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Technology foresight in traditional Bolivian sectors: Innovation traps and temporal unfit between ecosystems and institutions

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ABSTRACT

Combating poverty is a priority for developing countries. The program "Technology Foresight Initiative in Latina America" initiated by UNIDO (United Nations Industrial Development Organization) is in line with this context. This paper examines two Technological Foresight for traditional Bolivian activities: the "textiles from camelid fibers" sector and the "medicinal plants" sector. The study model takes into account two dimensions: the socio-technical regime and the formal institutions. Findings highlights the difficulty to implement a virtuous circle of innovation because of innovation traps (1) that can be seen as a consequence of the socio-technical regime, and because of some misfit between formal institutions (2) and what is required by the value chain. These results emphasize the learning curve of the TF for countries such as Bolivia.

As part of the special issue it seemed interesting to highlight a country whose realities are often little-known, the Bolivia. In the context of South America Bolivia is still a country which development level indexes are lower than those neighbors (cf. main characteristics of Bolivia in Annex 1). Indeed since a certain number of years this country is engaged in substantial reform in order to improve the life conditions of its inhabitants and some sectorial studies have been made as part of the program "Technology Foresight Initiative in Latina America" initiated by UNIDO (United Nations Industrial Development Organization). Our article is based on two of them. One concerns the "medicinal plants" and the second the "textiles from camelid fibers".

Despite their apparent disparities these two projects concern two traditional productions which have common points. They are mainly from the Altiplano Region characterized by difficult natural conditions – high altitude, irregular rainfalls - and poorly suited to agriculture and breeding. This region is also subject of an eradication plan of the extreme poverty implemented by the public authority of Bolivia. Remember that this extreme poverty in rural areas reached the figure of 62.9% in 2005 it moved down to reach 38.8% in 2013 (source: UNIDO in Bolivia). The both projects initiated by UNIDO – "*The future of Andean Medicinal Plants*", "*The future of the textile industry*" – are part of this strategy which first target is "to establish a vision of the future and the route to the production and marketing of product" (site web UNIDO – The future of Andean Products).

Since the seminal works of Sen (1983, 1985) there is in management an emergent whole field of research on the issue of reduction of poverty (Ansari et al., 2012) and on the more transversal topic on inclusive growth (Roxas and Ungson, 2011). The actions initiated by UNIDO in Bolivia are consistent with this issue and are a perfect illustrative example of the need but also of the complexity of the change management. The percentages of extreme poverty are significantly higher in Bolivia than those of Latina America.

In light of the specificities of this country we will take as first focal point of analysis the concept of "Innovation trap" initiated by Levitt et al. (Levitt and March, 1988) but by giving it a different meaning. Indeed we won't pay particular attention to the "myopia of learning" (Levinthal and March, 1993). We will highlight the existence of limiting factors which, interrelate between them, make virtually impossible any process of innovation. Such configurations constitute what we call "Innovation traps". These factors are very different in nature and concern for instance the low density of the social network, the lack or the low level of training of the actors, the lack of infrastructure (roads, telecommunications …), the endemic problems of malnutrition and poor health of the herds, user's linkages, etc.

A certain numbers of these limiting factors couldn't be resolved without the institutional environment's influence. Current approach considers that the institutions frame the interactions between people. They consist of informal dimensions (norms of behavior, conventions …) and formal dimensions (law, regulatory control, government agencies …) that pattern and regulate the human action in their social, political and economic aspects (North, 1990). This raises the question of the actions that are steered within this institutional context, as well as their

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temporalities and their spatial coherence. Because to be efficient these institutional actions have to be in phase with the actors' activities on the ground (Folke et al., 2007). Our research will underline that for Bolivia, in view of its characteristics, it's difficult to match these dimensions. When this two actions plans aren't in phase we will speak of unfit between a socio-technical regime and its institutions (Folke et al., 2007).

We try to highlight in this article that the complementary actions of the Bolivian state and of the actors involved in the socio-technical regime are required, but their time and space synchronization are complex because in the Bolivia context, a lot needs to be built.

In the next section, we present the political context and stakes of the two TF Projects. In Section 2 we detail difficulties and challenges from a conceptual point of view and we propose a study model. Section 3 summarizes our main finding on the innovation traps and the institutional misfits for the both projects studied. We discuss the implications of these findings in Section 4, before concluding on some avenues for further researches.

