

Developing Inclusive Innovation Processes and Co-Evolutionary University-Society Approaches in Bolivia

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**Developing Inclusive Innovation Processes
and Co-Evolutionary University-Society Approaches
in Bolivia**

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Doctoral Dissertation in
Technoscience Studies



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Este trabajo está dedicado con mucho cariño a la memoria de mis abuelitas y a la sonrisa de mi mamá, papá y hermanos.

Abstract

This study is part of a worldwide debate on inclusive innovation systems in developing countries and particularly on the co-evolutionary processes taking place, seen from the perspective of a public university. The increasing literature that discusses how innovation systems and development can foster more inclusive and sustainable societies has inspired this thesis work. Thus, the main problem handled in the research concerns the question how socially sensitive research practices and policies at a public university in Bolivia can be stimulated within emerging innovation system dynamics. In that vein, empirical knowledge is developed at the Universidad Mayor de San Simón (UMSS), Cochabamba as a contribution to experience-based learning in the field. Analysis are nourished by a dialogue with the work of prominent Latin American scholars and practitioners around the idea of a *developmental university* and the democratization of knowledge. The reader will be able to recognize a recursive transit between theory and practice, where a number of relevant concepts are contextualized and connected in order to enable keys of critical interpretation and paths of practices amplification for social inclusion purposes established. The study shows how, based on a previous experience, new competences and capacities for the Technology Transfer Unit (UTT) at UMSS were produced, in this case transforming itself into a University Innovation Centre. Main lessons gained in that experience came from two pilot cluster development (food and leather sectors) and a multidisciplinary researchers network (UMSS Innovation Team) where insights found can improve future collaborative relations between university and society for inclusive innovation processes within the Bolivian context.

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List of Abbreviations

AGRUCO	Agroecología Universidad Cochabamba (Agro-Ecology University Cochabamba)
APL	Asociación de Productores de Leche del Valle de Cochabamba (Association of Milk Producers of the Cochabamba Valley)
BCB	Banco Central de Bolivia (Central Bank of Bolivia)
BIOQ	Instituto de Investigaciones Bioquímicas (Institute of Biochemists Research)
BOB	Bolivian Boliviano
BTH	Blekinge Institute of Technology
CADEPIA	Cámara Departamental de la Pequeña Industria y Artesanía Productiva Cochabamba (Chamber of Small Industry and Productive Manufacturing of Cochabamba)
CAPN	Centro de Alimentos y Productos Naturales (Centre for Food and Natural Products)
CASA	Centro de Aguas y Saneamiento Ambiental) Centre for Water and Environmental Sanitation
CBT	Centro de Biotecnología (Centre for Biotechnology)
CDC	Consejo Departamental de Competitividad (Departmental Committees for Competitiveness)
CEUB	Comité Ejecutivo de la Universidad Boliviana (Executive Committee of the Bolivian University)
CIDI	Centro de Investigación y Desarrollo Industrial (Centre for Industrial Research and Development)
CIP	Centro de Innovación Productiva (Centre of Productive Innovation)
CI	Cluster Initiatives
CPE	Constitución Política del Estado (Political State Constitution)
CTA	Centro de Tecnología Agroindustrial (Centre for Agro-industrial Technology)
CyTED	Programa Iberoamericano de Ciencias y Tecnología para el Desarrollo (Ibero-American Program for Development of Science, Technology)
DICyT	Dirección de Investigación Científica y Tecnológica (Directorate of Scientific and Technological Research)
DTA	Departamento de Tecnología Agroindustrial (Department of Agro-Industrial Technology)
Eco-Fair	Asociación Eco-Feria Cochabamba (Association for Ecological Fairs Cochabamba)

EMBATE	Incubadora Empresas de Base Tecnológica (Technology-based Enterprise Incubator)
ELEKTRO	Centro de Investigación en Electrica y Electrónica (Centre for Electric and Electronic Research)
FCyT	Facultad de Ciencias y Tecnología (Faculty of Science and Technology)
FDTA	Fundaciones para el Desarrollo Tecnológico Agropecuario (Foundations for Agricultural Technology Development)
GDP	Gross Domestic Product
GMP	Good Manufacturing Practices
ICT	Information and Communication Technology
IDH	Impuesto Directo a los Hidrocarburos (Direct Hydrocarbon Taxes)
IESE	Instituto de Estudios Sociales y Económicos (Institute of Social and Economic Research)
INE	Instituto Nacional de Estadística (National Institute of Statistics)
INIAF	Instituto Nacional de Innovación Agropecuaria y Forestal (National Institute of Agricultural and Forestry Innovation)
IPRs	Intellectual Property Rights
MDPy EP	Ministerio de Desarrollo Productivo y Economía Plural (Ministry of Production Development and Plural Economy)
MDRyT	Ministerio de Desarrollo Rural y Terras (Ministry of Rural Development and Lands)
MSc	Master of Science
MSMEs	Micro, Small and Medium sized Enterprises
NGOs	Non-governmental Organizations
NIS	National Innovation System
PAR	Participatory Action Research
PDTF	Programa de Desarrollo de Tecnologías de Fabricación (Program of Manufacturing Technology Development)
Perii	Programa de Fortalecimiento del Acceso a la Información para la Investigación (Program of Strengthening Information Access for Research)
PhD	Doctor of Philosophy
PNCTI	Plan Nacional de Ciencia, Tecnología e Innovación (National Plan for Science, Technology and Innovation)
PND	Plan Nacional de Desarrollo (National Plan for Development)
POA	Plan Operativo Anual (Annual Operative Plan)

ProBolivia	Promueve Bolivia (Promoting Bolivia)
QUIMICA	Departamento de Química (Department of Chemistry)
R&D	Research and Development
RIS	Regional Innovation System
RQ	Research Questions
S&T	Science and Technology
SBI	Sistema Boliviano de Innovación (Bolivian Innovation System)
SBPC	Sistema Boliviano de Productividad y Competitividad (Bolivian System of Productivity and Competitiveness)
SEDEM	Servicio de Desarrollo de las Empresas Públicas Productivas (Development Service for Public-Productive Enterprises)
SENASAG	Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria (National Service of Agricultural Sanitation and Food Safety)
SICD	Sustainability Innovations in Cooperation for Development
Sida	Swedish International Development Cooperation Agency
SIBTA	Sistema Boliviano de Tecnología Agropecuaria (Bolivian Agricultural Technology System)
SITAP	Sistema de Información Territorial de Apoyo a la Producción (System of Territorial Information for Production Support)
SMEs	Small and Medium sized Enterprises
SO	Specific Objectives
ST&I	Science, Technology and Innovation
SUB	Sistema Universitario Boliviano (Bolivian University System)
UDAPRO	Unidad de Análisis Productivo (Productive Analysis Unit)
UIS	UNESCO Institute of Statistics
UMSA	Universidad Mayor de San Andrés
UMSS	Universidad Mayor de San Simón
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
USD	United States Dollars
UTT	Unidad de Transferencia Tecnológica (Technology Transfer Unit)
VCyT	Viceministerio de Ciencia y Tecnología (Vice-Ministry of Science and Technology)
YPFB	Yasimientos Petrolíferos Fiscales Bolivianos (Bolivian Enterprise of Oil Prosecutors Deposits)

PART I

Chapter 1

INTRODUCTION

It is evident that in a colonial situation, the 'not said' is what means the most; words cover-up more than what they reveal, and the symbolic language takes scene.
(Silvia Rivera Cusicanqui, 2010)

This study is part of a worldwide debate on inclusive innovation systems in developing countries. It is inspired by a concrete experience that dialogues with the increasing volume of literature discussing how university participation in innovation systems can foster more inclusive societies. In a Latin American context (Bolivia), the study analyses co-evolutionary processes within innovation systems, with a focus on the generation of university capacities and competences aimed at enhancing collaborative and trust-based relations within society.

The empirical knowledge in this thesis is taken from the Technology Transfer Unit of the Universidad Mayor de San Simón, where I held the role of cluster facilitator, among other positions, for the duration of the process. Consequently, no neutrality is claimed; rather, fidelity with the collective efforts of actors contributing to experience-based learning in the field. The main problem addressed by this research concerns the question as to how knowledge relations and socially sensitive research practices at a public university in Bolivia can be stimulated within emerging innovation system dynamics.

The subchapters below give the necessary context by which to identify this problem and frame the research question.

1.1 Experience background at Universidad Mayor de San Simón

The experiences discussed in this research took place at Universidad Mayor de San Simón (UMSS). Created in 1832, UMSS is one of Bolivia's eleven public universities

and a member of the Bolivian University System (SUB) coordinated by the Executive Committee of the Bolivian University (CEUB). UMSS is the second-largest public university in Bolivia, with approximately 75,000 students and 2,500 teachers in 2015. Autonomy and co-government are core values present in all public universities.

Research is one of the three main functions at UMSS, along with education (undergraduate and postgraduate) and social interaction or service to society (the so-called ‘third mission’). Since the 1980s, there have been increasing efforts to develop scientific research capacities at UMSS, mainly via support for international cooperation. To date, this aim has been achieved in certain scientific fields, with a number of significant developments taking place in recent decades. Nevertheless, strategies are still required to potentiate the impact and visibility of these research efforts in order to meet the claims for research with a greater social relevance. Historically, this shared concern has been a challenge to universities around the world, and it remains a driving force behind the vast and evolving literature providing different perspectives, applications and contexts to this ongoing, protean debate.

During the first decade of the twenty-first century, discussions at UMSS linked the development of an adequate university environment with the capacity to adapt the two main drivers of research. On one hand, the polyphonic demand for more university research activities linked to ‘real-life’ impacts in the region and the country. On the other, the more traditional academic goal – both internationally and within the university – of meeting the rigorous standards of global scientific research, leading to greater recognition and prestige in the worldwide academic arena. Both of these are legitimate, important aspirations, which are not necessarily conflictual. In order to be satisfied, both require best practices in knowledge production, as well as the effective articulation of sophisticated skills and resources.

The Technology Transfer Unit (UTT) was created at UMSS in 2004 to provide operative support to university directorates and research centres in fostering knowledge relations within society. The unit was physically located in the Faculty of Science and Technology (FCyT). While most research centres are concentrated in this faculty, the intention was that the UTT would incorporate multidisciplinary research teams from across the university. Experiences between 2004-2007 shaped the practices that are the topic of the present thesis. During that period, the UTT’s approach was influenced by linear university-society interaction models (either offer-pushed or demand-pulled). It soon became apparent, however, that these linear models were poorly suited to bringing about practical improvements to university-society interactions in the Bolivian context.

By 2007, UTT’s strategies focusing on the offer of research results found almost no local entrepreneurs recognizing the transferable potential, to the extent that they were driven to invest. On the demand side, entrepreneurs usually had no clear (pre-identified) requests for scientific knowledge production – a deficiency linked to the lack of research capacities developed by local industries. While large Bolivian industries generally own quality control laboratories, research activities are often performed by

their centralized agencies located in other countries. During this period, small and medium sized enterprises (SMEs) also lacked the research capacities and other resources to undertake a more visible collaboration with the university. SMEs represent the 99% of the manufacturing force in the Cochabamba region (SITAP-UDAPRO, 2015). Results from these linear interaction approaches were thus generally unsatisfactory. However, the experience revealed important insights that laid the groundwork for a more contextualized approach and an improved understanding of the role of the UTT within UMSS.

Thereafter, the proposals offered by UTT were more substantial in nature. An innovation system approach was adopted, the so-called “UMSS Innovation Program”, with the potential to generate richer university-society collaborations that were suited to the Bolivian context. At the end of 2007, the new program was approved for inclusion in a bilateral university program funded by the Swedish International Development Cooperation Agency (Sida). During the implementation phase, the UMSS Innovation Program received technical support from Sustainability Innovations in Cooperation for Development (SICD) – a network organization with experience of fostering innovation systems and cluster development in several African countries. This partnership enriched the internal university debates and supported the implementation process for bottom-up innovation system initiatives.

The UMSS Innovation Program consists of two main components: 1) actions within the university aimed at fostering an innovation culture in the academic community; and 2) actions involving to the university external actors aimed at generating interaction platforms. Two pilot clusters have already been developed as part of a strategy to facilitate university-government-industry collaborations. The specific goals of the UMSS Innovation Program are continually updated. However, the following has been clearly established (UTT, 2015):

- Academics and practitioners are highly educated (in the context of the project) in the innovation field at UTT;
- The UTT operates as a University Innovation Centre;
- The academic community (professors, researchers and students) at UMSS is mobilized, motivated and participates in activities related to regional and national innovation systems (NIS). The UMSS Innovation Team is an academic core network practicing (and introducing) an innovative mindset within UMSS;
- The two pilot clusters (for the food and leather sectors) have demonstrated a qualitative development. New clusters initiatives are identified based on the experience and capacity gained at UTT as an Innovation Centre.

The last three goals, which evolved interdependently, are of particular interest to this study. Notably, cluster development and the mobilization of the academic community around systemic innovation dynamics are the richest achievements to date. The implementation of the UMSS Innovation Program led to UTT’s original activities being updated, with a focus on the facilitation of emerging innovation systems and the de-

velopment of management competences. Cluster development was initially conceived as a series of co-evolutionary, triple-helix (university-government-industry) processes featuring transdisciplinary dynamic interactions. In her capacity as a member of the SICD team, Trojer (2014) has highlighted that *relevance and context of application and implication* constitute essential elements within innovation and co-evolutionary processes.

My own experience of the UTT's innovation system efforts dates from 2006. I worked as the cluster facilitator of the Food Cluster Cochabamba from 2008-2012. Latterly, I have been involved as Mode 2 researcher. I was also involved as a consultant (2012-2013) for the Vice-Ministry of Science and Technology (VCyT) for a project aimed at building a country-wide network of food sector researchers as part of the emerging NIS. The results obtained and the experience gained in the above roles provide the basis for the analysis and reflections developed in the subsequent chapters of this work.

1.2 Present Bolivian Context

Innovation system dynamics are highly context dependent. I will begin, therefore, by giving a brief overview of some general features particular to Bolivia. Specifically, I will introduce some key aspects relating to recent social struggles and transformations in the country, as these are closely linked to historical claims for social inclusion.

Located in a western-central zone of South America, Bolivia extends from the Central Andes through part of the Gran Chaco, as far as the Amazon: an area of around 1 million km². It is a multi-ethnic and multi-cultural country, with an estimated population of 11 million in 2015. With high levels of biodiversity, the Bolivian landscape contains a great variety of terrains and climates. It is landlocked since 1904 as a result of the War of the Pacific. The country's territory is organized in nine departments spanning three main physiographic regions: a) the highlands or Andean region, located 3,000 meters above sea level. This region is known for its Andean mountain chain, Titicaca Lake, the 'Salar de Uyuni' salt-flats, and mining activities; b) the valley or sub-Andean region in the centre and south of the country: an intermediate region between the highlands and the plains (*llanos*) distinguished by its temperate climate, farming activities and hydrocarbon (natural gas) exploitation (the Cochabamba territory exhibits most of the characteristics of this region); c) the lowlands or plain region (*llanos*) in the northeast. These extensive areas of flat land and small plateaus linked to the Amazonas are covered by rain forests containing enormous biodiversity. The region features big agriculture, cattle rearing and hydrocarbon exploitation.

Policy reforms of the last decade in Bolivia have been marked by the severe socio-economic crises resulting from periods of, first, dictatorship (1964-1982), then neoliberal economic policy (1982-2005) (most Latin American countries underwent these twin phenomena – dictatorship and neoliberalism – almost simultaneously). Under dictatorship, Bolivia experienced an apparent economic boom due to international loans and good global prices for exports such as tin and oil. Nevertheless, this situation was followed by one of the largest foreign debt crisis in Bolivian history, along with hyper-

inflation and severe social repression. Panizza (2009) states that free market reforms were perceived as the best solution for the region under the circumstances, leading to reforms proposed by the Washington Consensus and the country's subsequent 'neoliberal period'. Katz (2001) describes how neoliberal economic policies in Latin America prioritized the opening up of domestic economies to foreign competition, leading to the deregulation of a vast array of markets and the privatization of public-sector firms. Initially, these measures helped to control the country's hyperinflation crisis. However, consecutive Bolivian governments consistently failed to construct anything resembling a social consensus over the direction of the economy (Grugel, Ruggirozzi, & Thirkell-White, 2008). The crisis of neoliberalism was thus manifested in a tendency to national disintegration, a loss of control by ruling elites, and an inability to crisis-manage due to a lack of economic resources. These measures led to dramatic increases in poverty, inequality and unemployment. Finally, in 2000, public dissatisfaction about exporting hydrocarbons via Chilean ports allied to other, deeper feelings of unrest triggered huge socio-political protests. As a result, the President was unseated and new elections called in late 2005, with a commitment to follow a socially-oriented revolutionary agenda.

