative activities which are normally marginalized helping to move towards policies which guide and drive development in a more inclusive, systemic and sustainable way and showing how to leverage these activities into sustainable innovations trough wider and stronger links with the national system of innovation.

Also merits attention in the discussion proposed by this paper the warning about the common misconception of dissociating policies aimed at enhancing competitiveness and policies dealing with poverty/inequality (Furtado 1968). In spite of being a common characteristic of policy making (innovation policies included), the decoupling between the economic and social dimensions of development is not conducive to address the main questions of development.

The hypothesis of this work suggests that the configuration of a technological development pattern which escapes such misconception must, necessarily, be integrated in the broader scope of inclusive development trajectories. We must reconsider innovation and its insertion in development trajectories, blending innovative efforts with social concerns and interrelated development issues. In addition, it is argued that outdated policy models, which can be applied indistinctly, must be replaced by new policy frameworks based on the clear understanding of the types of problems, challenges and opportunities within the specific territory they are focused on. Indeed, standard approaches of innovation policy making simply do not work for the most disadvantaged.

In this sense, it is argued that emphasis must be put on innovation policies of a broader and systemic character. On this purpose, the interaction between welfare systems and innovation systems in developing countries can generate extremely positive synergies in terms of growth, efficiency and equity, thus constituting a significant link in a proactive strategy for inclusive development; a strategy in which the State must play a core role. The constitution of interaction between innovation

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systems being developed in the sphere of the Global Research Network for Learning, Innovation, and Competence Building Systems – Globelics.

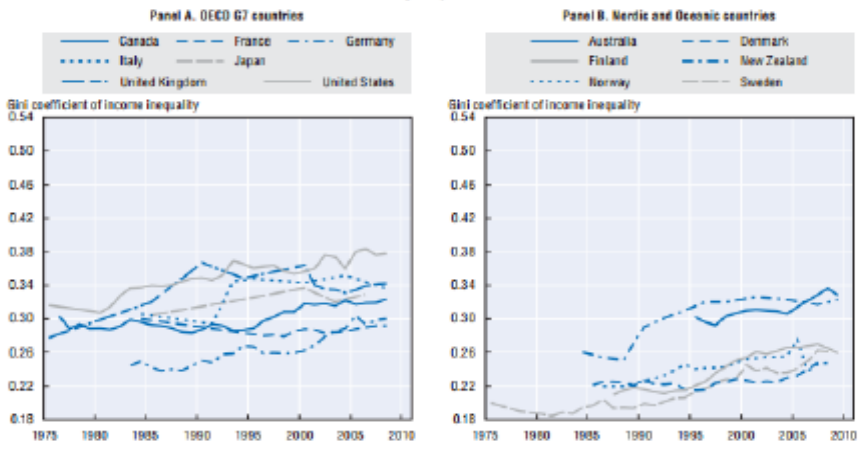
systems and systems that meet social priorities in developing countries shall be fruit of both institutional construction and long term structural reforms, which result from political decisions and articulations between State, market and society (Soares et al, forthcoming).

The paper is organized as follows. Section 2 briefly discusses the links between inequality, globalization and technical change building from the evolutionary and Schumpeterian perspectives. Section 3 introduces the background and motivation of the RISSI Project and presents the preliminary evidences based on empirical work done on health local innovation and production systems in Brazil, India, China, South Africa and Uruguay. Finally, in the Section 4 some concluding remarks are presented.

2. Globalization, Technical Change and Inequality

Deep economic inequalities prevail in the contemporary world. Income inequality has increased in practically all industrial countries – Europe, USA, Canada and Japan – and most middle income developing countries such as China, India and South Africa in the last two decades. In OECD countries, the Gini coefficient stood at an average of 0.29 in the mid-1980s but increased almost 10% by the late 2000s.

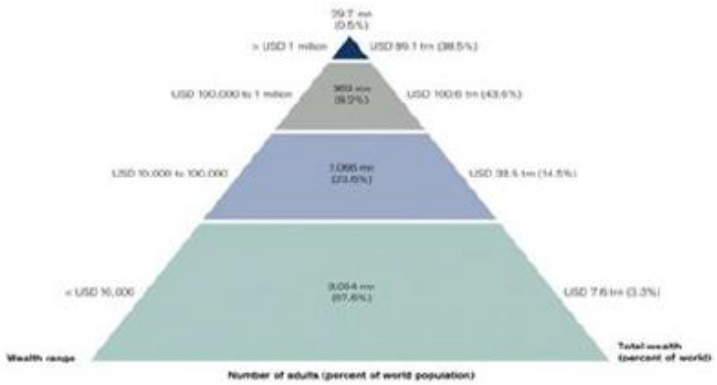
Figure 1: Gini coefficients of income inequality in selected OECD countries, 1975-2008



Source: OECD Income Distribution and Poverty Database

In the USA, the income share of the top 1 percent of earners has more than doubled from 1979 to the late 1990s. In mid-2011 29.7 million adults, about 0.5% of the world's population, owned more than one third of global household wealth. In contrast, 67.6% of the world's population - 3.054 billion people - held a mere 3.3 % of the world's wealth.