1. TFs "medicinal plants" and "textiles – camelids": political context and stakes

1.1. Elements on the Bolivian political context

Bolivia has shown a solid macroeconomic performance in recent years. Through solid economic policies and strong reserves cushion that reduced macroeconomic vulnerability, the country has registered in 2014 a growth of its GDP of 5.4%[1] ranking as the first growing country in the region. Simultaneously – after the election of president Morales in 2006, 2010 and 2014 – the government initiated a period of deep transformations of social policies as well as started a leading role of the state in economic affairs. Regarding this, it is important to emphasize the reduction of extreme poverty (from about 38% in 2005 to 18% in 2013[2]) and school desertion (from about 8.5% in 2006 to 4.4% in 2014[3]) on average (city and rural areas) in the whole country.

Bolivia has held since 2006 an important political and socio-economic reform that included a profound change in the Constitution, strengthening the role of the state in the economy and the implementation of various social programs. The new constitution (2009) is demanding various changes in the country's legal framework in various areas such as economy, education, production, management of natural resources and international relations among the most significant.

1.2. Knowledge and innovation: main stakes for traditional sectors

The favorable context of sustained economic growth it is an opportunity to promote scientific and technological development and the creation of human talent, both necessary to boost the country's development and generate changes in its productive matrix to improve the quality of employment and human welfare in the country. The National Development Plan establishes within its main policies the recovery, protection and use of local knowledge and ancestral know-how. Under this mandate Science, Technology and Innovation (STI) policies are focused on the sustainable use of natural resources.

In this sense, Bolivian Government in agreement other regional governments, has prioritized areas like medicinal plants and textiles from camelid fibers since its importance related to national policies mentioned above. Working on TF studies on this sectors were considered pertinent since they have not only a high potential in international markets but they include a wide range of local actors including local communities which historically have not been included in the development agenda and emergent local private companies with competitive advantages in both sectors (e.g. textile companies, designers and pharmaceutical industry).

Participate and foster technology foresight exercises initiated by United Nations Industrial Development Organization (UNIDO) in these two traditional sectors (cf. Annex 2 and 3) provide an invaluable opportunity to establish local and regional networks between actors with different market perspectives. For example a llama breeder who lives in a rural community without access to infrastructure or basic services does not have the same market expectations that a businessman or a fashion designer focused on European markets and trends. However both of them participate within the same sector.

Theoretically TF should be used to have a vision of science, technology and its possible applications for development, as a tool for planning in public and private organizations. However due early capabilities in most Latin-American countries the use of this instrument is still a challenge. Applying a TF study by using tools on anticipatory periods of 5–8 years and involving numerous stakeholders and experts could be hard to apply, especially in countries with limited institutional framework (public and private) and weak governance structures.

The camelids/textiles and the medicinal plants are traditional sectors in Bolivia and in the Andean Region. We expose their main characteristics with a short presentation of their global value chain (GVC) that shape the main relationships between actors (Gereffi et al., 2005).

Based on presentation of Tran et al. (2013) we can illustrate the camelids sector in three different groups of actors (cf. Fig. 1).

The first one is made up of farmers dedicated to breeding and fiber production with very limited resources. This is the most vulnerable group where there is a lack of technological assistance, especially focused on genetic improvement and fiber quality. This lack of capacities responds also a strategy of economic diversification or pluriactivity that forces rural communities to change of economic activity as a poverty resilience strategy. In this point it is important to mention the role of rural intermediaries that can hold up to 80% of revenues within the fiber commercialization.

The second group is comprised by industrialization of fibers composed by few existing medium and large enterprises which use more sophisticated machinery and equipment for carding, combing standardization and dying to produce mainly tops, knitting and clothing. These enterprises develop little research, with limited capacity for technological innovation for textile and clothing industry and little added value on the products; therefore most are exported as fiber or yarn.

The third group is about commercialization actors mainly performed by international agents or local companies with weak management systems that have limited access to position textile camelids in international markets. The sector only covers less than 1% of international fiber market and has not achieved to create an "Andean brand". This is because there are weak communication channels between GVC actors.

Universities run research programs mainly focused on primary production, but without a significant impact on rural communities' capacities. Additionally NGO's and International Cooperation Agencies are still financing programs on the sector but the challenge still remains to make them sustainable.

Regarding the productive chain of medicinal plants in the Andean region (cf. Fig. 2) it can be noticed that the sector is based on informal collectors. This is probably the main reason for the absence of production data.

These difficulties prevent an idea of the overall market situation in countries like Bolivia, Peru and Ecuador that limit the analysis and must be reduced to isolated data about certain products.

The abundant biodiversity posed by Andean countries provides enormous medicinal resources (see Table 1).

The market of medicinal plants can be divided in two. Local markets in Andean countries where plants are commonly used (80% in Bolivia and 50% in Peru) and international markets connected with natural products such as perfumes and cosmetics.

[1] Ministry of Economy and Public Finances – Bolivia.
[2] Economic Commission for Latin America and the Caribbean – United Nations.
[3] Ministry of Education – Bolivia.