Early measures adopted by the new government included the nationalization of natural resources, the establishment of ceilings and floors for interest rates, wage setting for the private sector (not limited to the minimum wage), and barriers to foreign trade, with low average import tariffs and fuel prices maintained at 'artificially' low levels (Morales, 2014). One of the core commitments of this reform program was to usher in a new nation-state constitution, approved in 2009, re-founding Bolivia as the 'Plurinational State of Bolivia'. The new Bolivian constitution strengthened the mechanisms of participatory democracy, incorporated enhanced social rights, and aimed to establish a plurinational and intercultural state (Schilling-Vacaflo, 2011). One important early outcome of these processes was the sense that the national dignity had been recovered. Early wealth redistribution measures were accompanied by a moderate decrease in inequality, in terms of extreme poverty (Seery & Arandar, 2014). These measures took mainly the form of conditional cash transfer programs extending to different social strata through a series of bonus- and rent-related actions.

The new constitution recognizes the important roles that science, technology, and innovation play in development processes. It highlights the role of innovation as a process resulting from diverse institutional interaction within the country. Part I, chapter VI, section IV, article 103, paragraph III explicitly states that:

The state, universities, productive firms and services both public and private, nations and peoples of indigenous origin; native nations and agrarian groups, will develop and coordinate processes of research, innovation, dissemination, application, and transfer of science and technology to strengthen the productive base and promote the overall development of society, according to the law.

In recent years, a long-term National Development Agenda (*Agenda Patriótica Bolivia to 2025* (2013)) was drawn up following a national participatory process. It establishes 13 core national goals based around the idea of *Vivir Bien/Buen Vivir (Living well)* – a concept that attempts to represent and synthesize a number of indigenous aphorisms. The agenda's long-term goals aim to inspire strategic policies and orient resources for

development programs at the national, regional and local levels. The fourth stated goal is: “Sovereignty for Scientific and Technological Production with Identity”. The text highlights Bolivia’s need to develop innovation, as well as scientific and technological knowledge, in strategic production- and service-related areas. These developments should complement indigenous knowledge, linking the richness of local creativity and know-how with modern scientific methods. The visible role of science, technology and innovation as an important developmental strategy has enhanced earlier attempts to build a national system of science, technology and innovation, which have featured in national plans since 2007. The Vice-Ministry of Science and Technology (VCyT), operating under the Ministry of Education, is the government body leading the promotion of a Bolivian Innovation System. Efforts are also underway by the Ministry of Rural Development and Lands (MDRyT) and the Ministry of Production Development and Plural Economy (MDPyEP) to support a national system of innovation and competitiveness in prioritized production sectors. The overall impact of these policies still needs to be evaluated in light of the original claims and ambitions relating to social transformation. Recent publications from scholars such as Aguirre-Bastos, Aliaga, Garrón, Rubín (2016) and Aguirre-Bastos (2017) offer important assessments of the evolution of the Bolivian Innovation System, as well as valuable academic contributions to the process of inclusive development.

The table below shows the general economic indicators, taking three main years as points of reference: i) 2000: the first year of the new century and the starting point for major mobilizations in Bolivia; ii) 2006: the beginning of the constitutional process and the nationalization of strategic industries; and iii) 2015: the most recent year considered by the present study.

Table 1.1 General Indicators of Bolivia

	(2000)	(2006)	(2015)
GDP (current US\$)	8,4 Billion	11,5 Billion	33 Billion
GDP growth (annual %)	2,5	4,8	4,8
Exports of goods and services (% of GDP)	16,9	41,8	30,1
Imports of goods and services (% of GDP)	23,3	32,8	37,1
Industry value added (% of GDP)	29,8	35,1	32,6
Manufacturing value added (% of GDP)	15,3	14,4	13,2
Forest area (% of land area)	55,5	53,7	50,5
CO2 emissions (metric tons per capita)	1,3	1,6	1,9 (2014)
Research and Development expenditure (% of GDP)	0,29	0,16 (2009)	-
Researches in R&D (per million people)	71,9	145,7 (2009)	165,7 (2010)
GINI Index (World Bank estimate %)	63	56,9	45,8
Urban poverty gap at national poverty lines (%)	25,6	21,8	10,5 (2014)
Rural poverty gap at national poverty lines (%)	65,4	50,5	30,5 (2014)

Source: The World Bank database¹.

¹ The statistics is based on information available at The World Bank website (www.worldbank.org) retrieved at October 15th of 2017.

Table 1.1 illustrates a trend for general economic growth. This does not seem to be followed by a significant transformation of the production structure able to prevail critical levels of environmental damage, while supporting sustainable and inclusive measures. However, despite the increasing number of researchers in the country, R&D expenditure does not follow the general tendency to growth. Policies to strengthen local research capacities to contribute to the diversification of the production matrix and national development remain incipient.

Finally, the most recent human development report, Informe Nacional sobre Desarrollo Humano en Bolivia, 2015 presented by the United Nations Development Program (UNDP) states:

The changes in the composition of the socio-economic profiles of Bolivians and their territorial location (mostly in urban areas) are elements that force us to think about interventions according to their new identity. Despite these phenomena are structurally central to the future of Bolivia, those should not make us forget about the priorities that the country still has in terms of improvements for a still large excluded sector, as well as in issues related to poverty in rural areas and marginalization of various human groups. However, we believe that part of the solution is precisely to integrate these priorities with those emerged from several decades of changes, in order to question our approaches and to adopt new strategies for inclusive well-being. (Vargas & Apaza, 2015)

1.3 Traces of Past

Any discussion of inclusive development in Bolivia cannot ignore the historical role of indigenous-peasant peoples. In general, these are recognized as oppressed social groups. Recently, however, along with other social movements, they have played a key political role in the early twenty-first-century reforms – a position strengthened by the ‘Unity Pact’ (*Pacto de Unidad*). A brief summary of some historical aspects from the perspective of these historically oppressed groups – ‘against the grain’, to borrow a term from Walter Benjamin – may be useful for later discussions of inclusive innovation practices.

Looking back to the time of the Spanish invasion and colonialism, most communities in the Andean region were part of the Inca Empire. The northern and eastern lowlands, meanwhile, were inhabited by a number of independent indigenous communities. Colonialism in America – a foundational element in the consolidation of early modernity (Dussel, 2007) – marked the evolution of Bolivia’s historical time and its integration into the world system. Tapia (2011) explains ‘historical time’ (*tiempo histórico*) in terms of a society’s rhythm and movement. It concerns the relationships and structures that organize social life, including the forms via which collectives understand both human-human and human-nature interactions. Its evolution occurs at various levels, and emerging contradictions and tensions are both a central feature of this study and a framework for ideas regarding social inclusion and the reduction of environmental deterioration in Bolivia.

Modernity is characterized by a change in the direction of the arrow of time thrown forward. In this vision of the historical time, some societies are placed in front of others as a guide and direction and in that sense domination is justified on those that are considered in the backward of time or those that continue in cycles movement. Thus, the colonial avant-garde, reproduced in the notions of progress and in most development theories. (Tapia, 2011)

The Republic of Bolivia was proclaimed in 1825 as part of a wave of independence movements in South America. The new republic-state became a main purveyor of modernity and development strategies in the region. Various, the Bolivian state played the role of intermediary within a global neo-colonial system that systematically marginalized ancient cultures. From a critical perspective, Gutiérrez Aguilar, Salazar Lohman, & Tzul Tzul (2016) state that while new policies, implemented by the landed oligarchy, tried to demolish community structures under the aegis of modernization, they were frustrated by the resistance of the indigenous peoples and the financial unfeasibility of the Bolivian State. Visualising these tensions provides a perspective of the historically antagonistic relations between the national government structures, on one hand, and the indigenous *majorities* on the other.

The construction of a Bolivian nation-state during the nineteenth and twentieth centuries entailed the overlaying of a dominant society upon resistant social structures characterized by other kinds of culture, forms of articulation and natural transformation, social reproduction, religious ritual, social policy, Cosmo-vision, language and, above all, other forms of self-government. Zavaleta (2015) uses the concept of a 'motley society' (*sociedad abigarrada*) to explain this phenomena. Motley society refers to the persistence or co-existence of authority structures that are in reality forms of self-government or systems of social relations. This suggests that countries can be both multicultural and/or multi-societal. Rivera Cusicanqui (2010) adds that motley society refers to the parallel co-existence of multiple cultural differences that do not merge, but rather antagonize or complement one another. Each reproduces itself via a private historical narrative, and thus enjoys a contentious relationship with other similar structures. This concept is central to understanding the key notion of '*ch'ixi*' in decolonization practices and discourses developed by Bolivian academics and activists.

Bolivia's modern governmental structure evolved historically as a weak political arena, mostly corresponding to the interests of the more prosperous social and urban spheres. Gutiérrez Aguilar et al. (2016) identify the main social struggles and revolutions of the twentieth-century as an increasing flux of organized forces which gradually dilute, erode and sometimes openly confront the scope of governmental power. Despite the complexity, context and specificity of every struggle, all are linked by two main recurrent themes: i) the struggle to secure the possession-ownership of land; and ii) the struggle to ensure areas of autonomy and forms of collective self-regulation to manage common issues.

At the beginning of the twenty-first century (2000-2005), the national crisis relating to neoliberal political-economic measures and cumulating in dissatisfaction with traditional political parties somehow reawakened the historical memory of past social and indigenous movements, giving rise to a revolutionary sentiment that spread across Bolivia. Tapia (2015) explains this as an organic watershed of the nation-state, centred around four main types of crisis: i) fiscal, ii) representation, iii) legitimacy and, iv) correspondence. He also notes that within this context, change was consolidated by the emergence of three core constituent powers that aspired to transform the established order: i) the Coordinating Committee for the Defence of Water and Life in the Cocha-

bamba region; ii) the inter-ethnic and political unification between the peoples of the Amazon, the East and the Chaco in Bolivia; and iii) the Aymara and Quechua peasant movements in the highlands and valleys, featuring the increasingly visible presence of organized groups of women acting in defence of the material conditions of life, with a great capacity for articulation and collaboration among a diverse range of social movements. Rivera Cusicanqui (2010) observes that themes may return but disjunctions and ends are diverse. That is, we return, but not to the same point. The movement is not linear but spiral: historical memory is reactivated and at the same time re-established and re-signified during cycles of subsequent rebellion. In these delirious moments of collective action, what is experienced is a change in consciousness, in identities and ways of knowing, in ways of conceiving politics. And it was the amalgamation of these diverse social claims that opened the way for a constituent process in Bolivia.

In 2006, the new government used these social claims to inspire a new national constitution, approved in 2009, which re-founded the country as the current Plurinational State of Bolivia. This new constitution adopted the indigenous aphorisms of *suma qamaña* (Aymara) and *sumak kawsay* (Quechua) as foundations of 'Vivir Bien/Good Living', with the aim of problematizing the neoliberal development agenda and inspiring discussions about upcoming national development programs. The importance of Bolivia's indigenous groups was highlighted as part of this process: 36 indigenous nations were recognized and granted visibility and space within the national political arena. Included in this were parliamentary representation, the legitimization of indigenous ways of territorial organization, and a wider participation in the national political life. As such, a kind of historical inversion was achieved: the insurgency of a past and a future, culminating in catastrophe or renovation (Rivera Cusicanqui, 2010). This may also be viewed as a modern manifestation of the ancient idea of '*Pachakuti*', emphasising the importance of fostering active spaces of discussion, action and learning, and of recognizing the responsibility incumbent on all Bolivians as subjects of national transformation.

1.4 Research Problem Statement

Positions within a public university entail both a commitment to public service and responsibility towards the production, accumulation-diffusion and reproduction of knowledge in society. In Bolivia, there is a persistent demand for increased relevance and impact of university knowledge production within the local and national development processes.

In the case of UMSS, as described above, a pioneering institutional response to improve university-society interactions led to the creation of UTT. Its early experiences evidenced the limitations of linear interaction models, with these shortcomings strongly linked to the lack of knowledge demand and absorption capacity within the Bolivian market (industry sector). This laid the foundations for the UMSS Innovation Program, inspired by an innovation system approach. The UMSS Innovation Program's main operative strategies are focused on bottom-up initiatives, such as cluster development and researcher networking. Results of the initiatives tested at UTT have been gener-

ally promising. However, these results still need to be analysed, discussed, developed and potentiated to enable collaborations with a more diverse range of social sectors. Similarly, insufficient knowledge about the specific features of innovation system interactions between the university, industry, the government and civil society remains a major challenge to experience-based learning.

During the last 10 years, the idea of fostering an NIS as a development strategy has featured in debates and official policy documents. Recent revolutions in Bolivia (between 2000-2005) have successfully situated aspects of social inclusion, environmental sustainability, sovereignty of natural resources, diversity of democratic forms of participation, and diversification of the productive structure as central issues influencing national development agendas. The sovereignty of science and technology to respond to critical national problems has also been highlighted as a central concern within the national development agenda, due to the high dependency on overseas knowledge. As such, policy makers and other actors at different levels are increasingly turning the debate to the local production of knowledge in their search for interventions that provide effective solutions to social problems. The university is generally seen as a key player in this context. As a result, research and innovation programs are mostly focused on supporting the supply side of scientific knowledge, with insufficient attention given to the importance of fostering demand-side capacities and to the relevance of experience-based knowledge. As such, endogenous knowledge production is still at risk of neglect, inhibiting Bolivia's already low research capacities and resources.

Developing knowledge of both innovation systems and the co-evolution of university- society relations in Bolivia is thus necessary to better guide decisions on resource allocation and to strengthen the articulation of a diversity of society capacities in practical innovation and learning processes. Responding to some of Bolivia's more challenging social problems, systemic collaborations are needed to enable structural transformation paths.

1.5 Objectives

1.5.1 Main Objective

The main objective of the study is to develop knowledge about innovation systems and inclusive development processes, with a focus on co-evolutionary processes.

1.5.2 Specific objectives

The specific objectives of the study are:

- To analyse the evolution of the national innovation policies created to strengthen the Bolivian Innovation System;
- To analyse university-society knowledge production at UMSS under the 'developmental university' approach;
- To develop inclusive innovation processes fostering co-evolutionary dynamics between the university, the government and different socio-productive actors, with a focus on MSMEs in the Cochabamba region.

1.6 Research Questions

The following questions guided the study:

- How are national innovation policies evolving within the framework of the Bolivian Innovation System?
- How can socially sensitive research practices and policies at UMSS be stimulated and enter into dialogue with more contextualized theoretical references within emerging innovation system dynamics in Bolivia?
- How has the Food Cluster Cochabamba evolved at UMSS? Has it developed inclusive innovation system approaches with their own characteristics?

1.7 Significance

Therborn (2015) begins his book "The Killing Fields of Inequality" by pointing out that inequality is a violation of human dignity: a denial of the possibility for human capabilities to develop. Inequality takes many forms and has multiple implications, including premature death, ill health, humiliation, subjection, discrimination, exclusion from knowledge or from mainstream social life, poverty, powerlessness, stress, insecurity, anxiety, lack of self-confidence and of pride in oneself, and exclusion from opportunities and life-chances. Inequality, then, is not just about the relative size of our wallets. It has a socio-cultural order, which (for most of us) diminishes our ability to function as human beings, our health, our self-respect, our sense of self, as well as the resources that allow us to participate as actors in the wider world. In summary, he states, *inequality kills*.

This study aims to make a very modest contribution to the challenges posed by exclusion from knowledge by offering some insights emerging from local attempts to encourage public university participation in emerging Bolivian inclusive innovation systems. Judith Sutz has pointed out that the NIS approach is particularly suited for innovation directed at fighting inequality. The concept of inclusive innovation implies a dynamic that links problems stemming from inequality to agents with the capacity to foster and implement innovative solutions (Soares, Scerri, & Maharajh, 2014).

This study seeks to use lessons learned within the university to open pathways to systemic collaboration. The aim is that these pathways help identify societal problems and develop processes for the democratization of knowledge, which can then be used to produce alternative solutions. This study pays special attention to the important role of MSMEs in the innovation process. Similarly, in the context of inclusiveness, the position of Bolivia's historically marginalized groups remains a core consideration.

1.8 Ethical Considerations

With the exception of names and contact addresses, no private or personal information was requested or recorded without the express permission of the individuals in question. In instances where confidential information was divulged, efforts were taken to protect it. The disclosure of any potentially derogatory information about a firm or organization participating in the study was avoided. All interviews, discus-

sions and meetings were conducted with adult male and female university employees, policy makers, local entrepreneurs or other affiliates of community organizations, all of whom gave verbal consent. An individual was free to decline to participate in an activity or interview, express reservations or leave the discussion and/or meeting any time that he/she felt uncomfortable. Descriptions of experiences and shared institutional information were validated during meetings and short lectures with university researchers and UTT staff. Other informational resources were already in the public domain, such as published papers and books, organizational reports, government plans and proceedings.

1.9 Organization of the thesis

The research presented in this thesis is motivated by historical claims for greater inclusiveness in Bolivia. I aim to show how innovation and learning system processes can nourish a revitalized role for the public university that responds to this demand. The papers presented in Part II can thus be understood as part of this exploratory and reflexive cycle.