Figure 2 – The Global Wealth Pyramid



Source: Credit Suisse, Global Wealth Report 2012

Globalization process is changing the world but the penetration of global influence is highly selective, increasing inequalities instead of equalizing its benefits (Tilly, 2005). The dynamics of globalization has produced simultaneously a growing economic integration across the world, but also a process of social disintegration for those countries, regions and social groups not able to integrate with the world economy on a favorable basis. In Reinert's (2004) words, "if there is something called 'progress' and 'modernization', globalization has – particularly for many small and medium-sized nations - brought with it the opposite: many are experiencing 'retrogression 'and 'primitivization' (pp.2).

Mainstream economists are conscious now that global governances require at least some attention to those regions and people not benefiting from globalization. In this respect, Munck (2005) calls attention for the growing call 'in the corridors of power' for addressing the divides and inequalities that globalization either creates or exacerbates, in the interests of good governance if nothing else. In terms of politics, it can be said that globalization effects have forced the political agenda to move away from the neoliberal discourse that prevailed until recently, which emphasized the need to free the markets of any constraints and that inequality was indeed beneficial for economic growth.

Tilly (2005) analyzes the bases of unequal welfare in the capitalist world, before and after the beginning of recent globalization period. Highlighting that in recent decades the combination of financial capital and scientific-technical knowledge has gained unparalleled influence in the production of inequality between those who control this asset combination and those who do not, Tilly quotes United Nations Secretary-General Kofi Annan in a plea for action against scientific-technical inequality:

> "Ninety-five percent of the new science in the world is created in the countries comprising only one-fifth of the world's population. And much of that science – in the realm of health, for example – neglects the problems that afflict most of the world's people. This unbalanced distribution of scientific activity generates serious problems not only for the scientific community in the developing countries, but also for development itself. It accelerates the disparity between advanced and developing countries, creating social and economic difficulties at both national and international levels" (pp 25).

This alert stresses that knowledge-based inequality is getting deeper in the contemporary world. The benefits of scientific advances are highly concentrated in already rich countries and their technological advantages over the rest of the world are increasing. Unequal access to knowledge and unequal control over its production or distribution matter as it causes other sorts of inequality arising from political, financial, and other advantages of its holders. Returns from knowledge allow its holders to reproduce the institutions and relations that sustain their advantages, opening room for dramatic unequal distribution of benefits and costs between countries and peoples.

Freeman (2004) argues that the combination of technical change, increasing returns to scale and the cyclical aspects of growth are at the core of the process of economic growth and related effects on income distribution and social cohesion. In the same perspective, Perez (2004) adds that the understanding of the different phases of technological revolutions is crucial to the understanding of both business cycles and uneven development. According to her, during paradigm transitions there are very intense transformations in technology and the economy, which conflicts with a high level of inertia in the socio-institutional level, the later resulting from past successes and vested interests. This difference in rhythms of change leads to a decoupling of these two spheres. The resulting mismatch brings about what she calls the 'bad times', a period of uncertainty and extremely uneven development.

The social consequences of each transition period are vast and deep. It is then that the social pressure for change is clearly felt and the need for a profound institutional renewal becomes progressively evident (Perez, 2004). In the past, the reaction during the 'bad times' towards a policy of narrowing inequalities has been the result of political revulsions against the hardships emerging from the growing inequalities that ultimately led to programmes of social reform designed to mitigate the worst effects of structural change (Freeman, 2004).

Audretsch (2004) refers to what came to be called 'the social question' - the growing economic inequality and increasing misery in the middle of a technological revolution in the nineteenth century in Europe. The 'social question' was only solved by creating institutions that became building blocks of a system that produced increasing welfare: minimum wage, health and safety standards, health insurance, unemployment benefits and so on (Reinert, 2004).

Now we are facing a new and global version of the 'social question'. This time, however, it goes beyond the borders of industrialized countries, spreading to the developing world and consolidating as a global scale problem. More than half of the world's nations were poorer in the late 1990s than in 1990. Statistics show the starling

distributional problems both between and within nations. How to deal with this pressing problem?

Freeman points to the challenge of creating new ways of thinking and new policies in order to reverse the present trends.

3. Innovation Systems and Social Inclusion: the RISSI Project

One of the main characteristics of inequality in the contemporary world is that it is also and overriding knowledge-based. But only recently the complex relationship between inequality and knowledge creation and use started to receive more attention from scholars and policy makers. Given to the complexity of the subject, its understanding still constitutes a huge challenge. Together with political will, new analytical and normative frameworks are required to lead research and innovation to address social priorities.

The RISSI research project aimed at advancing this issue under the innovation system perspective. It also intended to develop a methodological framework capable of capturing the dynamics of inclusive innovation systems which are outside public policy radar and are not captured by traditional indicators. A research network gathering academics from Brazil, South Africa, India, China and Uruguay was set up to study the dynamics of local innovation and production systems (LIPS) with promising results for social inclusion, seeking to provide policy advice in this area.

The LIPS approach was developed in the 1990's by the Brazilian Research Network on Local Production and Innovation Systems (RedeSist) and nowadays is largely used by governmental and private institutions in Brazil. It represents an analytical and normative instrument that is used to characterize and foster local development emphasizing learning and capacity-building. It means a new policy framework capable to deal with the opportunities of different territories - especially those less developed, recognizing their diversity and specificities.