The thesis is organized into three parts. Part I contains three chapters:

- Chapter 1 introduces to the context, experiences and main objectives of the study;
- Chapter 2 presents the general conceptual framework for NISs, knowledge production, and the role of the university in inclusive development and innovative cluster development. It also presents methodological considerations and approaches used in the study;
- Chapter 3 introduces other relevant concepts shaping my own position as a researcher.

Part II is a collection of six papers. Some of these have been published in international or national academic journals, while others were presented at international conferences between 2015-2017. Part III is an epilogue containing the main findings and lessons learned.

Chapter 2

CONCEPTUAL AND METHODOLOGICAL CONSIDERATIONS

But innovation is always a double-edged sword.
(David Harvey, 2014)

2.1 Conceptual Framework

The main concepts used in this thesis are:

- National Innovation Systems
- Inclusive Development
- Developmental University
- Co-evolutionary Processes
- Mode 2 Knowledge Production
- Technoscience
- Cluster Development
- Triple Helix

This chapter will show how the following concepts are interlinked and used for both empirical and analytical purposes.

National Innovation Systems

The innovation system occupies a central position in the experiences and analysis that comprise the present thesis. It was initially adopted by UTT as an alternative to linear university-society interaction models, the limitations of which are described above. This chapter describes the conceptual features and elements that contextualize an innovation system.

According to Niosi, Saviotti, Bellon, & Crow (1993), the idea of a National Innovation System (NIS) entered the theoretical battleground in the late 1980s as part of an effort to explain the role of innovation in the success of certain countries. Initial NIS research came from authors such as Friedrich List (1909), Christopher Freeman (1987), Bengt-Åke Lundvall (1992), and Richard Nelson (1993). Originally linked to the sub-discipline of development economics, it is currently used across a wide spectrum of disciplines. A common theme to all these works was their movement away from the linear approach towards technological progress, with micro-, meso- and macro-level innovations as the main drivers of growth (Lundvall, Vang & Chaminade, 2009).

The NIS is a social system based on two main assumptions (Lundvall, 2010):

1. That the most fundamental resource in the modern economy is knowledge and, accordingly, the most important process is learning;
2. That learning is predominantly an interactive and, therefore, a socially embedded process, which cannot be understood without taking its institutional and cultural context into consideration.

Recently, Lundvall (2016) explained that the concept of an NIS presumes the existence of nation states, and as such has two dimensions: the national-cultural and the political. The ideal *abstract nation state* is one in which the two dimensions coincide; that is, where all individuals belonging to a nation – defined by its cultural, ethnical and linguistic characteristics – are gathered into a single geographical space controlled by one central state authority (without foreign nationalities). Another weakness of the innovation system approach is that it lacks the capacity to handle the power aspects of development. Certainly, in the case of Bolivia – a multi-cultural, multi-ethnic, plurinational state – the concept requires contextual considerations before being put into practice.

In their discussion of Latin America's NIS, Arocena & Sutz (2003) highlight the following aspects:

- The NIS is an ex-post concept, constructed in the north on the basis of empirical findings; in the south, meanwhile, it is an ex-ante concept;
- The concept carries normative weight, stressing the relevance of diversity, as different NISs require their own specific policy support;
- The concept is fundamentally relational: what matters is the concrete web of interconnections between different types of collective actors;
- The concept has policy implications. Current situations concerning knowledge and innovation can be subject to deliberate efforts to change them.

Thus, as a general conceptual reference, I have taken the definition given by Lundvall, Chaminade & Vang (2009) in their "Handbook of Innovation Systems and Developing Countries: building domestic capabilities in a global setting" as a useful starting point:

The national innovation system is an open, evolving and complex system that encompasses relationships within and between organizations, institutions and socio-economic structures which determine the rate and direction of innovation and competence-building emanating from processes of science-based and experience-based learning." (Lundvall et al., 2009)

In the case of Bolivia, the NIS is an ex-ante concept framework. Its aim is to generate and promote innovation policies that dynamize interactions and resources between the different actors within the context of an emerging innovation system. An emerging innovation system can be understood as a system where only some of its building blocks are in place and where the interactions between the elements are still in formation (Chaminade, Lundvall, Vang, & Joseph, 2009). In this context, Bolivian innovation policies are created to offer strategic and operative support for national development goals.

Inclusive Development & Innovation Systems

Alongside climate change and environmental degradation, rising global inequality is among the most worrying challenges of our time (Brundenius, 2017). In his book, "Global Inequality: a new approach for the age of globalization", Branko Milanovic (2016) gives an overview of the continual rise in global inequality over the past two centuries (1820-2011) – a period encompassing the rise of capitalist modernity and the marriage of science and technology. The relationship between growth and inequality, however, is complex. In discussing strategies to combine economic growth and social inclusion, Johnson & Andersen (2012) affirm that economic growth is fundamental, with the following provisos:

- economic growth alone is not enough; and
- it is not uncommon for economic growth to be pursued in such a way that social and economic exclusion are increased rather than diminished.

This may reflect the experiences of most Latin American countries in recent decades. Arocena & Sutz (2014) analysed how in 'central countries', an economy based on knowledge and driven by innovation (at least since the 1980s) has shaped the emergence of a capitalist society, which naturally fosters the privatization of knowledge. This privatization, they explain, makes it difficult to use advanced knowledge to improve the quality of life of poorer people in underdeveloped countries. It is a complex structural problem, whereby knowledge has become the nucleus of the technological base by which social power relations are sustained. In a society based on advanced knowledge, those who have the opportunity for high-level learning and who work in conditions that promote continuous knowledge acquisition strengthen their ties to certain power structures, whereas the opposite happens to those who are denied these opportunities. Therefore, the authors argue, the general trend towards increased inequality observed since the 1980s is not only a function of neoliberal policies but also a direct result of the growing role of advanced knowledge.

In the last decade, many scholars have discussed the relation between innovation and inequality, especially within developing countries. Cozzens & Kaplinsky (2009) argue

that while innovation is neither the main nor the only influence on inequality, it is nonetheless causally linked to poverty and inequality via a range of different economic, social and political processes. However, this causality is not unidirectional. Innovation and inequality co-evolve, with innovation reflecting and reinforcing inequalities at certain times, and undermining them at others. It is also bimodal, with inequality sometimes influencing the nature and trajectory of the innovation itself.

Inclusiveness as a general concept is related to social equity, equality of opportunity and democratic participation (Papaioannou, 2014). The idea of ‘inclusive development’ emerged in recognition of the fact that development processes often marginalize certain groups, increasing social exclusion. Thus, inspired by the ideas of Sen (1999, 2000) on social exclusion, poverty and ‘development as freedom’, Johnson & Andersen (2012) argue that the notion of inclusive development hinges on the inclusion of excluded people and the utilization of their capabilities, noting that both social exclusion and social inclusion – and, hence, both capability deprivation and capability creation – are relational. There is little doubt that excluding parts of the population from different kinds of education may seriously diminish a country’s possibility to develop into a ‘learning society’. As learning and innovation become more and more important to the processes of economic change, limited and unequal access to different kinds of learning are increasingly detrimental to economic development. Thus, the same authors came up with following definition in their Globelics thematic report of 2011 entitled, “Learning, Innovation and Inclusive Development: new perspectives on economic development strategy and development aid”:

Inclusive development is a process of structural change which gives voice and power to the concerns and aspirations of otherwise excluded groups. It redistributes the incomes generated in both the formal and informal sectors in favour of these groups, and it allows them to shape the future of society in interaction with other stakeholder groups.” (Johnson & Andersen, 2012)

Regarding potential inclusive development efforts in the global south, Andersen (2011) argues that even if substantial resources are mobilised, it may be almost impossible to build up, maintain and develop an adequate knowledge structure and a diverse set of competences if there is a lack of domestic demand for knowledge. If private firms and public organisations do not employ people with newly acquired competences to solve problems and develop solutions relating to daily production activities, their competences will deteriorate. Knowledge will be lost, and new knowledge will fail to develop. Similarly, if the demand for knowledge and competence primarily comes from international companies, the development of a domestic learning society with innovation-driven development will be hampered. Successful learning spaces thus require the coexistence of learning capabilities, learning opportunities, and demand for competences and knowledge.

Pursuing inclusive development has a direct impact on the innovation system approach as a central framework for analysing and understanding innovation and development processes. Clearly, inclusive innovation is an important component of inclusive development, which can be fostered within NISs. Indeed, Brundenius (2017) uses the terms ‘innovation for inclusive development’ and ‘inclusive innovation’ interchange-

ably. However, the concept of an inclusive innovation system is somewhat complex, as inclusion must be understood at several levels (system-level interdependencies). The innovation processes of firms and other organizations may be more or less inclusive. The same goes for inter-organizational learning spaces. Similarly, the inclusiveness of institutions linking firms, banks, learning spaces, public organizations and policy makers, which allow them to interact, may be variable (Johnson & Andersen, 2012).

A study by Altenburg (2009) published in the “Handbook of Innovation Systems and Developing Countries: building domestic capabilities in a global setting” suggests that *innovation policy should focus on inclusive innovations and their diffusion*. Innovations in areas where poor people live and work (e.g., a focus on upgrading agriculture including forward and backward linkages, post-harvest handling, etc.) are especially relevant. To tackle the lack of interactive learning in developing countries, Arocena & Sutz (2002) proposed the notion of building ‘interactive learning spaces’ providing actors with opportunities to strength their learning capacities while searching for solutions to given problems in an interactive manner. These may include a range of different organisations and individuals and can emerge in a variety of contexts. Examples include the many concrete cases of sustained co-operation between producers and researchers leading to mutual change and growth while fostering collaboration between the involved parties and other actors, educational institutions, public organisms, NGOs, etc. Interactive learning spaces can develop system dynamics in their own right and may be regarded as potential seeds for inclusive innovation systems. Indeed, the cluster development experiences described in the following chapters of this study evolved in a similar manner.

The Developmental University

The role of universities in national innovation systems remains a hotly debated topic in Latin American countries, particularly when it comes to public universities, where the majority of national research capacities are generally concentrated. Sutz (2012) explained that underdevelopment can be very partially but not inaccurately characterised as an ‘innovation as learning’ systemic failure. A systemic failure is defined as the inability of an innovation system to support the creation, absorption, retention, use and dissemination of economically useful knowledge through interactive learning or in-house R&D investments (Chaminade et al., 2009).

Regarding national NISs in the global South, the idea of developmental universities seems to offer a more suitable conceptual framework, with focus more on socially inclusive knowledge production and inclusive development. Brundenius, Lundvall, & Sutz (2009) explain that the term ‘socially inclusive knowledge production’ emphasizes purposeful action towards producing knowledge, with the explicit aim of *solving problems faced by those excluded from common facilities or benefits*. This aim can be extended to support for production, particularly for SMEs, who find it difficult to purchase ready-made solutions in the world market and who may benefit from a more ‘tailor-made’ approach to their knowledge needs. Certainly, it is an ongoing cause for concern for civil society that increasing numbers of such problems remain unsolved and unaddressed by both the public and private sectors (Brundenius, 2017).

The ‘developmental university’ has been defined as an open, interactive setting incorporating different groups within society, including industry. However, it does not operate according to the logic of making profit. Rather, its major aim is to contribute to social and economic development, while at the same time safeguarding a certain degree of autonomy (Brundenius et al., 2009). As such, the developmental university offers an important and more contextualized framework, particularly relevant for public universities in Bolivia (where most research capacities are concentrated). Arocena, Göransson, & Sutz (2015) describe developmental universities as committed specifically to social inclusion through knowledge along three main avenues:

1. democratization of access to higher education;
2. democratization of research agendas;
3. democratization of knowledge diffusion.

At the same time, the developmental university is characterized by its commitment to inclusive development by means of three interconnected practices (Arocena & Sutz, 2017):

1. teaching;
2. research;
3. fostering the socially valuable use of knowledge.

Co-evolutionary Processes and Mode 2 Knowledge Production

The mixing of norms and values across different segments of society is part of a diffusion process that fosters further communication by creating a common culture and language (Gibbons et al., 1994). The different approaches described above can offer an initial concept framework by which to foster innovation and learning systems dynamics. Nevertheless, when it comes to the question of implementation, deeper transformations in knowledge production for innovation and contextualized approaches are still required.

Nowotny, Scott, & Gibbons (2010) argue that changes in scientific knowledge production, as well as social, economic, political and cultural transformations, are characterized by co-evolutionary processes. These processes consist of relationships that are neither causal nor linear, but reflexive and interactive. Science and society become transgressive: a potential dialogue is opened up whereby science speaks to society (as it has done with conspicuous success over the past two centuries) and society speaks back to science. Problems can no longer be ‘solved’ once and for all; indeed, solutions in this simplistic sense may no longer appear possible. Instead, problem-solving forms a non-linear dynamic leading to new (uncertain) potentialities into which the dynamic itself becomes embedded. Any ‘solution’ thus merely offers temporary reprieve, becoming a vector for the next inevitable ‘challenge’.

Gibbons (2000) defines what is known as Mode 1 and Mode 2 knowledge production. In Mode 1, problems are set and solved in a context governed by the interests of specific academic communities. In Mode 2, knowledge is produced in a context that

includes a much broader range of actors. Mode 2 is transdisciplinary: not only does it draw on disciplinary contributions but it can also set up new frameworks that extend beyond their source. It is thus more socially accountable and reflexive than Mode 1. The two modes employ different types of quality control. Peer review still features in Mode 2, although its usage here includes a wider, more temporary and heterogeneous set of indicators. Mode 2 knowledge production focuses on dialogue between the sector and users, as opposed to the traditionally univocal academic knowledge generation process. To date, an increasing number of scholars and practitioners have developed a diverse range of approaches to Mode 2 within their own communities, with an emphasis on sharing the experiences, advantages and challenges inherent in transdisciplinary knowledge production.

Mode 2 can also be understood as an approach aimed at democratizing knowledge and limiting global efforts supporting the transfer of public science into privately-owned domains. Indeed, Nowotny, Pestre, Schmidt-Assman, Shultze-Fieltz, & Trute (2005) argue that the democratization process pushes citizens to become involved in research agenda priority setting, thereby inducting themselves into the workings of a wider, scientific institution that works for the benefit of society.

Technoscientific approach

The Technoscientific approach, inspired by Donna Haraway (1988, 1991) and developed at the research division of Technoscience Studies at Blekinge Institute of Technology (BTH), is close in nature to the epistemological and practice-driven approach of Mode 2. As Trojer (2017) emphasizes, the epistemological, methodological and empirical fields of practice are not owned by a group of researchers able to independently define the goals or means in use. Rather, this is a meeting point for disparate experiences, skills and stories. Patience and work are required for something new to emerge out of the asymmetries. That which unites all the actors, however, is the desire for a sustainable future, which can only be created in association with others. Citing the paper “Inclusive innovation processes – experiences from Uganda and Tanzania” Trojer, Rydhagen, & Kjellqvist (2014) illustrate some of the bases of the Technoscientific approach.

It is important to recognize that knowledge always is situated as it grows in specific contexts, as e.g. Haraway (1988) gives profound accounts of. Knowledge transfer is thus always difficult, and may be particularly so when people with scientific schooling, administrative drill and entrepreneurial skill move out of their habitual context to meet people in informal settings. Haraway's proposal is to recognize and admit the localisation of 'knowledges' in bodies, including our own, to be aware of the symbolic meanings of the knowledge that we hold and that it might differ from others' symbolic meanings. To live with and make use of the 'situatedness' "... we do need an earth-wide network of connections, including the ability to partially translate 'knowledges' among very different – and power-differentiated communities" (1988:580). If so, different ways of articulating a demand for knowledge might be recognized and acknowledged. Knowledge has been shown to spread in locally established clusters, where social bonds and trust through face-to-face interaction facilitate sharing of relevant and specific knowledge. (Trojer, et al, 2014)

In both the Mode 2 and Technoscientific approaches, the determinants of a potential solution involve the integration of different skills into a framework of action. However, the consensus may be only temporary, depending on how well it conforms to the demands of the context. In the case of ‘not-yet’ dynamic relations within the Bolivian Innovation System, it is imperative to start developing stable platforms for networking and collaboration between the organizations involved in concrete innovation and learning processes. The approach developed at UMSS initially promoted two pilot clusters with this priority in mind.

A ‘cluster’ consists of specialized firms or farms that are co-located within a geographical area and which have links to suppliers, supporting organizations and knowledge institutions. Firms within a cluster can benefit from common assets such as natural resources, infrastructures, and access to a specialized, qualified workforce. Innovative clusters have a capacity for renewal and innovation that spurs competitiveness and growth. Triple/quadruple helix-based collaboration creates a policy framework that stimulates joint vision and joint action. Similarly, trust among cluster firms and other cluster actors generates social capital – an important cluster asset (Clusterpedia on Cluster Development, 2011).

Production sector conditions in Latin America can be precarious. Parrilli (2007) describes the emergence and particular characteristics of clusters formed by SMEs (so-called ‘survival clusters’). These clusters are formed by micro and small craft firms using obsolete technology and manual techniques to produce low-quality non-standardised goods for low-income consumers in local markets, with no division or specialisation of labour. These conditions are similar to those of most Bolivian and indeed Latin American SMEs, whose relevance lies in the fact that they have the largest influence over firms, employment and GDP. Based on his empirical work in Latin American countries, Parrilli (2007) goes on to suggest ways in which SME cluster development may be improved. These suggestions are framed around what he terms the ‘stage’ and ‘eclectic’ approaches:

- The ‘stage approach’ is linked to the need to identify the characteristics of each cluster and its effective potential to grow, which cannot be independent from its present development stage. Targeting feasible and progressive stages of development for dynamic ‘survival clusters’ can help these local production systems to respond to the new challenges represented by globalisation and to face the threatening entry of new competitive production systems to the world market.
- The ‘eclectic approach’ is linked to the need to consider the relevance of several different determinants within the development process. These determinants are those identified over time by bodies of literature addressing SME cluster development (e.g., ‘collective efficiency’, ‘social embeddedness’ and ‘policy inducement’).

Cluster initiatives at UMSS have used a variation of the Triple Helix approach that is adapted for maximum diffusion and aimed at attracting a critical mass of actors (university, government, MSMEs) for starting interactions. This concept was originally presented as a model for innovation studies by Etzkowitz & Leydesdorff (1995,

1998). The Triple Helix entails the formation and consolidation of learning societies, which are deeply rooted in knowledge production and dissemination, in conjunction with a well-articulated relationship between the university, industry and the government (Etzkowitz & De Mello, 2003). The model helps explain both where interactions occur and why a dynamic triple-helix process can be formed, with gradations between independence and interdependence and conflicts and confluences of interest (Etzkowitz, 2008). In Latin America, the Triple Helix model can be linked to the so-called ‘*Sabato’s triangle*’ (Sábato & Botana, 1968) – a similar triadic schema developed previously as a diagnosis and strategy formulation instrument for S&T policy and national development.

Inspired by satisfactory results for similar clusters in Africa facilitated by SICD, cluster operatives at UMSS adopted the Triple Helix approach. The concept provides a schematic basis for non-linear interactions, highlighting some of the main actors who should be called on to participate. Rydhagen & Trojer (2014) offer the following description:

.... in order to move from the linear model of knowledge production and as well as of innovation development and evolution, it is not enough to link academic research with private sector and industry. It requires at least three key players that is university, industry and government, which constitutes the triple helix model presented above. In order to come closer to innovation issues I want to use the general understanding of the Triple Helix model from Triple Helix Research Group (2011). The Triple Helix concept comprises three basic elements: (1) a more prominent role for the university in innovation, on a par with industry and government in a knowledge-based society; (2) a movement toward collaborative relationships among the three major institutional spheres, in which innovation policy is increasingly an outcome of interaction rather than a prescription from government; (3) in addition to fulfilling their traditional functions, each institutional sphere also “takes the role of the other” performing new roles as well as their traditional function. Institutions taking on-traditional roles are viewed as a major potential source of innovation in innovation. The Triple Helix model is a frame and a boundary object on Star (1989) which involved actors can join and find out understandings and roles in always-complex contexts and circumstances. That is a big step forward in the process of dissolving the linear paradigm. But it is not enough. As mentioned earlier, the Triple Helix model does not by itself mean that we all know how to work together and develop the integrating process, which brings us to Mode 2 again. (Rydhagen & Trojer., 2014)

The Triple Helix approach may thus be used as an initial framework by which to build dialogue and forums linking Bolivian socio-productive sectors with the academic sector and government bodies. Clusters allow for the merging of all the above-mentioned concepts, congregating actors within a trust-building process and fostering bottom-up contributions to NIS dynamics. It is important to point out that UMSS cluster development operates in a manner distinct from the idea of the ‘entrepreneurial university’ proposed in theoretical texts relating to the Triple Helix model. The selective use of concepts according its relevance in the local context and the capacities of the actors involved is a feature common to all experiences generated within these emerging innovation and learning processes.

2.2 Methodological Considerations

Research design positioning

The chosen research design was inspired by Participatory Action Research (PAR) and mixed methods based on both theoretical and empirical (quantitative and mostly qualitative) analyses. Action Research, PAR and Action Learning are the most common terms used to describe my research methodology, which involves *“a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview...[and bringing] together action and reflection, theory and practice, in participation with others in the pursuit of practical issues of concern to people, and more generally the flourishing of individual persons and communities.”* (Reason & Bradbury, 2001)

From a research objectives perspective, the first part focuses on analysing secondary data from published materials on science, technology and innovation policy, as well as Bolivian development reports. Published academic material (theoretical and empirical studies) on innovation systems, clusters development and themes related to inclusiveness also feature, with a particular focus on Latin America and Bolivia. Secondly, regarding the concept of the developmental university, my analysis is centred on specific empirical results generated by the UTT at UMSS. My third objective concerns the ways in which knowledge production, cluster development and inclusive innovation processes can be anchored under systemic approaches in Bolivia. To this end, the participatory approach was enriched with interviews and group meetings with some of the more active researchers, cluster entrepreneurs, policy makers and representatives of other sectorial organizations involved. Finally, my own experiences and those of the various co-authors (both academic and non-academic) since the creation of the UMSS Innovation Program have allowed for a range of different perspectives by which to feed discussions. The research is thus both practice and theory driven, with potential benefits for both dimensions.

Participatory Action Research

PAR researchers recognise the existence of a plurality of knowledges across a variety of institutions and locations. PAR strives to embody *“a democratic commitment to break the monopoly on who holds knowledge and for whom social research should be undertaken by explicitly collaborating with marginalised or ‘vulnerable others’”* (Kendon, Pain, & Kesby, 2007). PAR highlights the existence of a socially constructed reality, within which multiple interpretations of a single phenomenon are possible by both researchers and participants (Greenwood & Levin, 1998). This perspective opens up spaces for translations between different forms of knowledge and knowledge production via methodological innovation and political action.

The PAR process is also cyclical (Kendon et al., 2007). Researchers and participants identify an issue or situation in need of change. They then initiate research that draws on capabilities and assets to precipitate relevant action. Both researchers and participants reflect on, and learn from, this action, which in turn becomes a stepping stone

for new cycles of research/action/reflection. Together, they develop context-specific methods to facilitate these cycles. McIntyre (2008) explains that the PAR approach is characterized by:

- the active participation of researchers and participants (in this case, socio-productive actors, researchers and government officers) in the construction of knowledge;
- the promotion of self- and critical awareness leading to individual, collective, and/or social change;
- emphasis on a co-learning processes whereby researchers and participants plan, implement, and establish a process for disseminating information gathered by the research project.

One of the most important features of these methods that deal with marginalized or vulnerable people is their ‘hands-on’ nature. Also significant is their ability to enable people to generate information and share knowledge on their own terms using their own symbols, language or art forms (Rydhagen, 2002). Kendon et al. (2007) explain how these methods challenge more conventional social science approaches in which the external researcher sets the agenda, decides on the questions, and implements the interview or questionnaire survey for later analysis. Participatory methods and techniques that are now in common usage, meanwhile, emphasise shared learning, shared knowledge, and the importance of a flexible yet structured collaborative analysis. They require the researcher to relinquish control (Sense, 2006) and position themselves as a facilitator rather than a director of the process (Wadsworth, 2006).

Situated Knowledges and Mode 2

Both Mode 2 and Technoscientific approaches have inspired my practices since 2007 in a range of different roles within the UTT. Over this time, the UTT has increased its competences and transformed towards a recognised Innovation Centre at UMSS, with the aim of encouraging the university to increase its participation in innovation systems.

PAR is closely linked to the methodological approaches employed by the research division of Technoscience Studies, a key component of which is the practice of situated knowledges. Introduced by Haraway (1988), this concept forms part of an epistemological and political effort to create alternatives to the mainstream scientific ‘voice’, described by Sharon Traweek as ‘that voice of entitlement, the voice-of-control start, that accompanies the conquest of empires far from home’ (Traweek, 1992). Haraway views all knowledge as local and historically and culturally dependent. It is thus problematic to argue for watertight bulkheads between the research subjects and research objects; between the observance of an object and the change effected; and between research and politics. The researcher is considered to be an active participant in the research process. She/he creates and organizes knowledge as an on-going interaction with the reality ‘on’ which she/he is conducting research (Björkman et al., 2015).

To practice situated knowledges is to operate within the context of the application – a core methodological characteristic of Mode 2. As discussed above, Mode 2 offers the

methodological answer to the question of how co-evolving processes can occur among all involved actors within the scope of this research.

The relation between research questions and methods is presented in the following Table:

Table 2.1 Relation between Research Questions and Methods

Question 1: How are national innovation policies evolving within the framework of the Bolivian Innovation System?

Methods:

Review of existing theoretical and historical literature; analysis of government policy documents published; discussion with experts, policy makers and local practitioners. Paper 1 focuses on this question.

Question 2: How can socially sensitive research practices and policies at UMSS be stimulated and enter into dialogue with more contextualized theoretical references within emerging innovation system dynamics in Bolivia?

Methods:

PAR in the UTT of UMSS since 2007. Review of relevant academic literature available and of institutional documents published: university research plans, reports, evaluation results and normative assessments. Assessment studies and interviews with key actors at national and local levels. Seminars and workshops within food sector researcher networks. Discussions relating to this question are addressed in Papers 2, 5 and 6.

Question 3: How has the Food Cluster Cochabamba evolved at UMSS? Has it developed inclusive innovation system approaches with their own characteristics?

Methods:

Review of available empirical academic studies and international/local case studies on cluster development (or similar initiatives). Participatory action research facilitating innovation system-cluster development at UMSS between 2008-2015. Analysis of practices, processes and relations established within the cluster development process. Seminars, meetings and semi-structured interviews with cluster members and international practitioners (Sweden). The main findings and reflections are presented in Papers 3 and 4.

A more schematic figure of how these papers are related to individual research questions and specific objectives is presented in the first chapter of Part II of this thesis.

Chapter 3

MY POSITION

There is a picture by Klee called Angelus Novus. It shows an angel who seems about to move away from something he stares at. His eyes are wide, his mouth is open, and his wings are spread. This is how the angel of history must look. His face is turned towards the past. Where a chain of events appears before us, he sees one single catastrophe, which keeps piling wreckage upon wreckage and hurls it at its feet. The angel would like to stay, awaken the dead, and make whole what has been smashed. But a storm is blowing from Paradise and has got caught in his wings; it is so strong that the angel can no longer close them. This storm drives him irresistibly into the future, to which his back is turned, while the pile of debris before him grows towards the sky. What we call progress is this storm.
(Thesis IX, On concept of History, Walter Benjamin, 1974)

In this chapter, I agree with scholars’ onto-epistemological position that theoretical and methodological approaches are interlinked and cannot be separated. A more detailed explanation of my stance on this topic can also be found in Part II. My work as a researcher is particularly inspired by the following themes:

- Social transformation
- Community
- Culture
- Modernity and capitalism
- Reproduction of life

On Social Transformation

I am guided by the idea of inclusive development proposed by Johnson & Andersen (2012). This concept is initially introduced as “a process of structural change which gives

voice and power to the concerns and aspirations of otherwise excluded groups...". We may agree that in more or less democratic spaces, any possible structural change at the bottom level should be closely related to or co-evolve with social transformation processes. However, attempts to achieve this in Latin America have not always been fruitful, leading to discuss critically the idea of social transformation processes and how it may be carried out in favour of the excluded.

Gutiérrez & Salazar (2015) argue that discussions around the notion of social transformation usually start by understanding the world as something already configured or established. Consequently, we are driven to think of social transformation as something in the future, as *possibilis* – frequently, as a contra-factum of the status quo. Social transformation thus becomes an imaginary negation of the present, leaving space to think about what we should *do* or *build* in the future, while falling back into pre-conceived designs/models.

Gutiérrez & Salazar's (2015) Bolívar Echeverría-inspired discussion of the idea "*transformation as the capacity of producing forms, beyond or against what is given*" is of particular relevance here. Social transformation thus becomes part of the broader deployment of human capacities to produce and reproduce collective forms whose origin is neither domination, exploitation nor dispossession. So conceived, social transformation is no longer centred in totalization: the conversion of a social order perceived as a totality into another social order that we also conceive as a totality (judging a priori that it is superior to the first) is no longer fundamental.

This discussion engenders other related questions, such as: How are capacities for social transformation collectively unfolded? How are these capacities for social transformations produced on a day-to-day basis? What are the necessary conditions for their preservation or/and regeneration? Answers to these kinds of questions cannot arrive via logical deductions from determined principles; rather, they depend on a theoretical strategy that can be held accountable for the *practical scope* of everyday unfolding struggles and the *horizons of desire* (Gutiérrez Aguilar, 2008, 2013) of men and women whose daily efforts articulate and facilitate the transformation of their situated social reality.

On Community (*Communitas*)

My experience as a cluster facilitator made visible the relevance of the ideas of Roberto Esposito (1998) in "Communitas: the origin and destiny of community". Esposito's analysis, briefly summarized here, discusses the etymology of community (from the Latin 'communitas' [*cum-munus*]). His conclusions are a radical departure from previous definitions of community, and his main findings can be briefly summarized as follows:

- The *munus* refers to the gift that one gives both because one must give and because one cannot not give. The sense is of being obliged to modify or even interrupt the one-to-one relation between the giver and the recipient. Although the product of a previously received benefit, the *munus* indicates only what is given, not what is received. The totality of the *munus* is projected onto the transitive act of giving. This does not by any means

imply the stability of possession, and even less the acquisitive dynamic of something earned; rather, loss, subtraction, transfer. It is a 'pledge' or a 'tribute' that takes an obligatory form; an obligation undertaken with respect to the other that invites a suitable release from that same obligation; a gratitude that *demand*s new donations. In accepting the *munus*, an obligation is created to exchange it for either goods or services.

- The *cum*, on the other hand, is something that exposes us. It places us in front of others in a situation of surrender and calls upon us to conclude 'the experience', which is none other than the fact of being 'with'... *Cum* unites us with the other, but it is neither a mixer, nor an assembler, nor a tuner, nor a collector. It is a respect to, as is noted when 'with' also means 'with respect to'.

Therefore, Esposito (1998) explains, *communitas* is the totality of persons united not by a 'property' but by an obligation or a debt; not by an 'addition' but by a 'subtraction': by a lack or a limit that is configured as an anus, or even as a defective modality for those who are 'affected' as opposed to those who are 'exempt' or 'exempted'. And it is here that we find the final, most characteristic feature of the oppositions associated with (or dominating) the distinction between public and private. That is, the elements that fundamentally contrast *communitas* and *immunitas*. Whereas *communitas* is bound by the sacrifice inherent in the act of compensation, *immunitas* implies the beneficiary of the dispensation.

And this does not refer to subjects. Or, rather, it refers to subjects of their own proper lack, of lack of the proper. Subjects of a radical impropriety that coincides with an absolute contingency or just simply 'coincides': that fall together. Finite subjects delineated by a limit that cannot be interiorized. A limit that constitutes precisely their 'outside': the exteriority that they overlook and that enters into them as a function of their common non-belonging. The community cannot, therefore, be thought of as a body or a corporation in which individuals are subsumed into a larger individual. Neither is community to be interpreted as a mutual, intersubjective 'recognition' in which individuals are reflected in each other as confirmation of their initial identity. That is, as a collective bond connecting individuals in anticipation of their later separation. The community is not the subject's expansion or multiplication but its exposure to what interrupts and inverts its closure: a dizziness, a syncope, a spasm in the continuity of the subject (Esposito, 1998).

This concept is used in Paper 4 to establish a basic foundation for the idea of an 'innovation community' as a way to support future cluster development processes in terms of its political dimension, the democratization of knowledge production, and the formation of more inclusive collective identities.

On Culture

The cultural is an immanent dimension of human life, the comprehension of which is both challenging and complex. To open the way for more contextualized local discussions with a practical scope, the contributions of Bolívar Echeverría (2001) in "Definition of Culture" are fundamental to my position as a researcher in Bolivia. Echeverría proposes a critical conception of culture drawn from analysis and discussion surround-

ing the process of social reproduction and the complex societal interplay between culture, economics and politics. He provides the following definition:

Culture is the self-critical moment where the reproduction of a determined group of people, within a particular historical circumstance, makes its concrete singularity; it is the dialectical moment of the cultivation of its identity. Therefore, coextensive to human life, a dimension of itself; a dimension which only becomes visible as such, within that reproduction, when it highlights the conflictive relationship (between subjection and resistance) which maintains -as use which is of a particular or sub-coded version of the general code of human behaviour- precisely with the sub-coding that identifies it. (Echeverría, 2001)

Culture, the critical factor in the cultivation of identity, means the opposite of safe-keeping, conversation or defence. It implies being out in the open and testing the validity of the individualized sub-coding, and confronting the potential 'loss of identity' in encounters with others in terms of interiority or reciprocity. The history of culture reveals an unstoppable process of miscegenation in which each social form, in order to propagate itself, has engaged in self-questioning and sought, ultimately, to be something else. In so doing, its code is loosened in a double movement: in opening itself to the corrosive action of concurrent forms it simultaneously enmeshes itself into the fabric of foreign codes in an act of (paradoxical) de-structuring affirmation.