This framework involves empirical studies, using specific questionnaires and interview guides that explore issues related to the structure and dynamics of productive organizations, the processes of interactive learning, cooperation and innovation in the territory and the articulation with the training, scientific and technological subsystem, the social dimension and the broader institutional set-up. Therefore, this methodological approach is particularly useful to capture the specificities of innovation processes in less developed countries where a significant amount of innovative activities take place in informal settings. Understanding the dynamic interactions among different actors – formal and informal, public and private, large and small scale -, and the learning processes that take place among them is crucial to improve the effectiveness of STI policies in less developed contexts.

The empirical work covered LIPS focused on health and connected to social inclusion. The focus on health systems is based on the understanding that health equity is a central concern to social justice (Sen, 2004). In addition, health systems are broadly recognized as crucial for economic growth and innovation. Consequently, RISSI network consider important to raise the profile of health care among innovation policy makers and to stress the need to integrate health innovation systems into the design and implementation of inclusive development strategies.

Using common methodologies, the case studies[2] were focused on the following issues:

Table 1: Selected Case studies under RISSI Project

Local systems of innovation and production	Country
Traditional medicine: the example of Ayurveda in Kerala	India
Innovation for low-cost medical equipment	China
Locally centered innovation system geared towards social inclusion: The case of the Hospital de Tacuarembó	Uruguay
Health innovation in two rural areas in the Eastern Cape Province: The Mbizana and Ingquza Hill Municipalities	South Africa
Phytotherapy in the Amazon State of Amapá	Brazil

Source: own elaboration

In South Africa, two municipalities were studied - Ingquza Hill and Mbizana, both located in rural areas of the Eastern Province of Cape Town. Population in these municipalities show low social indicators and depends mostly of migrant labor and social guarantees from the government. The multiple challenges faced by South Africa arising from poverty, unemployment, inequality, and environmental crisis are exacerbated in rural areas, including Ingquza Hill and Mbizana. These regions undergo from limited access to clinics and hospitals and the rural inhabitants often go without basic health services, suffering from inefficiencies and poor quality of health system.

Exacerbating this picture, there is significant nationwide incidence of diseases like AIDS, high infant mortality, non-communicable diseases and violence. Also, the existing better quality health services in the country tend to benefit more those who are employed, ie, subsidized by their employers. Despite a high government spending on health (8.5% of GDP, what is more than the minimum recommended by the World Health Organization), the result is not great. Inequalities between the public and private health are striking: despite receiving the same budget, the public sector serves 84% of the population. This unequal distribution of resources ultimately benefits the private sector and the ones who have access to it.

The main difficulties of the rural health system in South Africa are: shortage of skilled professionals, large distances to major hospitals, limited access to specialized services

[2] The analysis developed in this topic is based on the case studies developed in the scope of RISSI Project. The five studies are cited in the references.

and pharmacies, financial barriers related to low income and low health plan coverage, high transportation costs, low quality infrastructure, and high demand for healthcare professionals.

Interesting to note that health care system in South African rural context has its own peculiarities. Both due to cultural traditions and to poor formal health care infrastructure, the concept of health acquires a more holistic meaning. It includes mental, emotional, cultural and spiritual wellness. Thus, traditional medicine is part of the community's understanding of their health care options. Knowledge and beliefs that include the use of medicines based on plants, animals and minerals, in addition to songs, prayers and spiritual therapies are used in the prevention, diagnosis and treatment of diseases. Traditional healers are part of the health of communities and are often the first patient contact.

Thus, the health care system in these areas includes formal, semi-formal and informal actors. Among the formal organizations, it can be mentioned rural hospitals and clinics, NGOs and homeopathic communities, the later being an important bridge between Western medicine and informal traditional medicine. Among the semi-formal actors, traditional chiefs and traditional healers are important actors for identifying health community problems and a reference point for contact with clinics and NGOs healers, but although registered they do not have a legal status. The informal system relies on unregistered traditional healers, herbalists, divine healers, faith healers, traditional birth attendants and traditional surgeons.

This more holistic and hybrid health care system, as well as the co-existence of scientific and traditional knowledge in health care, also characterizes the LIPSs of Amapá, in Brazil, and of Kerala, in India, as will be seen subsequently.

The state of Amapá, Brazil, is characterized by a broad mixture of cultures that resulted from the interaction between native indigenous people, European settlers and, later, African slaves. The resulting population – called 'cabocla' – has in its social matrix a blending of different kinds of knowledge and traditions. Amapá is placed on the North of Brazil and is one of the poorest states in the country, with low IDH index and precarious public infrastructure, including the health basic care.

The use of the rich natural resources from the local flora and fauna to meet the basic health needs has always been and remains present in everyday life of the Amapá state. The survey data shows that 87% of respondents claim to know medicinal plants and 67% practice cultivation of medicinal plants at home. Many of the products used as bark, leaves, roots and stems, are marketed '*in natura*' (fresh) usually in farmers' fairs; others are sold with some kind of processing by local pharmacies.

The precariousness of local health care services, both public and private, also induces the use of traditional medicine. Currently, modern medicine and other traditional forms of health care coexist with the predominance of the later in the poorest segments of the population especially in rural areas. Informal medicinal plant collectors, midwives, traditional healers and herbal medicine producers figures out as

relevant local actors in the LIPS, together with 'living pharmacies'[3] and other formal health care structures.

But despite the cultural tradition in the use of medicinal plants by the local population, only in 1995, with the implementation of the Sustainable Development Plan of Amapá, the use of phytotherapy became a priority in the strategic planning of the state government as an alternative within public health system. Investments were made in the Research Institute of Amapá (IEPA) ensuring substantial progress in the research on the use, validation, increased production and dissemination of phytotherapy in the state.

One of the main programs developed by IEPA was an initiative focused on the improvement of rural communities' health, which had as its core the creation of the 'living pharmacies'. Project units were installed in 14 of the 16 municipalities of the state and specific training was offered for health workers, midwives, community leaders, teachers and nurses. The main products sold by the 'living pharmacies' are barks, roots, resins, oils and syrups, especially geared to the treatment of liver diseases, diarrhea, asthma, gastritis, flu, amoeba, anemia, bronchitis and skin diseases. Positive results in improving the local population health conditions occurred until 2002[4], when political changes in state government led to discontinuation of the strategy of including phytotherapy as an important component of the health policy.

In 2010, a new state government favorable to reintroduce phytotherapy as a policy goal was elected. Yet, now, two different models for phytotherapy development are under debate at state level. The first one aims to set up the production of herbal medicines in industrial scale, based on public-private partnership and focused on the marketing of herbal medicines at national level. Considering the strong influence that pharmaceutical industry has in the health industry (pressing to inhibit the production of herbal medicines) and the rigor of national regulation for phytotherapic manufacturing, this option may find restrictions to lead to positive results.

The second model aims the widespread use of herbal medicine and medicinal plants as a state policy goal for basic health care, seeking to expand access to, and use of, good quality traditional medicine by the local population, especially the ones with low purchasing power[5]. In this case, the perspectives of health care and social inclusion are privileged, focusing on low-scale production systems such as living pharmacies, small scale pharmacies, etc for which legal restrictions do not impose obstacles. However, there are concerns that prevailing political seems to be neglecting this later option.

[3] Living pharmacies refer to the gardens of medicinal plants in community units and in units of the national health care system maintained under the supervision of professionals from the state and municipal public service. They are intended to carry out the cultivation of medicinal plants and to ensure for the community assisted access to herbal 'in nature "and guidance on the preparation and the correct use of home remedies performed by trained professionals.

[4] Survey data show that 99.5% of respondents stated that the treatments with medicinal plants and herbal medicines were effective.

[5] It is worth mentioning that 99% of the consumers interviewed by the research in Amapá would like to have phytotherapy and herbal medicine included in the health care services offered by the Municipalities in the state, considering their use proper for treatment and prevention of various diseases. Additionally, the interviews have shown that there is a widespread perception of phytotherapy and herbal medicine as a public service, which should be object of health care public policies.

Diverse and every so often conflicting paths regarding traditional health systems development also appear as a characteristic of the Indian context of indigenous medicine.

The Indian case study examined the development of Indigenous medical system in the state of Kerala, with focus on Ayurveda. Kerala's development experience has attracted world attention on account of its human development indicators comparable even to the developed countries but with a low per capita income. However, in the recent years there was a reversal in this trend. The impressive growth in GDP contrasted with a high degree of governance deficit that have ultimately led to a decline in the quality of public services. As well, the state known for its equity has become the most iniquitous state in India. Along with inequity in consumption, inequality in the access to health care services also accentuated especially in a context wherein the state has been increasingly withdrawing from the public provisioning of health care services with increasing role being assigned to the private sector.

Indigenous health systems have long tradition in Indian society, dating back several millennia. Historically, Ayurveda has been a source of inclusive health system contributing significantly to improve health care outcomes. Particularly, Kerala state has profound claims of tradition, practice and institutional built up in the sphere of Ayurveda.

Kerala's Ayurveda is known for its therapeutic contributions especially for certain widely prevalent diseases. But the Ayurveda local production and innovation system in Kerala is under transition. The current focus is moving from basic health care towards the rejuvenerative and cosmetic concerns greatly associated to the health tourism and export-market oriented strategy of Kerala Ayurveda.

Driven by state policies and profit making opportunities, there is an increasing number of large firms in Kerala, both foreign and local. Due to the stringent regulations on scientific evidence, many traditional medicine drugs are not entering the foreign market as medicinal products, but as nutraceuticals, which needs only standardization and toxicity checks but not efficacy claims. Therefore, industrial transformation of indigenous knowledge in Kerala has diversified the use of knowledge into not only medicine, but in nutraceuticals and cosmetics in order to open new market opportunities. The practice of Kerala Ayurveda is thus changing under the impact of forces of commodification and globalization putting constrains over local small firms, restricting interventions towards domestic markets and shifting technological capabilities of the LIPS.