Modern culture can be characterized as a reproduction of a plethora of identities existing in a state of unsolvable contradiction. The same necessity to question the hollowness of archaic forms of identity underpins the necessity to question the variety of new forms that our modern 'humanism' posits as a substitute.

Echeverría suggests that the identity that modern culture must dialectically cultivate is one in permanent crisis: both crisis according to its traditional definition and crisis in terms of its possible (future) definition. It thus becomes, simultaneously, a 'messianic' and 'utopic' culture. This is contrary to creativism, which substitutes necessary innovation for a febrile reinvention. With its arrogant contempt for traditional forms, creativism operates under the premise of rescuing or 'saving' modern culture, presenting itself as an indispensable compromise for a new humanity seeking to assimilate archaic forms. Similarly, this is contrary to traditionalism, which confuses the defence of archaic roots with the repression of innovation. The proliferation of new forms appears in all aspects of modern social life. Through a process of capitalist distortion, these are denounced as having 'no place' within true innovation.

On Modernity and Capitalism

To explain my position in a political context I refer to Lewis Mumford's (2006) *Technics and Civilization*. Mumford names the eleventh century as the time of the *technical revolution* on which modern technics is founded. Thereafter, human productivity was no longer based on the accidental or spontaneous discovery of new instruments copied from nature. Similarly, their use began to be based on the capacity to deliberately invent new instruments and the corresponding new technics of production.

Following Mumford but inspired by Walter Benjamin (2003) in *The Work of Art in the Age of Technical Reproduction*, Bolívar Echeverría (2013) points out that the technical

revolution, for the first time in history, opened up the possibility for human work to not be designed as a weapon for the domination of nature. That is, the chance that human subjectivity need not imply the annulation of the (inevitably mysterious) subjectivity of 'the other' (in this case, nature). This refers to what Benjamin calls the 'second technic' or 'ludic technic'. Historians have shown that there were many civilizations, first in the east and later in the west, which have sought ways to find and update new technics – an act that is the essence of modernity. However, it was the ability of the European capitalist society of the time to achieve historical success over the other competing possibilities that led to the emergence of the current capitalist-modernity.

Nevertheless, Echeverría insists, the capitalist method discriminates between and chooses from the possibilities offered by neotechnics. It only updates or implements those that promise to be functional in pursuit of its stated goal: the accumulation of capital. Capitalism thus demonstrates that it is only capable of fostering and integrating neotechnics in a unilateral and impoverishing way. It treats the neotechnic as if it were a qualitatively enhanced version of the same old neolithic technic. In this sense, the appeal to capital implies not merely setting aside but systematically repressing the qualitative neotechnic aspect. That is, the transformation of what Marx termed the 'natural form' into the 'use value' by which society's objective wealth is reproduced. This also implies, therefore, the repression of everything that concerns the possibility of new treatment by the 'human' of the other (the extra-human, or nature). The neotechnic is conceived as a technic for appropriation – one that the capitalist updates as an increasingly powerful instrument of domination over nature. As we saw earlier, this is in conflict with the neotechnic's original goal: the elimination of all domination and power relations.

From this perspective, particularly in the context of inclusive innovation processes, the visibility of the relation between modernity and capitalism (as the 'only' alternative for social relations) is of note. Equally, their necessary decoupling opens discussions aimed at revealing other ways in which the modern technic can generate solutions or alternatives to local and global crises. These considerations can be supportive for the on-going discussions and actions surrounding social innovation and inclusive development, summarized by Brundenius (2017) in *Challenges of Rising Inequalities and the Quest for Inclusive and Sustainable Development*, addressed in a similar vein.

On the Social Reproduction of Life

I consider it important to highlight the following. One of the main historical problems of capitalist-modernity promoted in Latin American, particularly in Bolivia, concerns the fact that "*in capitalist modernity, the economic system is based on capital accumulation, and does not ensure or guarantee the reproduction of life. Instead, it imposes a form of reproduction: the reproduction of capital, not of life. Capital attempts to dictate and enforce a homogenised type of subjectivity, denying and nullifying our diverse and varied capacity of giving form*" (Gutiérrez Aguilar, Linsalata, & Navarro Trujillo, 2016). The *reproduction of life* is thus the foundational point in an on-going debate of huge complexity that is nevertheless able to articulate and represent a number of heterogeneous and poly-

phonic social groups (e.g. movements of indigenous-peasants, feminists, ecologists, etc.) with more or less visibility in different parts of the world.

In the case of Bolivia, its understanding offers important insights into how, since the sixteenth century, in the context of *'superexploitation'*, the reproduction of national labour forces have not been contingent on the salaries obtained (Marini, 2015). Indigenous-peasant peoples persist in developing complex, occasionally contradictory strategies that combines the dynamics of resistance to, and integration in the capitalist economy. In urban spaces, similarly, multiple mixed strategies of social reproduction and organization have become embedded within different strata of Bolivian society. Bolívar Echeverría (2000) presented the notion of 'ethos barroco' as the predominant and inertial attitude to life in Latin American countries, but recognized, within its mixtures and flexibility, a potential to produce alternatives within society. The concept is a vehicle for the critical discussion of modernity and the re-thinking of culture and history, both in Latin American societies and in the majority of peripheral countries. Thus, in the context of a crisis of the nation-state at the beginning of the twenty-first century, what we saw was the emergence of indigenous-peasant peoples alongside other social movements as political subjects of first-order in Bolivia. Nevertheless, their collective capacity of collaboration as a productive social force is in constant danger of being expropriated or re-captured by private or state-governed power relations, which are historically linked to a corrupted form of democratic organization in Bolivia (see Salazar Lohman (2015) for an in-depth discussion of this topic).

Another important source of inspiration for both Bolivia and Latin America comes from the fertile interplay between feminists and indigenous-peasant movements inspired by Silvia Federici's (2010) discussion in "Caliban and the Witch", among others. Federici's (2001) initial argument is that globalization strives to give corporate capital total control over labour and natural resources and must, therefore, expropriate workers from any means of subsistence that may provide resistance to exploitation. As such, it cannot succeed except through a systematic attack on the material conditions of reproduction and on the main subjects of this work, who in all countries are women. Women are also victimized because they are guilty of the two main crimes that globalization is supposed to purge. They are the ones whose struggles have most contributed to 'valorising' the labour of their children and communities, which they achieved by challenging the sexual hierarchies on which capital accumulation has thrived, and by forcing the state to expand its investment in the reproduction of the workforce. They have also been the main supporters of the non-capitalist use of natural resources (land, waters, forests) and of subsistence-oriented agriculture, thus standing in the way of both the full commercialization of 'nature' and the destruction of the last remaining 'commons' (Kumar, 1997; Matsui, 1999; Shiva, 1993; Steady, 1993).

PART II

Chapter 4

PAPERS

4.1 Introduction to Papers

This thesis is composed of papers published in academic journals or international conferences or in the process of being published in peer-review proceedings. The papers have been reformatted to suit the requirements of the thesis. Below is an introduction to the papers and an explanation of how they relate to one another.

Paper 1:

Acevedo, C., Céspedes, M., Zambrana, E. (2015). Bolivian Innovation Policies: Building an inclusive innovation system. *Journal of Entrepreneurship and Innovation Management*, 4(1), 63–82. ISSN: 2147-5792

This paper explores how science, technology and innovation policies have evolved in Bolivia during the last three decades. The study later focuses on the government plan in force to make the national innovation system more dynamic, which is linked to the long-term national development agenda. The paper recognizes the positive influence of the wider participation by social sectors in the construction of science, technology and innovation strategies with socially inclusive and sustainable objectives.

Paper 2:

Acevedo, C., Céspedes, M., & Zambrana, E. (2017). Developmental university in emerging innovation systems: the case of the Universidad Mayor de San Simón, Bo-

livia. In A. Tsvetkova, J. Schmutzler, M. Suarez, & A. Faggian (Eds.), *Innovation in Developing and Transition Countries*. ISBN: 978-17-8536-965-0. Cheltenham: Edward Elgar Publishing Limited.

Inspired by the innovation system concept, this paper studies the main characteristics of the research system in place at UMSS, highlighting experiences gained around bottom-up innovation system approaches at the UTT (cluster development, research network, technology-based incubator). The discussion recognises the 'developmental university' as context-relevant, with the aim of supporting university efforts and self-critical reflections towards increasing the contribution of research activities to inclusive development goals.

Paper 3:

Acevedo, C. (2015). Cluster initiatives for inclusive innovation in developing countries: the Food Cluster Cochabamba, Bolivia. In *Developing Inclusive Innovation Processes and Co-Evolutionary Approaches in Bolivia* (pp. 73–88). ISBN: 978-91-7295-312-3. Licentiate Dissertation Series No. 2015:05. Karlskrona: Blekinge Institute of Technology.

This paper gives a detailed introduction to the emergence of the Food Cluster Cochabamba and to my personal experience as cluster facilitator between 2008-2014 at UMSS. This was a pioneer university initiative aimed at generating an interactive platform for university-government-industry collaboration within innovation system dynamics. The study discusses how cluster development can be used in this context as a knowledge democratization mechanism to benefit MSMEs in a specific production sector.

Paper 4:

Acevedo, C., & Trojer, L. (2017). Re-reading Inclusive Innovation Processes: cluster development, collective identities and democratization of research agendas. *Revista Científica "Ciencia y Tecnología"*, Universidad Mayor de San Simón, 9(1), 108-116.

This paper attempts to anchor the knowledge generated by cluster development and inclusive innovation processes. It recognizes the relevance of a political perspective and seeks to re-read the dynamics at play in a real-life inclusive innovation setting (the Food Cluster Cochabamba). The paper's findings reveal insights into how relations are evolving among the different actors participating in the cluster. Paths of mutual learning are sought, with the aim of facilitating more democratic and inclusive innovation processes.

Paper 5:

Acevedo, C., & Zambrana, E. (2017). *The emergence of the "UMSS Innovation Team": potentials for university research culture transformation and innovation community building*. (submitted).

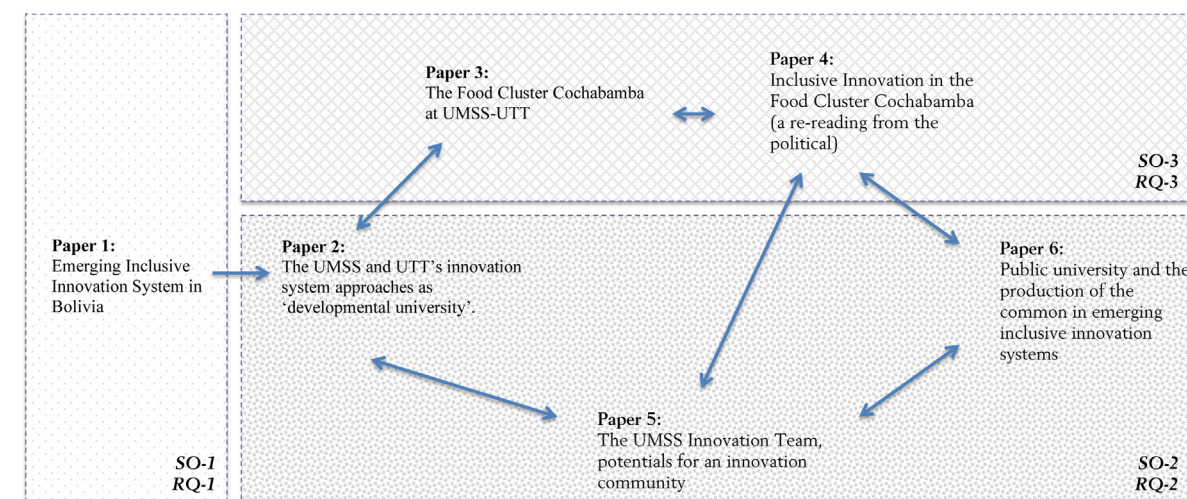
This paper presents the co-evolution of cluster development and a network of researchers for innovation at the university, the "UMSS Innovation Team". It highlights the personal perceptions of the main researchers at various research centres involved in cluster development between 2008-2015. The specific approaches of 'culture' and 'community' are identified to suggest the idea of an 'Innovation Community', with the aim of enriching discussions and strengthening inclusive innovation processes within cluster development at UMSS.

Paper 6:

Acevedo, C. (2017). Public university and production of 'the common' for emerging inclusive innovation systems in Bolivia. (in manuscript). A previous version was presented in the 14th Globelics International Conference: "Innovation, Creativity & Development: Strategies for Inclusiveness and Sustainability", 12th to 14th of October 2016, Bandung, Indonesia.

This paper discusses how the cluster development experience at UMSS should not be viewed as isolated from other Bolivian experiences of inclusion and collective action. Existing literature on inclusive innovation is examined, and the analysis highlights the relevance of the 'production of the common' as a social relation with potential to build bridges between the public university and a wider range of social actors within emerging inclusive innovation systems in Bolivia. These interactions will lead to long-term relations of mutual learning and the enhancement of local capacities in society from a bottom-up perspective.

Figure 4.1 Flow and interaction map of papers in relation with the Specific Objectives (SO) and Research Questions (RQ) in the thesis.



4.2 Paper 1

Bolivian Innovation Policies: building an inclusive innovation system

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Abstract

This study explores the policy paths the Bolivian government has followed in the last three decades to organize science, technology, and innovation. We present strategies proposed by the government to make its National Innovation System more dynamic and socially inclusive. We analyse the process and strategies followed under the light of the Triple Helix (government-industry-university) model of innovation.

Keywords: Innovation system; Triple Helix; inclusive innovation; developing countries; Bolivia.

Introduction

Bolivia, as many other countries in Latin America, is creating policies and institutions and building networks to strengthen the dynamics of its National Innovation System (NIS). This more systemic view of the innovation processes explicitly recognizes the potentially complex interdependencies and possibilities for multiple kinds of interactions between the various elements of the innovation process (Edquist et al., 1999). The Bolivian government uses this systemic approach at the policy level to unify strategies and gather national institutions to address social priorities such as poverty and inequality reduction, food safety, and interactive local production of knowledge as well as to increase industrial competitiveness.

We start this study by briefly introducing the concept of NIS and its relevance for developing countries focusing on Latin America. Then we present a narrative description of the main policies and institutional context promoted to organize science, technology, and innovation in Bolivia since the end of the dictatorship period. Finally, we analyse the “National Plan of Science, Technology and Innovation” under the light of the Triple Helix model of innovation, used as a tool to discuss the characteristics of the model adopted in Bolivia.

National Innovation Systems (NIS)

Concept framework

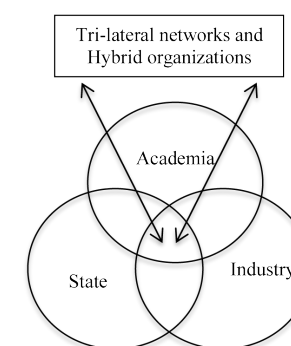
The concept of National Innovation System (NIS) enhances the role of innovation and interactive learning in economic growth and development within national borders. Lundvall et al., (2009) define the national innovation system as an open, evolving,

and complex system that encompasses relationships within and between organizations, institutions, and socio-economic structures, which determine the rate and direction of innovation and competence-building emanating from processes of science-based and experience-based learning.

Based on the successful experiences in developed countries, sooner rather than later, the NIS concept was also introduced in developing countries as a conceptual framework to create new policies and strategies to organize science and technology as well as the production and diffusion of knowledge for development responding to urgent social needs. Developing countries are less developed in terms of institutional composition, sophistication of scientific and technological activities, and linkages between organizational units (Kayal, 2008), thus strategies that could work in some countries could do not work as well in another. Thereby - according with the innovation system approach - innovation is considered to be deeply dependent on the local specificities of social, political, and economic relations, being therefore directly affected by both history and the particular institutional context of countries or regions where it occurs (Scerri et al., 2013).

We use in this study the Triple Helix approach developed by Henry Etzkowitz as a starting perspective to understand and discuss interactions between the main institutions in the Bolivian innovation system development process. Arocena et al. (2000), cited by Etzkowitz et al., (2003), point out that the Triple Helix explains the formation and consolidation of learning societies, deeply rooted in knowledge production and dissemination and a well-articulated relationship between university, industry and government. The model helps explain why the three spheres keep relatively independent and distinct status, shows where interactions take place, and explains why a dynamic triple helix process can be formed with gradations between independence and interdependence and, conflict and confluence of interests (Etzkowitz, 2008).