In spite of fostering new business opportunities, these changes don´t seem to be working to encourage Ayurveda as an inclusive health system. All these changes are having impacts on the nature of demand for the ayurvedic health personnel, therapeutic practices, diagnostic methods, research effort priorities, among others. For instance, there is a growing demand for therapists from the health tourism sector, whereas the ayurvedic doctors are among the lowest paid professionals. Traditional practitioners keeps largely making use of local health knowledge for public health benefits, based on trust and time tested efficacy. But in the absence of an appropriate institutional architecture, traditional healers and small manufacturing centers keeps

sustained mostly by their inherited knowledge and are hardly involved in any form of interactive learning either with the competing firms or with other institutions. More worrying, the early concerns on nurturing Ayurveda as public health care tool for assisting local people are also fading.

But Kerala study also showed examples on how indigenous medical systems can promote inclusive development. The Jeevani ('the life giver') traditional medicine was developed based on the reports from the Kani tribal people about the anti-fatigue properties of a local plant. The association of traditional knowledge with scientific research, together with a broad institutional coordination, which respected benefit sharing principles established by the Convention of Biological Diversity, allowed indigenous medicine innovation to act as a push for not only better health outcome within community settings, but to provide livelihood opportunities, as the community become a major beneficiary of the entrepreneurial outcome.

The Chinese study consisted of cases of development of local innovation systems for low cost medical equipment to address local needs of a large country with a significant rural population lacking access to health. The most interesting case is the development of a "marine terminal", a multi-function diagnostic bed suitable for village clinics. Designed initially by Shenzhen Institute of Advanced Technology (SIAT), a research institution of the Chinese Academy of Sciences, it includes a multi-function diagnostic bed, a portable diagnostic bag a multi-parameter check-up instrument, a general diagnostics system and related medical software. The portable diagnostic bag is suitable for rural regions where people are sparsely distributed. The bag is equipped with a blue-tooth module, used to transfer data of the physical check-up to the multi-function diagnostic bed once the village doctor returns to the clinic.

It combines all basic diagnostic functions including blood analysis, urine analysis, 12-lead EKG, non-invasive blood pressure and blood oxygen, monitoring, and general testing (sight, color blindness, internal medicine, surgery and ophthalmoscope). In addition, it is equipped with a workstation software system and a health digital record system. The whole set of equipment can meet rural residents' basic medical diagnostics needs and alleviate the serious equipment shortage in rural areas at a low cost of 35,000 RMB. With this system, farmers only need to pay about 30 RMB for a physical check-up, and a dozen tests can be done within 10 minutes. These beds are sold in over 20 provinces in China and have been listed in the "community health service enhancement" equipment procurement list by several provincial governments. Although new, the equipment is widely used over 1000 villages, and over 30 million rural people benefit from it. There are plans to use such equipment in more than 500,000 villages.

In the early phase, the R&D of "marine terminal" is first started by Shenzhen Institute of Advanced Technology with financial support of the government´s "low-cost medical fund". An important characteristic of the project was that SIAT has widely collaborated with enterprises, hospitals, government and other institutions to advance this low-cost health care project. In 2006, SIAT first put forward the plan for low-cost health care and began to do R&D of medical technology and product which are suitable for rural areas. In 2007, in order to take advantage of local production capacities, it set up one

manufacturing firm, Shenzhen Zhongke Huaqiang Technology to produce low-cost medical products. While SIAT focus mainly on R&D, its industrial subsidiary takes responsibility to connect with hospitals, government and other parties to jointly develop the innovation of new products.

In 2012, SIAT set up low-cost health industry-academy-research alliance with Shenzhen University, Shenzhen Medical Devices Industry Association and dozens of healthcare enterprises. Through government coordination and support members of the alliance work collectively and in close interaction to integrate different kinds of resources, establish service platform for public and share industrial generic technologies. Particularly, stable and long-term collaboration between enterprises, institutions and universities are highly valued and different forms of innovative activities have been carried out in the alliance including joint R&D, co-developing new products and core technologies, establishing associated labs , united training talents and sharing national major projects. In addition, this alliance is also responsible for the management of this low-cost health industry, establish industry standard and coordinate upstream and downstream product in the industrial chain.

Through this model, SIAT and its partner institutions (more than 30) have already developed 94 new medical devices with total sales above 1 billion yuan. It is important to emphasize that one particularly important achievement was made through the collaboration between the low cost medical equipment industry and the ICT industry. Together with the "marine terminal", SIAT initiated the development of a "health cloud platform" which links the "marine terminals" in rural villages to main urban hospitals making possible to share the health data nationwide. This project brings together in Shenzen 58 public hospitals that, with SIAT and Shenzhen Zhongke Huaqiang (the manufacturing firm), cooperatively built a local "health cloud platform" where around 10 billion records of diagnosing and treating information are included. With IT technology such as cloud storage and computing technologies gradually permeating in healthcare industry, Shenzhen high-tech enterprises in IT have congregated jointly with the healthcare industry in activities such as communications technologies, telemedicine, telemonitoring health care for patients with diabetes mellitus, hypertension and some other diseases.

Apart from the collaboration in the product development, the development of the "marine terminal" to rural areas also involved coordination and interaction subjects with different partners. First, it is worth noting that government plays an essential role during the whole process. As sustainability of this low-cost medical device requires large-scale use and high rate of coverage in rural areas local government was of fundamental importance as they bear the costs. Furthermore, Shenzhen Zhongke Huaqiang receives a direct government subsidy of 5000RMB per equipment to build the cloud computing platform. Also, central government promotes an international policy that enables cooperation with African countries which in fact allows for the exploration of external market. Only with increasing coverage rate and expanding market will it be economic sustainable to encourage enterprise take part in. Financial organizations like leasing enterprises also join the promotion.