Figure 4.2 The Triple Helix model of university-industry-government relations



Source: Etzkowitz et al., (2000)

This model can be used at different levels (macro-meso-micro) within a nation as an operative framework to strengthen innovation policies and mechanisms proposed according to the local context and priorities. Triple Helix strategies are especially im-

portant to less-developed countries and in particular to Latin American countries with scarce R&D activities undertaken by firms, and mostly concentrated at universities and research institutes (de Mello et al., 2008).

NIS in Latin America

Alcorta et al., (1998) locate the origins of national research coordinating organizations in Latin American countries in the 1950s, with the creation of the first national councils for science and technology (the National Institute for Scientific Research - Mexico, 1950; the Brazilian National Research Council - Brazil, 1951; and the National Council for Science and Technology – Argentina, 1958). During the 1960s and 1970s, a significant number of Latin American countries established some form of systemic policy thinking to develop science and technology (S&T) organizational structures. The mere creation of such institutions, however, did not make them operational or dynamic, and in some of the countries (Bolivia, Paraguay, and Nicaragua) S&T plans as well as the so- called S&T funds existed on paper only (Velho, 2004).

In 1964, a wave of military coups (that began with the Brazilian coup) started in Latin American's governments, and lasted until the first half of the 1980s. The relationship in this period between the state and the industrial sector was important, but it was not focused on innovation (Arocena et al., 2000). Influential thinkers in Latin America argued that the way in which the research councils were operated was 'marginalising' local science from local needs. They associated this with the character of the industrialization model adopted – defined by its reliance on technology transfer – which did not require local R&D activities but only the accumulation of specific capabilities to operate technology developed elsewhere (Velho, 2004).

The end of the dictatorship period was followed by a democratic transition - so called *neo-liberalism* - proposing macroeconomic policy and economic reforms highly influenced by the Washington Consensus. This model prioritizes the opening up of domestic economies to foreign competition, the deregulation of a vast array of markets, and the privatization of public-sector firms (Katz, 2001). All of these measures, but primarily the latter, were implemented with wide opposition from social movements. Yoguel et al., (2007) describe three main characteristics of S&T policies of that time: first, a general perception that public goods were dispensable because knowledge could be incorporated through the purchase of capital goods; second, the selection of prioritized industrial sectors was rejected, because it was the market that should lead the selection; and third, there were no policies that promoted networks, except by isolated experiences through horizontal policies.

Eventually, political and economic breakdowns in Venezuela after 1998 and in Argentina after 2001 and widespread social protests in Ecuador and Bolivia in the early years of the twentieth century culminated in the election of governments committed to the introduction of counter-cyclical policies, programmes of national (and sometimes regional) economic investment, and the extension of social policy coverage (Grugel et al., 2012). These events opened the scenario up to a new attempt to build a more democratic and socially oriented economic model in Latin America called post-neo-

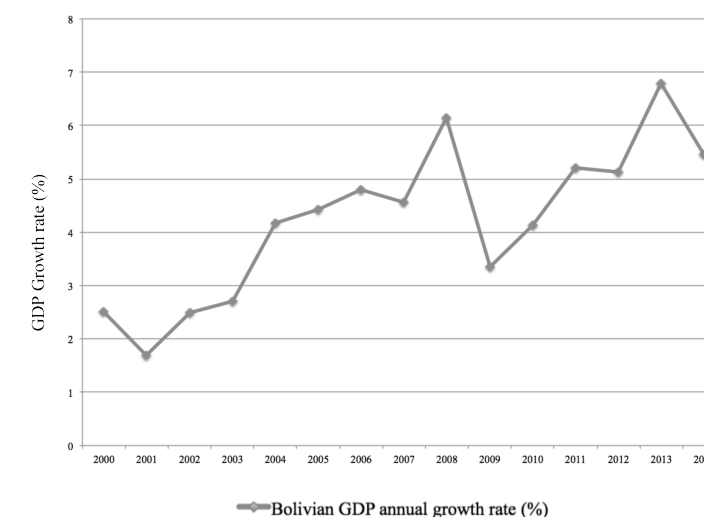
liberalism (find more in "Contemporary Latin America: development and democracy beyond the Washington Consensus" by Panizza, 2009). Grugel et al., (2012) assert that post-neoliberalism is not so much an attempt to return to state capitalism as it is an attempt to refashion the identity of the state, redefine the nature of collective responsibilities, build state capacity, and rethink who national development is for. In this context, a renewed set of strategies for development has emerged in Latin America. Post-neoliberal governments look at NIS as a tool to orient science, technology, and productive structures to achieve sustainable national development. Under these conditions, the concept of inclusive innovation has been enhanced at the time that governments strengthen national innovation systems involving social actors in the decision-making process.

Bolivian innovation policies

Background

The Bolivian GDP increased 6.8% and 5.4% in 2013 and 2014 respectively following a positive tendency in the last decade. The rate of growth in 2013 was the highest in the last thirty-eight years (Central Bank of Bolivia, 2013). The main economic activities that contributed to this growth were: crude oil and natural gas exploitation, financial services, charges for bank services, and internal revenue (INE, 2014). This performance follows the positive tendency in the Latin American region in the last years and exposes the high dependence on natural resources exploitation.

Figure 4.3 Bolivian GDP annual growth rate (%) 2000-2014



Source: World Bank database ¹

¹ The statistics is based on information available at The World Bank website (www.worldbank.org) retrieved at March 23th of 2015.

During the last thirty years, the Bolivian government has created institutions and established councils at the national and regional levels as an attempt to organize S&T. After the dictatorship period ended in 1982, Bolivia found itself in an instable transition to democracy. At the beginning, Bolivia experienced an apparent economic prosperity because of international loans and good international prices for Bolivian exports, such as tin and oil. Nevertheless, that situation was followed by one of the largest foreign debts crisis in Bolivian history, along with hyperinflation that destroyed the purchasing power of the population.

During the 1990s, like many countries in Latin America, Bolivia followed several economic reforms including an extensive privatization of the state enterprises and reduced spending in social services. Arriarán, (2007) considers that the transition to democracy in Bolivia seemed to be characterized by a kind of divorce between the economic and the political. The economy was, in fact, stabilized (stopping hyperinflation). However, it was done based on a model that paradoxically widened social gaps and neglected distributional and equity aspects.

In 2000, the Bolivian Agricultural Technology System (SIBTA) was created under the Ministry of Agriculture as a funding and technology diffusion mechanism to support the agricultural sector. The SIBTA supported agricultural research and extension, creating four regional semiautonomous foundations (FDTAs): highlands, valleys, tropical, semiarid lowlands (Chaco). The evaluation of Hartwich et al., (2007) of this experience suggested that to foster efficient agricultural innovation processes in a decentralized funding scheme such as the SIBTA's approach, the government needs to actively establish priorities, assure that others participate, guarantee transparency and accountability, maintain responsiveness to the demands of users, focus on impact, delegate administrative responsibilities to local agencies that are closer to the farmers, strengthen linkages among the various innovating agents, and provide a strategic vision.

The Ministry of Planning of Development created other systemic initiatives in 2001 with the Bolivian System of Productivity and Competitiveness (SBPC). This initiative introduced a new understanding of the industrial sectors as regional productive chains and proposed mechanisms to organize institutions such as universities, industry, and public bodies around this perspective. At the regional level, Departmental Committees for Competitiveness (CDC) were created in 2004 as operative tools for the system. They were supported by international cooperation, promoting agreements with regional institutions such as universities and suggesting regional strategies based on studies of local productive chains. There were 18 productive chains studied, generating important information but mostly proposing strategies difficult to replicate in the unstable Bolivian context. Eventually, the CDCs became more decentralized from the SBPC, focusing on supporting the medium-large private industries at the regional level. The general reflections of Hartwich et al., (2007) about the Bolivian systemic approaches during the neoliberalism period state that governance in innovation systems is less about executing research and administering extension services and more about guiding diverse actors involved in complex innovation processes through the rules

and incentives that foster the creation, application, and diffusion of knowledge and technologies.

Plans, reforms and support structures 2006 – 2014

A new government was elected in December of 2005 with a strong indigenous rhetoric and brought significant social stability by increasing the political participation and power of the traditionally excluded indigenous groups and other social movements. The recovery of the social and indigenous esteem was an early effect of these measures involving an important participation of social and indigenous movements in consultation and governance processes. The new government enjoyed a wide majority in the parliament, which allowed it to push forward larger reform processes with the main goal of creating a new political state constitution (CPE), which was approved in 2008 by the Congress of the Nation.

With the new CPE, Bolivia adopted a new *plural* economic model, so-called “national-productive” model (García, 2008). This model recognizes several forms of economic organizations - community, state, private, and social cooperative - and is mainly focused on an active participation of the government in economy, the industrialization of natural resources, a focus on social needs, and the redistribution of wealth.

The government started the reforms with the nationalization of key industries, reaching 19 firms by 2014: (e.g.: YPFB (hydrocarbons), 2006; Huanuni (mining), 2006; ENTEL (telecommunication), 2007; Vinto (smelter), 2007; Air BP (jet fuel), 2009; Corani (electricity), 2010). Another early measure implemented was to reduce the president's salary, which implies by law that no other public servant can earn more than the president. According to the Ministry of Economy and Finance, the president's salary was 18,800 BOB per month by 2014, or about 2,845 USD\$. This austerity measure limits the possibility of economically incentivizing the research community (at public universities) that increase their current activities (researching and teaching) by participating in future initiatives that encourage collaboration with productive actors and the government.

In 2006, the Ministry of Planning and Development presented the “National Plan for Development 2006-2011” (PND), later approved by a supreme decree in 2007. This plan was important for the new political reforms, because it was used as reference for following actions at the national and regional levels. The plan proposed policies, strategies, programs for development, and gave a high priority to increasing capacities in science, technology, and innovation to support the productive sector. It also defined strategic areas for productive development with a systemic and socially inclusive approach through the creation of the Bolivian Innovation System (SBI). The plan oriented Bolivian governmental institutions to face the challenges of gathering and organizing all the actors of the system in order to find technology-based solutions, while recognizing and including ancient indigenous (non-academic) knowledge in the process of innovation as well.

The responsibility of the SBI lies in the Vice-Ministry of Science and Technology (VCyT), created in 2006 under the Ministry of Planning and Development. In 2007, the VCyT presented a proposal to establish the SBI, which schematizes institutional complexity and relations between the actors, and identifies 15 geographical sub-regions based on productive and cultural similarities to increase the scope of the actions (Carvajal et al., 2007). In 2009, the VCyT was moved to the Ministry of Education, but remained in charge of promoting the SBI. The VCyT prepared a new planning draft in 2009, and after an extended participatory consulting process, published an official version in 2013. This plan is focused on long-term strategies for the period 2014-2025. It seeks the development of human and institutional capacities under the rhetoric of sovereignty in science and technology with the perspective of social inclusivity. We will discuss the strategies presented in the plan in more detail in the following section. Meanwhile, we mention other initiatives carried by other ministries according to the framework of the Bolivian Innovation System presented in the PND, but independently from the VCyT's proposal.

In 2008, the National Institute for Agricultural and Forestry Innovation (INIAF) was created under the Ministry of Rural Development and Lands (MDRyT). It was formed following the PND guidelines as a component of the Bolivian Innovation System (SBI). It is a decentralized institution with the aim of establishing guidelines, implementing policies, and generating technologies for agricultural and forestry innovation. This institution replaced the functions of the former SIBTA. The INIAF supports farmers and seed suppliers to increase the productivity on prioritized sectors (wheat, potatoes, corn, rice, vegetables, livestock and forage, quinoa, forests and sugarcane). The INIAF seeks to increase the scope and impact of the former experiences by using participatory and inclusive mechanisms to build consulting platforms at four levels: national, regional, local, and by product. These platforms involve researchers, local producers, institutions (private, public and mixed), and agents from the government at all levels.

On the other hand, the Ministry of Productive Development and Plural Economy (MDPyEP) implemented three strategies to strengthen the productive sector according to the PND guidelines. In 2008, the MDPyEP created three decentralized development agencies – *ProBolivia*, *Insumos Bolivia*, and *Promueve Bolivia* – with the aim of changing the productive matrix and supporting competitiveness in the manufacturing sector. At the same time, a new norm was approved that allows these agencies to execute public-public and public-private financial transfers. In this way, in 2012 these agencies started promoting contests as a strategy to motivate public-private as well as academic and non-academic partnership for innovation projects in prioritized sectors (food, leather, wood, metal-mechanic, textile, and handicrafts). A second strategy was the creation of “productive clusters” (complejos productivos) supported by the regional governments based on the capacity of the local productive chains. The productive clusters will be technically strengthened by productive centres for innovation (CIP) in collaboration with public universities and regional governments. The third strategy to change the productive matrix was the creation of state enterprises in strategic national

priority areas (in addition to those ones nationalized). By now, five new state enterprises have been built (LacteosBol (dairy products), 2007; PapelBol (paper), 2007; CartonBol (cardboard), 2010; EceBol (cement), 2008; and Eba (almond), 2009), but there are many others pending. In order to manage this process, the Development Service for State Enterprises (SEDEM) was created. These state enterprises seek to ensure the supply of basic products for the population and the industry, but a lot of controversy was generated around unfair competition from the state with the local-private industries. Anyhow, it is part of the strategy adopted by the government to mobilize resources and strengthen the national economy. Most of these strategies are in the very first phases of implementation. Follow-up studies will complete analysis and will determine their impact on the society.

In 2012, the Ministry of the Presidency started a wide consulting process to create a long-term roadmap for national development so-called “The Patriotic Agenda: Bolivia 2025.” This document was presented in 2014 with the aim of continuing the reform process started with the National Plan for Development (PND). The Patriotic Agenda was built based on 13 core guidelines, identifying science and technology explicitly in the 4th guideline as “*sovereignty over identity and development of science and technology*.” In that section, innovation is located in the core of the proposal and is considered a result of a process of systemic convergence that involves the academic sector, the government, the productive sector, and the native-indigenous sector (both as knowledge-generators and users of science and technology) as main actors.

General Comments

The Bolivian government promotes several initiatives around the systemic vision of innovation for development, looking for a closer partnership between the academic, the productive, and the governmental sectors to reduce poverty. We have considered the initiatives presented by the VCyT as a core element in the system, which is in charge of organizing institutions for innovation to give a conceptual framework and promoting policies to make it more dynamic. However, we argue that the dimension of the current Bolivian Innovation System exceeds the scope of the System of Innovation under the VCyT, which responds mainly to the Ministry of Education's concerns, but is complemented mainly by the initiatives of the Ministry of Agriculture and the Ministry of Productive Development. We expect in the short-term the Patriotic Agenda and its executing organisms to coordinate (at the highest level) all the systemic initiatives to promote innovation for sustainable social development.

National Plan for Science, Technology and Innovation (PNCTI)

Main components of the PNCTI

In 2013, the VCyT presented a National Plan for Science, Technology, and Innovation (PNCTI). It was the result of a graduated consulting process that involved 940 representatives of the three main sectors identified in the system (667 academic, 141 social-productive, and 132 government). In this plan, the VCyT defines the Bolivian System for Science, Technology, and Innovation (ST&I) as follows:

The set of interrelated and complementary actors, using science, technology, and innovation in a coordinated and constructive form that generates integral solutions for productive, social, and environmental problems, with a focus on participatory equitable and sustainable development. (VCyT, 2013)

The plan is organized in two phases of implementation; the first one (2014-2019) looks to strengthen the system, and the second one (2020-2025) looks to consolidate the system according to the challenges proposed in the “Patriotic Agenda: Bolivia 2025.”

The PNCTI presents eight prioritized sectors to be fortified: health; agricultural development; industrial and manufacturing transformation; local and ancient non-academic knowledge; natural resources, environment and biodiversity; energy; and mining.

The Bolivian System of ST&I was presented in terms of the interactions (demand-pulled) between three main sectors: the knowledge-generating sector, the science and technology demanding sector, and the government sector. The VCyT presents a Triple Helix approach formed by bilateral relations among the government, the knowledge-generating sector, and the sector that demands science, technology, and innovation. These sectors are defined in the PNCTI as follow:

- *The governmental sector* involves all the entities with the capacity to generate, regulate, promote and implement policies related to science and the technological development of the nation. The main representatives of this sector are the Ministry of Education, the Vice-Ministry of Science and Technology (VCyT), and institutions yet to be created to support the system according with the plan.
- *The knowledge-generating sector* involves universities, public and private research centres, and non-academic agents, highlighting local experiences and ancient knowledge mainly developed and preserved by indigenous groups. The role of this sector includes activities of human training skills for research, technology development, technology transfer, and professional management of the productive sector.
- *The sector that demands science, technology, and innovation* is represented by the socio-productive sector that encompasses the society (in general), agricultural producers, indigenous groups, and the industrial sector (public, private, small, medium, and large enterprises).

In this model, social actors and indigenous groups are explicitly included and recognized as knowledge producers as well as users of science, technology, and innovation. This approach responds to the claim of inclusion of the traditionally excluded segments of the population as dynamic actors in innovation processes and development strategies.