But, perhaps, the most interesting feature of this case is the participation of public hospitals in the innovation process. In fact, hospitals are connected with the “marine terminals” by the “health cloud platform”. Hospitals cooperate with medical enterprises and institutions, provide the records of diagnosing and treat information to facilitate the establishment of “health cloud platforms” and knowledge sharing. Information about physical examination was delivered to medical staff in hospital through the “health cloud platform” and with this information physicians can interact with local staff in rural areas. It is similar in Xiniang province’s low-cost healthcare project.

The paper on China point out, however, that there are several unresolved challenges for the long run feasibility of low cost medical equipment in China. Industrialization is still confronted with lack of finance and sufficient human resources, the industrial chain is still to be built completely and most enterprises need investment. In Shenzhen’s case the Government’s share in total investment is around 90%.

Nevertheless the Chinese case study shows that the establishment of an inclusive innovation system in low-cost medical equipment is possible and that the government has an important role to play particularly for coordinating different sets of institutions and organizations. Such organizations including research institutions, government, enterprises with different specializations and hospitals interact and collaborate with one another and benefit from their specific type of knowledge base.

The role of government and policy is however, much broader, including procurement (acting as consumer of inclusive innovation), partnerships with enterprises and hospitals (providing funds for enterprises to build cloud computing, for example), building complementary facilities for product promotion and using international policy as impetus to explore the external market.

The Uruguayan case study analyzed the social inclusive effect of particular innovation processes in the field of human health care. It addressed the innovative experience of a public hospital named Hospital de Tacuarembó (HT), located in the Northern region of Uruguay, one of the poorest of the country. The case study focused on two sub-cases involving the development of medical equipments. The first, called neuronavigator is a medical device that improves neurosurgical procedures in quality and safety. The second, a milk pasteurizer was specifically developed to meet the needs of the milk bank at the public hospital, allowing the implementation of a newborn healthcare program providing donated milk to babies who cannot be breastfeed.

A comprehensive analysis of several factors - mainly organizational rather than technological - shows how the HT has gradually become a provider of increasingly varied and sophisticated health services. The organizational dynamic of the HT is considered the driving force behind the innovative experiences, operating as a leader in the local health innovation system. This organizational dynamic has been marked by a "receptive attitude" to the incorporation of new health care services, many of which demand new technologies and/or creative process for the development of known

technologies in a cheaper and more suitable way for the context. Additionally, both the neuronavigator and the milk pasteurizer innovations derived from existing local needs, which were picked up as technological demands by the organizational dynamics of the HT.

The development of the two medical devices benefited from the HT's motto of complementarity, which is observed in the interrelationship among the three levels of care and regarding other hospitals, both public and private at the regional and national levels. Further, HT has several international cooperation agreements and linkages with other public and private institutions. Besides different forms of collaboration at national and international levels, the HT is also deeply inserted into the local community. There is a network of formal and informal ties around the Hospital which contributes to its effectiveness in meeting the local health needs.

But if the local context favors the innovative and inclusive dynamic of a public hospital in a poor region of Uruguay, the linkages with the broader set of public policies seems to lack further improvement as will be seen.

During the last five years, health care sector in Uruguay has been substantially transformed. The process is oriented to the rational organization of the activities performed by the public and private health subsectors under the general orientation of solidarity funding, integral health assistance and public-private articulations. In this process, technology has received renewed attention especially regarding the regulation and control of medical equipment incorporation, mostly large equipments and highly specialized methods. The rationale of this policy is to organize investments according to the epidemiological map of Uruguay.

In this regard, technology health policy is oriented to improve the allocative efficiency and to promote equity, but it is not intended to be a pro-innovation policy itself. It fosters the installation of large medical equipment in a rational manner, according to available resources, population health needs, and territorial distribution. But, the importance of technological related issues in the whole system is comparatively insignificant, accounting for less than 1% of the overall health expenditure. Important mentioning that Uruguay is strongly dependent of imported industrial health products meaning not only high internal costs, but the supply of goods - equipments included – every so often inappropriate for the local context.

In 2005, an institutional reform oriented to the establishment of a National Science Technology and Innovation System took place. Subsequently, in 2010 the first National Strategic Plan for STI was announced. This plan explicit the need for equity and social inclusion trough STI, and health related issues are particularly highlighted as key points to be prioritized by policies. However, the effective coordination at the institutional level between the national health innovation system and institutions of the STI system is not adequately resolved.

This mismatch is evidenced in the innovation experiences in the HT. If on the one hand, agents with innovative capabilities were able to conduct successful innovation

processes with positive impacts to the local health system, on the other, these capabilities may remain hidden or inactive.

As the study shows, the innovation processes were triggered as the result of several informal relationships or bottom up entrepreneurial behavior. In both cases, personal ties prompted the generation of knowledge, providing practical solutions for local needs despite the lack of public policies that support technological initiatives. Also, there are not policy tools that promote the use and development of these capabilities. Therefore, both innovation results (neuronavigator and milk pasteurizer) have remained encapsulated. Their use stays restricted to HT, in spite of the potential they may represent to an inclusive health innovation system.