The challenge for the Bolivian government in a demand-pulled model of innovation is that this model needs a dynamic demanding sector able to mobilize and organize internal resources into a long-term productive vision that involves sectorial leaderships that would be able to facilitate collaboration with other institutions in the system and look for common goals rather than institutional claims. The Bolivian economy is still highly dependent on natural resources, and most of the population works in a

low added value sectors. This context has influence on the performance of a demand-pulled model of innovation. Sometimes in non-dynamic sectors, financial programs of cooperation are exploited only for the traditionally best-positioned companies and organizations, which as a result contributes to maintaining current system dynamics. In fact, Benavente (2005) and Yoguel et al. (2007) present evidence from Chile and Argentina respectively pointing out that the experiences of horizontal financial agencies showed a tendency to concentrate supporting resources for the productive sector in a reduced number of firms, probably those most dynamic in their sectors, but not contribute to reducing inequality as expected.

PNCTI first phase of implementation (2014-2019)

This phase of the PNCTI is focused on the passage of a new Law of Science, Technology, and Innovation and its regulation. It will create a decentralized unit to execute the PNCTI and another to manage the financials of the social-productive and academic sectors (both under the VCyT).

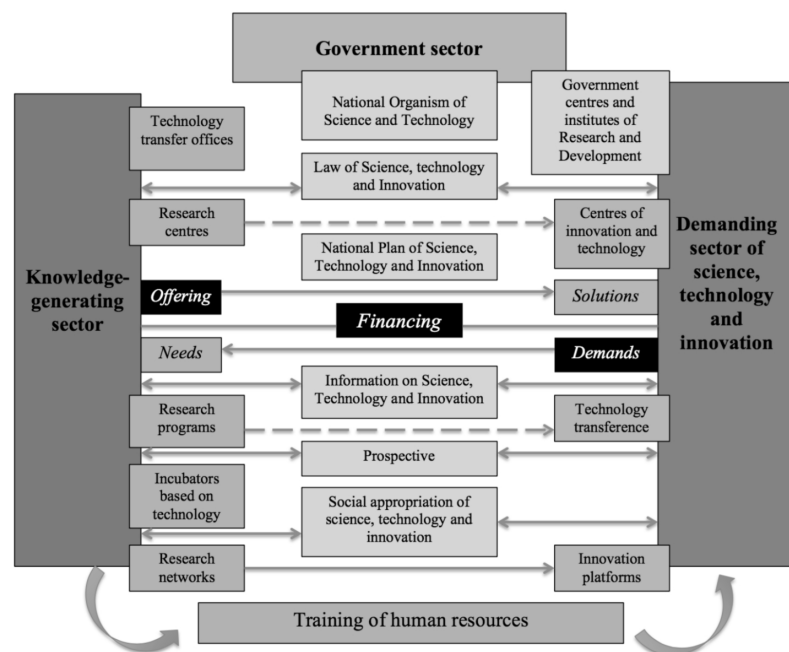
The starting actions performed in the last years by the VCyT as a foundation for the system were:

- Establishment of 12 scientific and technological research networks in prioritized fields, gathering more than 400 scientists. These networks offer scenarios to discuss socio-productive needs and to apply for resources by proposing projects based on trans-disciplinary collaboration.
- Facilitation of free access to 19 international databases linking national scientist to over 3000 Scientific Journals.
- Presentation of 2 editions (2009 and 2011) of surveys about the Bolivian science and technology potential. These reports put an end to a decade without similar studies performed at the national level.
- Yearly promotion of “scientific olympics” (national contest) as part of a program for the popularization of science. This contest has the purpose of increasing scientific and technological capabilities for high-school students through competitions in mathematics, chemistry, biology, informatics, and robotics. In more than four years, more than a half million students from all over the country have participated in the olympics.
- Organization of tailor-made workshops for public, private, and academic partners in order to spread the concept of innovation systems, understand the role of key stakeholders, and use this concept as a policy tool in the Bolivian context.

This phase seeks to consolidate these initiatives and allocate resources to make them sustainable in the time. 75% of the Bolivian capacities (infrastructure and human resources) in science and technology lie in public universities (VCyT, 2011). This tendency is repeated in most Latin American countries. In this context, the VCyT identifies universities as key institutions for initial mobilizing activities. In addition to the started actions mentioned above, the VCyT proposes the implementation of a *National Program for Developing Human Talent* in strategic scientific and technological areas - food, biodiversity, mining, and energy - as well as looking for the support of existing research infrastructures at universities in collaboration with the socio-pro-

ductive sector. The first phase also stipulates initial activities through the creation of several mechanisms to facilitate linkages between the actors and implement support programs. Nevertheless, the implementation of most of them will be clarified in detail in following planning documents to be elaborated for the second phase (2020-2025). Meanwhile, the PNCTI presents a scheme of the bilateral relations in the system including these organizations and institutions to be created:

Figure 4.4 Sectors and interactions in the Bolivian System of Science, Technology, and Innovation



Source: VCyT (2013)

The second phase (2020-2025) of the plan suggests a consolidation of the functions of the mechanisms to be started during the first phase, directing them towards objectives to be presented in the “Patriotic Agenda: Bolivia 2025.” In this phase, there is expected to be an increased scope of activities of the Unit of Execution and for the Financing Program, promoting the implementation of new mechanisms (organisms to transfer research results, scientific parks, incubators, and so on). At the same time, the training programs are initially supposed to focus on master degree programs that could be continued by PhD programs to enrich the critical mass of researchers. Then it comes to the challenge of creating strategies for incorporation of new professionals, not only in the academic sector, but also in the productive sector. Finally, the phase includes plans to transform the monitoring system of science and technology into an observatory of science and technology that also includes prospects studies in different sectors.

General Comments

The PNCTI presented proposes the creation of new institutions and several new experiences of organizations where Bolivia has few or no successful experiences yet (industrial parks, incubators, innovation platforms, and organisms for technology transfer). To achieve the proposed goals, the plan also demands building innovative culture among the involved actors, creating a solid law for S&T and reliable platforms to create trust and networking, as well as breaking institutional barriers for collaboration and ensuring inclusivity. Recent experiences at a public university (Universidad Mayor de San Simón) creating the first university Technology Transfer Office have shown that these kind units can support the articulation of regional innovation systems. The public university can work as a relatively neutral and reliable platform for dialogue in order to support innovation processes and reinforce trust after decades of deteriorated relations among the actors.

Concluding remarks

The Triple Helix model of innovation can be used as an ex-ante concept and as a strategic tool to open up roads for a catch-up process with an ultimate goal of creating a learning society (Etzkowitz et al., 2003). This can be the approach in Bolivia, where a similar interactive triadic approach has been adapted and expanded to be more socially inclusive, recognizing indigenous groups and other social movements as important actors in the production and use of knowledge in terms of ST&I. At the same time, it is necessary to give one more step in PNCTI breaking linear models of interactions and start to focus on non-linear relations in order to establish new roles in the traditional institutions in the system. This can increase the cohesion between actors to create better synergies emerging also from bottom-up initiatives in the system. Triple Helix processes can enrich the current practices denoting not only the relationships of university, industry, and government, but also internal transformation within each of these spheres (Etzkowitz et al., 2000).

Currently, several governmental bodies promote diverse initiatives focused on fostering innovation culture based on Triple-Helix partnerships to contribute to national development by responding to socio-productive needs. Since 2006, Bolivia has had a relatively stable socio-political environment. This situation allows for the construction and implementation of long-term strategies and reforms to achieve social goals. The VCyT promotion of the Bolivian Innovation System since 2007 has driven the development of a medium-term plan to strength the National System of Science Technology and Innovation (2015-2019). This proposal, complemented by initiatives of other ministries, needs a national coordinator body in order to make an efficient use of the limited resources available. The long-term plan, so-called “Patriotic Agenda: Bolivia 2025”, will orient efforts of all the governmental bodies promoting innovation for development towards a common goal and a more efficient use of the national resources allocated.

We must be conscious of the fact that demand-based strategies in non-dynamic socio-productive sectors need strong leaderships from the sectors and strategies to create

cross-boundary organizations to catalyse processes of networking at national and sub-national levels, ensuring the inclusivity at several levels of the more needed population to reach the social impact. The reflections of Cozzens et al., (2009) based on studies of developing countries explain how innovation and inequality co-evolve with innovation, sometimes reinforcing inequalities and sometimes undermining them.

The success of NIS rests on the degree of integration and matching efficiency between the various drivers and components of the system (Kayal, 2008). The creation of national research networks became an important scenario to recover and open new bridges with the research community to discuss national policies, diffuse research results, and share bottom-up initiatives contributing to the system. Since most of the research and high-level training capacities are concentrated in few public universities, this gives them a key role in the Bolivian Innovation System. This social responsibility for the national development is transforming the traditional missions of universities. They are evolving from providing higher education and scientific knowledge into constantly encountering claims from society and government to transcend institutional spheres in the knowledge production process. This is done by promoting institutional dialogue and involving social actors as sources of knowledge and users.

Finally, no one of these important efforts will be complete if the national government does not consider substantial reforms to market policy to promote and support the local industry (private-public) and entrepreneurs. This issue has been a constant demand in all the dialogue platforms. Bolivia is part of a regional policy learning process looking at the national innovation system concept as an alternative for development and competence building. The Bolivian policies for innovation means one step forward focusing efforts also on the legitimacy of science, technology and innovation by including the indigenous groups and society in general as important actors in the creation of knowledge in collaboration with the traditional institutions mentioned in the Triple Helix model of innovation (university-government-industry). We expect that further studies can determine the impact of these policies in the co-evolutionary processes. The experiences gained can contribute to the perspective of social inclusive innovation systems, but wider perspective of inclusion is needed to face national challenges of development as proposed in the “Patriotic Agenda 2025.”

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4.3 Paper 2

Developmental university in emerging innovation systems: the case of the Universidad Mayor de San Simón, Bolivia

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Abstract

This paper presents a case of the Universidad Mayor de San Simón (UMSS) where pro- active institutional efforts have shaped collaborative dynamics characteristic of a ‘developmental university’. The chapter offers empirical insights about the public universities’ competency in emerging inclusive innovation systems within a relatively undemanding context, in Bolivia. The study is a result of a participatory action research performed within UMSS’ technology transfer office. It describes the role of this university’s unit as an innovation intermediary and manager, which developed co- evolutionary approaches of collaboration linking the university with the industry, government, and other stakeholders and shaping the science, technology and innovation agenda within the university, regionally and nationally.

Keywords: developmental university; inclusive innovation systems; technology transfer office; Mode 2; cluster development; Bolivia.

Introduction

There is a strong need to generate a normative, financial and institutional environment that facilitates interactive dynamics of collaboration between research universities, the government and the industrial sector in many developing countries including Bolivia. Given a certain autonomy universities often enjoy, they are well positioned to promote internal transformations and to adopt a proactive role in initiating and developing collaborations with other actors, thus enhancing the positive impact of university research activities on society.

This chapter shares the experience and lessons learned from implementing several initiatives launched by a public university in order to make its internal and external innovation environment more dynamic. The university in focus is Universidad Mayor de San Simón (UMSS), the second largest public university in Bolivia located in the Cochabamba region. The university aims to enhance the impact of its research activities on regional and national development. To this end, it adopted a systemic perspective and proactive institutional attitudes to promote innovation by developing trans-disciplinary platforms of interaction in a context of major social, cultural and political transformations in Bolivia.

The chapter presents a case study based on eight years of participatory action research by the authors who performed academic and policy-making roles during the study period. The primary data from the university Technology Transfer Unit (UTT) and from public sources constitute the basis of the analysis. The lessons learned at UMSS can be useful to build fruitful long-term relations, not necessarily focussed on state-centred or market-centred initiatives, but aiming at inclusive development aspirations.

Theoretical framework

National Innovation Systems (NIS)

The concept of National Innovation System (NIS) has been widely used by policy-makers and studied by academics in the last decades. Lundvall et al. (2009) defined the national system of innovation as an *“open, evolving and complex system that encompasses relationships within and between organizations, institutions and socio-economic structures, which determine the rate and direction of innovation and competence-building emanating from processes of science-based and experience-based learning”*.

In the case of developing countries, especially in Latin America, the concept of NIS has been used as the basis for economic development policies, but it is still unclear how operative this concept is in specific contexts. Edquist & Hommen (1999) argue that the systemic approach to innovation process explicitly recognizes the potentially complex interdependencies and possibilities for multiple kinds of interactions among its various elements. In this light, many empirical studies recognize that university-government-industry interactions are key elements in systemic process of innovation. The Triple Helix model of university–industry–government relations (Etzkowitz, 2008) shows the interaction of the three elements in a system and tries to capture the dynamics of both communication and organization as an overlay of exchange relations that feed back to the institutional arrangements (Leydesdorff & Meyer, 2003). In this model, industry operates within the Triple Helix context as the locus of production; government as the source of contractual relations that guarantee stable interactions and exchange; and the university as a source of new knowledge and technology, the generative principle of knowledge-based economies (Etzkowitz, 2003). In the Bolivian context, however, it was pointed out that the Triple Helix Model should be supplemented by the fourth element, meaningful societal participation.

According to Lundvall (2010) the NIS concept is based on two main assumptions: (i) the most fundamental resource in modern society is knowledge and, accordingly, the most important process is learning; (ii) learning is predominantly interactive and, therefore, a socially embedded process, which cannot be understood without taking into consideration its institutional and cultural context. In the context of developing countries, Sutz (2012) argues that ‘innovation as learning’ is a systemic failure due to the relative weakness of innovation processes in developing countries and the lack of opportunities to learn through such processes. This failure is systemic because it is built-in in the productive specialization of most developing countries where the learning content of productive activities is weak. In such circumstances, universities play a

key role in learning and innovation but the specific position and functions of universities and their mechanisms of interactions within NIS of developing countries are not clearly defined mostly as a result of the NIS context dependency.

Universities in National Innovation Systems

A sizable proportion of the research capabilities of Latin American countries is concentrated at universities. Recently, the institutional relevance of universities as facilitators of social and economic development in society via their research activities have been increasingly emphasized. Vaccarezza (2011) argues that current Latin American research suffers from a double periphery status: it occupies a relatively marginal position within the international scientific community and is not fully able to integrate into the ‘context of application’ marked by innovation and production flows of international capital. This situation becomes even more critical in the Bolivian case, where according to the Vice-Ministry of Science and Technology (VCyT) (2011), about 90 per cent of the country’s research capabilities are located at (mainly public) universities. As a result, the last two decades saw intensified efforts to embed universities into NIS with the goal of their active participation in socio-economic development of their regions.

For centuries, the main two missions of the universities were teaching and research. Nowadays, it is believed that universities should have more than these two missions. Brundenius, Lundvall and Sutz (2009) propose the ‘third mission’ of universities to further the relationships of universities and the society to which they belong. Similarly, the concept of ‘Mode 2 science- production’ contends that knowledge is produced based on a fluid dialogue between the academy and other actors. Unlike Mode 1 in which knowledge is mostly generated by academic actors within a specific community, in Mode 2 knowledge is produced in a context of application involving a much broader range of perspectives. Mode 2 is transdisciplinary and not only draws on disciplinary contributions but also on new frameworks beyond them; it is characterised by a heterogeneity of skills, by a preference for flatter hierarchies and transient organisational structures. It is more socially accountable and reflexive than Mode 1.

In Bolivia, most policymakers still regard universities, especially public ones, as potential ‘knowledge generators’ to facilitate socioeconomic development by transferring research results, technology and innovation. Bramwell and Wolfe (2008) maintain that this mechanistic view of the way basic scientific research translates into commercial products demonstrates a misconception of the commercialization process and the role universities herein. The flow of knowledge drives innovation, but knowledge transfer from universities to industry is a complex process that involves many different actors. Brundenius et al. (2009) argue that linking universities closer to users is fundamental for enhancing their role in relation to economic development. Especially in countries where a significant proportion of the research effort is located at universities, it is important to find ways to enhance the interaction between universities and industry as well as with other users in society.

This non-isolated or self-sufficient understanding of universities’ role represents basic foundations of new emerging concepts. Etzkowitz (2008) - looking at some experi-

ences in California (USA) - proposed the concept of the “entrepreneurial university”. He argues that the *capitalization of knowledge* is the heart of a new mission for the university, linking universities to knowledge users more tightly and establishing the university as an economic actor in its own right. This model is impractical in the Bolivian context since values of public university are strongly linked to social concerns and the social common sense is not perceptive to such institutional behaviour. Additionally, Bolivia does not have well-developed productive structures nor public normative structures with respect to intellectual property and technology transfer procedures.

In developing countries, the concept of a developmental university seems to be more appropriate to the existing context, for example in Bolivia. Brundenius et al. (2009) defines a developmental university as an open entity that interacts with different groups in society, including industries, but it does not have profit-making as one of its missions. Its major goal is to contribute to social and economic development while at the same time safeguarding a certain degree of autonomy. Within the Latin American context, Arocena, Göransson and Sutz (2015) went further, arguing that such universities are committed specifically to social inclusion through knowledge and, more generally, to the democratization of knowledge, along three main avenues: democratization of access to higher education, democratization of research agendas and democratization of knowledge diffusion. Additionally, they point out that developmental universities are those involved in the production of learning and innovation processes which foster inclusive development.