Perhaps, the main failure in the general policy design is the absence of a broader and systemic view of the national system of innovation. The mismatch between the health policy and the STI policy, as well as the lack of articulation with other relevant development policies (industrial, financing, etc) may represent a strong obstacle to take full advantage of the introduction of innovations in the public health care system.

Last but not least, the study indicates that STI policy in Uruguay is still a centralized policy, with a bias towards R&D and academic research. This makes it difficult to connect local problems that can benefit from technological solutions, with national capabilities to create viable solutions. Therefore, recognizing the relevance of local communities and agents for the identification of health problems and their technical solutions, the Uruguayan case remarks the need to bring STI policies to the territory.

4. Concluding Remarks

In the last years, the sharp social effects of globalization and technological change brought the problem of inequality back to the political agenda. Nevertheless, the deep social consequences of the current transition period seems to demand - perhaps in a more radical way than in the past - profound institutional changes and conscious inclusive development policies. New ways of thinking need to be created together with new policy frameworks in order to reverse the world present trends towards social and environmental deterioration.

The RISSI Project aimed at moving ahead on the building of new analytical and normative frames capable to lead research and innovation to cope with social priorities. With this goal, the LIPS framework was adopted. Health area was selected for empirical work as it represents simultaneously a central concern to social inclusion and a major driver of economic growth.

Regarding the case studies, a preliminary analysis of its results identified varied spaces of social exclusion in the local territories stressing the need for innovative and inclusive development strategies that take into account the characteristics and requirements of each specific territory. They also highlight the need of increasing the visibility and support - by public policies - of inclusive health innovations already in place. Moreover, they raised interesting elements for discussion on how to make health innovation serves the purpose of social inclusion.

As social inclusion is a broad and complex issue, it is clear that the case studies have not shed light in all aspects on how social inclusion can be enhanced at the local level through improved health innovation systems. Keeping this in mind, we will underline some preliminary findings that emerged from the empirical work.

The first is that emphasis must be put on innovation policies of a broader and systemic character. The studies evidence the need of addressing social inclusion in the broader scope of innovation and development policies, from a systemic approach. For this goal, a proper understanding of the context and roles of different actors in the LIPS is essential. The key actors obviously vary according to the specific territory, but it is highlighted that analysis should go beyond R&D and S&T organizations, including other institutions that affect the local system and shape competence building at local level.

The Uruguayan case study shows that innovation processes in Tacuarembó Hospital resulted from an organizational process led by strong management leadership, based on continuous improvement, highly receptive to the external opportunities, oriented to incorporate new services and massively supported by the local community. Nevertheless, despite the innovation processes have succeeded in terms of offering suitable and low cost solutions to some local health care problems, the results remained encapsulated in the territory.

The mismatch between the health policy and the STI policy, as well as the lack of articulation with other relevant development policies (industrial, financing, etc) was appointed as key obstacle for allowing the dissemination of the inclusive innovations in the public health system, as well as for fostering national capabilities in the production of health equipments. Thus, the lack of a systemic approach has restricted both economic and social potential results of innovation efforts.

The China case study is an example of how a systemic approach to policy can generate a more virtuous dynamic innovation system geared towards inclusiveness. The government played an important coordinating role and provided several policy mechanisms including procurement to help making viable the evolution of the system. Different types of knowledge in the health and in other fundamental areas such as IT were mobilized and different organizations, particularly hospitals interacted to develop products appropriate to the needs of local rural people.

Second, the interaction between welfare systems and innovation systems in developing countries can generate extremely positive synergies in terms of growth, efficiency and equity, thus constituting a significant link in a proactive strategy for inclusive development. But, as the case study in China has shown, the State must play a core role in this strategy. Yet, advancing in the constitution of interaction between innovation systems and systems that meet social priorities is still a challenge in most developing countries as they face different kinds of institutional and political blockages as noted, amongst other, in the case of Kerala Ayurveda and Amapá Phytotherapy. This interaction shall be fruit of both institutional construction and long term structural reforms, which result from political decisions and articulations between State, market and society.

Third, there is a need of a more holistic approach by national health innovation systems in developing countries. The World Health Organization recognizes that 80% of the population in developing countries uses traditional practices in their basic health care. As shown by the case studies in Brazil, South Africa and India, the use of medicines based on plants, animals and minerals, as well as treatments rooted in traditional therapies are segments of health care systems adopted in the promotion, prevention, diagnosis and treatment of diseases, leading to systems that blends modern and traditional health care practices.

If adequately supported, improved and regulated, these alternative health care systems could not only enlarge access to quality health services, but also foster the strengthening of knowledge and innovation in developing countries. Nevertheless, development planning and health policies worldwide – which among others guide national health regulations - are usually based on very negative assumptions about indigenous knowledge. Since the 1990s some changes can be noticed trough a shy but progressive recognition on the need to develop innovations based on the traditional medicine. The World Health Organization for instance has been encouraging the strengthening of policies to develop, support and promote traditional medicine in accordance with national priorities, together with the promotion of standard setting to ensure its quality, safety and efficacy. Improvements in this direction can be noticed in the cases of Brazil and India[6].

However, the vested interests eager to circumvent the potential of health indigenous systems are not easy to overcome. The modern pharmaceutical and medical industries inhibits the increased use of traditional knowledge in health as well as the adoption of more holistic approaches by national health systems as shown by the case study of India. Their influence on international/national markets and on regulation of health provisions is often noted, restricting the improvement and expansion of traditional medicine, besides hindering the effective integration between traditional and 'modern' national health care systems.

Then, fourth, blend traditional knowledge with new technologies is absolutely essential for successful health inclusive innovation systems, as innovation is not only a social and localized process, but also a cultural process, as pointed out by Furtado (1986).

The systemic perception of innovation emphasizes the importance of interactions between the different actors, locally and globally and of various types of knowledge including modern and traditional, formal and informal, etc. The significant advancement in medical western technologies although important does not per se

[6] In India, the National Health Policy (2002) remarked that alternative systems of medicine at national level have a substantial untapped potential. The policy highlighted the need to integrate alternative systems of medicine with the allopathic services, and to strengthen the Indian systems of medicine and homeopathy in the public health service system. In Brazil, the federal government approved the National Policy on Medicinal Plants and Herbal Medicines (2006) to be 'an essential part of public policies in health, environment, economic and social development as a key element for mainstreaming the implementation of actions capable of promoting improvements in population quality of life'.

leads to a virtuous process of health development. Solutions based on advanced medical technologies are normally imposed by outside experts and fails as they do not take into consideration the local social, cultural and political institutions. They constitute a reductionist and linear approach in health innovation that are unsuccessful as they ignore the accumulated local traditional knowledge.

The case studies of South Africa, India and Brazil suggest that the sustainability and efficiency in the local health innovation system depends on capabilities of actors, individuals and institutions, and contextualization. Successful system reaction occurs when there is interaction between external methods, devices, technology and people with local knowledge tradition, culture and thinking, as customary laws in indigenous health remain an important characteristic of local systems.

In the case of the two South Africa´s rural municipalities of Mbizana and Ingquza Hill both formal and informal institutions worked together to address high incidence of HIV/AIDs. In these communities, high levels of unemployment, low income and high levels of illiteracy are combined with deteriorating medical infrastructure and a strong presence of traditional customs. In such an environment traditional healers, birth attendants and surgeons, herbalists, divine and faith healers and informal community arrangements work both as gatekeepers of innovation and as a necessary access point of any external knowledge that intends to be introduced in the local society.

The South Africa paper presented several examples of knowledge sharing and learning processes involving both external and local actors, such as knowledge sharing between traditional birth attendants and nurses, knowledge sharing between traditional healers, NGOs, hospitals and government institutions for HIV/AIDS information and prevention, knowledge sharing between traditional healers, the homeopathic community and the university and the Forums of Traditional Healers.

Fifth, public health logic (oriented to collectivity well being) should prevail over business models directed by private agents (profit oriented) in health innovation systems. As shown in the cases of India and Brazil every so often conflicting paths of LIPS development are rooted in priority goals based on exclusive economic interests that lead to poor social achievements. The enhanced competitiveness of the productive and innovative basis in health not necessarily fits with health requirements in terms of socio-sanitary priorities and needs. For instance, from a socio-sanitary perspective, the LIPS in Amapá should privilege the widespread use of phytotherapy in public health system, *vis a vis* the production of a few herbal products in industrial scale focused on national market. The same is true for Kerala's Ayurveda LIPS development, which is moving away from its tradition as a source of inclusive health system to focus on rejuvenerative and cosmetic products greatly associated to health tourism and export-market oriented strategies.

The influence of private interests on public policies ends up leading to LIPSs misleading development policies which decouple economic and social dimensions, restricting the possibilities of adequately addressing the main questions of development in the territory. The configuration of a productive and innovative pattern which escapes such misconception must, necessarily, be integrated in the broader scope of inclusive

development trajectories, blending innovative efforts with social concerns and interrelated development issues.

Finally, the preliminary analysis of the case studies findings suggest also that (i) preventive health wellness should not be scorned by the hegemonic perspective of curative medicine in respect to innovation policies and priorities; (ii) Imports of goods and services in health besides costly brings with it a technological pattern often incompatible with local specificities and needs[7]: there is a need of increasing innovative efforts focused on low cost medical devices and associated technologies suitable to local health care problems; (iii) STI policies aiming health inclusion should improve its links to the territorial dimension if growing effectiveness is to be reached; (iv) problems affecting social inclusion – health care issues included - needs to be increasingly incorporated in academic research agendas: pick up local needs is a key demand source for technological development; v) improving the visibility of local inclusive innovation processes may help to move towards policies which drive development in a more sustainable way.

Inclusive innovation outcomes for health should necessarily be strongly linked to local specificities, culture and traditions. A broader approach to innovation beyond formal organizations, including institutional and social innovations is necessary. Also, innovation policy proposals and action should take into account and respect the existing local ethos of the targeted communities, their norms and accumulated historical knowledge and values.

But at the end the whole approach to inclusive innovation systems in health should be based on a political vision in order to seek for effective ways to translate into, and interact with, the needs and interests of the poorest and marginalized actors into helpful innovation that really addresses their problems.

[7] According to Madhavan (2013), 40% of imported health equipments are not working properly in the developing countries

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