It follows from the discussion above that universities have the power to determine the way in which different university bodies interact and contribute widely to society. Universities can be the test laboratories for adapting and creating new university-based mechanisms to support NIS strategies, and in general to further societal goals carefully taking into consideration the local context. Under this umbrella, university bodies like technology transfer offices can play a crucial role leading institutional transformations and linking the university research dynamics with the socio-productive demands. Wahab, Rose and Osman (2012) refer to Maskus (2004) and contend that the technology transfer concept involves not only the transfer of technological information or knowledge but also shaping the technology recipient's capability to learn and absorb technology into the practical market applications. More recently, a number of scholars argue that the main role of UTTs is to build legitimacy of university actions in society (Codner, Baudry, & Becerra, 2013; O'Kane, Mangematin, Geoghegan, & Fitzgerald, 2014) defined as a “*generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions*” (Suchman, 1995).

The case of the Universidad Mayor de San Simón

The context of the study

Bolivia's state reforms started in 2006 and recognized the need to develop innovation policies to foster a NIS. The NIS was first presented as a tool of the “National Devel-

opment Plan (2006-11)” aimed at strengthening the national research capabilities and linkages with the productive sectors. In 2013, the VCyT presented a “National Plan of Science, Technology and Innovation (2014-25)” (ST&I) developed after a wide participatory process, which included representatives from several social movements. The plan divided institutions within the system based on bilateral and trilateral relations between three main sectors interacting: (i) the government, (ii) the knowledge-generating sector (iii) and the recipient sector of ST&I. In addition to the traditional institutions in the former two groups - universities and industries – the plan explicitly included indigenous groups and social grass roots organizations to play a role as both knowledge generators and recipients of ST&I. A more diversified approach adopted by the plan aimed to be more socially inclusive by recognizing academic and non-academic ‘native indigenous’ knowledge as a source for demand-oriented innovation (Acevedo, Céspedes, & Zambrana, 2015).

The VCyT report (2011) estimates that more than a half of the Bolivian research capabilities are located in public universities with only 4 per cent of research activities in the country focused on experimental development. This reflects low orientation towards the generation of own knowledge and low knowledge-absorptive capability of the national industries. Currently, the interactions between Bolivian universities and the industry are very scarce. This appears to be the case for many countries of the global south where market demand for knowledge is very low resulting in underutilisation of the (weak) knowledge that is available and further weakening the knowledge capabilities of developing countries (Arocena & Sutz, 2014).

The Universidad Mayor de San Simón (UMSS) was created in 1832. It is a public university, declared as an autonomous one in 1931. It is also a part of the Bolivian University System (SUB) and currently is the second largest university in the country enrolling approximately 65 000 students as of 2014. The University offers about 82 undergraduate courses within eleven faculties and one technical school. Graduate programs, mostly specialization and master programs, are primarily oriented at training professionals for the local and national markets. Students in these programs are usually people already holding a job, wishing to improve their skills in order to enhance their performance at work, and increase their chances when competing in the labour market. Unlike under-graduate education, which is fully funded by the government, graduate training requires students to pay for their full tuition. Only research-based graduate programs implemented with the support of international cooperation offer scholarships or other forms of financial aid. Research is one of the three core functions of UMSS, together with education (training of professionals), and community outreach. The Directorate for Scientific and Technological Research (DICyT) is the university body in charge of managing and organizing the research system at UMSS. The research capabilities at UMSS are formed by 42 research units and 219 researchers (UMSS, 2012).

Research activities background

The development of research capacities at UMSS has historically been dependent on international cooperation – most notably with Sweden – and, more recently, on funds coming from the Direct Hydrocarbon Taxes (IDH) collected and distributed by the central government. This support has allowed the creation of scientific competences, physical infrastructure and the acquisition of modern scientific equipment. However, the absence of institutional strategies and priorities to support research resulted in a scattered landscape of research at UMSS. The research community had to face often opposing demands to align research activities with the ‘real life’ and the needs of the region and to establish and build its presence in the international research community.

The accumulation of research resources along the different faculties had a direct relationship with the prioritized fields of the international research cooperation. More than 50 per cent of research resources and activities at UMSS have been and are centred in the Faculties of Science and Technology, and Agronomy. All financial resources allocated to research centres follow a procedure developed by DICyT for prompt and transparent selection of research proposals following international standards. Other Bolivian universities replicated the procedures developed and implemented at UMSS. Recent efforts at UMSS also included defining new, more inclusive and contextualized research agenda that promotes local economic development (see DICyT, 2012).

The university technology transfer unit and its activities

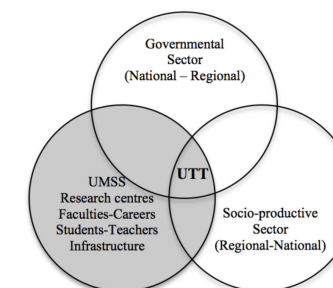
The UMSS Technology Transfer Unit (UMSS-UTT) was created in 2004 within the Faculty of Science and Technology (FCyT). UMSS-UTT started its operation with the creation of a database of the available research resources at FCyT (equipment, laboratories, services, human resources) that could be used to offer research services to industries. The first years of operations revealed that there was no demand for research services from the industry, while demands of a greater university contribution to solving social problems were mounting. Therefore, the original supply-based UMSS-UTT’s business concept proved to be impractical in the Bolivian context for a number of reasons. Large firms were mostly self-sufficient and did not see value in university collaboration. Medium-sized companies showed more interest in collaborating with university research centres, but lacked the funding to invest in research activities and expressed concerns about intellectual property issues. Small and micro firms were interested in getting support from the university. Nevertheless, collaboration was hindered by firms’ inability to formulate clear requirements, lack of funding, low level of training, short term vision focused mostly on marketing, and low level of collaboration with other institutions due a widespread mistrust.

In response to these challenges, in 2006, UMSS-UTT adopted a new approach for interaction processes. The Innovation Systems Approach was adopted as a basis for the UMSS-UTT research initiatives in an attempt to increase the impact of UMSS research activities in local socio-economic development. Using funds (mainly for mobilization and training activities) from an external supporter, UMSS-UTT created an innovation program at UMSS, which partnered with Sustainability Innovations in

Cooperation for Development (SICD) at the Blekinge Institute of Technology (BTH). This partnership helped to shape the vision of university’s participation in socio-economic development and to operationalize innovation processes as co-evolutionary interactions among non-isolated institutions in dynamic relations.

In terms of Trojer (2014), innovation consists of co-evolving processes, where relevance and context of application and implication constitute essential elements. These processes at UMSS were schematized in terms of the Triple Helix (government-university-industry) model of innovation, because it was easier to build a common understanding framework also in non-academic contexts (Figure below). However, the question of how these co-evolving processes are carried out was better answered by the concept of Mode 2 knowledge production. Furthermore, Trojer (2014) highlights that co-evolution is not only a hand in hand process between actors within and outside universities. It is an integrating process between Mode 2 researchers and predominantly Mode 1 researchers and partners in society.

Figure 4.5 Innovation scheme adopted by Technology Transfer Unit at Universidad Mayor de San Simón



Source: Author’s own elaboration based on the Triple Helix model of innovation by Etzkowitz (2008)

The innovation program promoted by UMSS-UTT aimed “to develop at UMSS institutional competences and capabilities for studying, promoting and actively participating in systems and processes of innovation at the local, regional and national levels” (UTT, 2006). This objective defined the activities performed by UMSS-UTT inside and outside the university. On the one hand, it built up an innovation culture and capabilities at UMSS, sensitizing research activities toward socio-productive demands, inspired by Mode 2 knowledge production paradigm. On the other hand, it linked research resources with the demand from the industry by promoting cluster development and by generating an innovation system environment based on the Triple Helix model of innovation.

According to UTT (2015), the main actions promoted by UMSS-UTT are oriented towards developing an efficient system of innovation management at UMSS; making the academic community (professors and researchers) more dynamic, participating in activities related to innovation systems (regional and national); developing informa-

tion systems and standard procedures for contracts with external actors, taking into account intellectual property aspects; studying innovation systems and cluster development; promoting cluster development in the Cochabamba region, supporting innovation system dynamics; and generating capabilities to influence innovation policies at the regional and national levels.

Systemic interaction approach: cluster development

Cluster development was adopted by UMSS-UTT as a permanent platform of interaction where specific demands (from governments and socio-productive actors) can be articulated. The goal was to coordinate multidisciplinary research activities and to find synergies with other institutions to meet those demands. After an empirical context diagnosis, UMSS-UTT chose to start cluster activities within the diverse food sector in Cochabamba. The decision was based on the presence of significant research capabilities related to this sector at UMSS, the long food industry specialization of the region and the special attention the government pays to food industry in its economic development plans.

Starting in 2007, UMSS-UTT put considerable efforts into attracting the main institutions in the region, such as regional government, micro, small and medium sized enterprises (MSMEs), business associations, financial agencies and other supporting agencies, to be a part of the clustering processes. A series of meetings were held with various stakeholders and potential participants where UMSS-UTT informed about research capabilities of UMSS and highlighted the significance of interactions within innovation processes with the goal to gather a critical mass of institutions and people committed to participating in cluster initiatives.

The “Food Cluster Cochabamba” by UMSS-UTT was launched in 2008. It was open to any MSMEs and government body (regional and local) with activities linked to the food sector. From the university side, several research centres and laboratories of services located in the Faculty of Science and Technology were involved, including Centre for Food and Natural Products (CAPN), Centre for Agro-industrial Technology (CTA), Centre for Biotechnology (CBT) and others.

Inspired by the Food Cluster initiative, and responding to the explicit request from the leather industry, the “Leather Cluster Cochabamba” was created in late 2008 with the aim to support linkages between research centres such as Centre for Water and Environmental Sanitation (CASA), Centre for Agro-industrial Technology (CTA), Centre for Industrial Research and Development (CIDI) and the Program of Manufacturing Technology Development (PDTF). Both sectors (Food and Leather) enjoy a long industrial tradition in the Cochabamba region and have been prioritized in development programs for the region.

The Innovation Program at UMSS-UTT organized bi-annual planning workshops for each cluster. These workshops were dialogue-based forums to generate a shared long-term vision and to openly design short-term common agendas for collaboration. Annual agendas were built based on strengths expressed from the productive sectors and

by on making common demands visible, as well as presenting research results and services available in research centres. Besides, in order to facilitate the generation of ideas for collaboration, both clusters organized annual guided tours to university research centres, showcasing the equipment and its main functions. Meetings between researchers with productive actors and government agents to discuss technical issues related to new proposals for cluster initiatives were also organized. Activities prioritized by each cluster were discussed in detail by an advisory board, composed of volunteer and committed cluster members who showed particular interest in implementing specific cluster initiatives. A ‘cluster facilitator’ provided by UMSS-UTT has supported each cluster. This person was in charge of organizing the allocation of resources, projects management and networking, while fostering trust building and dynamic dialogue arenas. Interactions within clusters dynamics were open and mostly informal.

According to UTT (2015), by 2014, the Food and Leather Cluster initiatives had gathered about 120 productive units and firms, 15 governmental bodies, 21 research units at UMSS and nine sectorial institutions. Approximately 800 people from the main three sectors - academy, government and industry - have been involved directly in diverse Food and Leather Cluster initiatives. Additionally, UMSS-UTT has mobilized more than 500 students to support different cluster initiatives linking them to their academic activities (research projects, short studies, surveys, industrial practices, training courses and local productive fairs).

During the first years, the incorporation of productive units and firms in clusters had been linked to the interests of local business associations to participate in cluster dynamics. Nevertheless, cluster forums have been focused on giving a voice mainly to productive units and firms. Representatives from business associations had their own agendas and claims, competing for sectorial leadership. This context, at the beginning, made processes of demand identification and trust building more difficult. However, business associations proved good partners mobilizing entrepreneurs, supporting defined activities and involving cluster members in their own supporting programs. In the case of the Food Cluster Cochabamba, the more dynamic entrepreneurs and producers in cluster initiatives have been those weakly or not linked to business associations.

Looking at governmental bodies, an unstable political context and continuous turnover of public officials at the regional level have complicated the structuring of long-term supporting programs. However, cluster development was included in the Annual Working Plan (POA) of the regional Secretariat of Productive Development. On the other side, a more stable central government allowed establishing more dynamic relationships, in particular with the VCyT, which linked some international supporting training programs, such as CyTED and Sur-Sur, to the cluster initiatives and used the UMSS-UTT infrastructure and cluster networks as regional references for implementation of sectorial supporting programs.

From the university side, the dynamics of clusters enhanced the role of UTT inside UMSS and in society in general. Thus in 2010, the vice-chancellor of UMSS formally

acknowledged the UTT as a university unit in the Faculty of S&T, with a cross-facultative scope of operation. This recognition allowed UMSS-UTT to involve research centres from other faculties, including Agronomy, Economy, Biochemistry and Sociology among others, into innovation programs. Research centres at UMSS demonstrated great interest in participating in cluster initiatives and within innovation systems. Despite this fact, active participation of research centres in cluster initiatives was limited by the low S&T demands and the lack of financial resources for fostering university collaboration with productive units. However, UMSS-UTT was able to meet the most of low-technology demand (in terms of knowledge generation, laboratory tests and pilot practices) by facilitating access of students and researchers to research centres and productive infrastructures.

Most of initiatives in both clusters conformed to the five main guidelines described by Sölvell, Lindqvist and Ketels (2003): research and networking; policy action; innovation and technology; commercial cooperation; and education and training. Whereas it is difficult to measure specific effects the two cluster initiatives had on firms, on the university side, the reorientation of a share of resources towards cluster causes was obvious, as well as the development of new dialogue channels which facilitate collaborations and influence research agenda at UMSS.

Mode 2 and innovation culture: UMSS research community

A multidisciplinary team of researchers across university faculties named UMSS Innovation Team was officially created in 2012 based on the initial group of scholars linked to cluster development. It now includes about 35 researchers representing diverse disciplines and about 20 university research units. The team's goal is to promote a more dynamic research community at UMSS, fostering both innovation culture and Mode 2 practices institutionally. The team holds annual meetings to discuss collaboration initiatives aimed at the development of national and regional innovation systems from within the university. Many of the team participants are members of national and international research networks within their disciplines.

Another UTT initiative, the Technology-based Enterprise Incubator (EMBATE), was started in 2010 with the goal to promote innovation and entrepreneurship culture among students. Using resources of the research centres located in the Faculty of S&T, the incubator supports selected technology-based business ideas from students and organizes contests of business ideas that should teach students to generate proposals based on entrepreneurial ideas. EMBATE was early linked to the Bolivian start-up network led by the VCyT. In 2012, VCyT organized local training activities (transferring entrepreneurship and start-up models developed by "Instituto Politécnico Nacional de Mexico" Start-up Unit to 12 Bolivian universities including UMSS) using the UMSS-UTT infrastructure. EMBATE was recognized by the national government as a useful node for national and international universities linked to its network. More recently, in 2015, the national significance of EMBATE was confirmed by a proposal for Latin-American start-ups supported by CyTED.

Over the years, UMSS gradually achieved considerable improvements in the quantity and quality of the research community, enhanced a number of research facilities, strengthened the management of research, the overall execution of research activities and created a positive research environment and culture by the adoption of appropriate routines and practices. According to Arocena et al. (2015) developmental universities are characterized as universities that provide effective incentives to include in their research agendas problems whose solutions can lead to the democratization of knowledge. UMSS is still far from those ambitions, but its efforts are going in that direction, thus we propose an ex-post categorization of UMSS experiences as a "developmental university" approach. Developmental university approach has a place in emerging innovation systems in Bolivia, playing a key role for the democratization of knowledge and inclusive development ambitions.

Conclusions and remarks

In this chapter we categorize (ex-post) the empirical practices and reforms adopted by UMSS as a "developmental university" approach. Through the experience described above UMSS developed its own institutional competences and mechanisms to influence national and regional socio-economic development. The presented case study suggests that building an innovation system, at least in the beginning, is more about building social relationships than technical and scientific issues.

The experience gained by the technology transfer unit (UMSS-UTT) has demonstrated that offering research services to the industry in a context of a non-dynamic productive system in Bolivia does not work. Thus, systemic approaches of interaction adopted since 2007 by UMSS-UTT fostered more dynamic interactions between the university, the government and the socio-productive actors. These initiatives shaped a dual role for UMSS-UTT promoting innovation system dynamics inside and outside the university permeating the institutional borders. UMSS-UTT proved in practice that the concept framework given by Mode 2 science production and the Triple Helix model of innovation make communication of the idea of innovation systems easier to both academic and non-academic agents and generate open environments of interaction and trust building. The UMSS experience demonstrates that universities can play an active role in building and shaping the emerging innovation system dynamics in developing countries such as Bolivia.

In 2013, the VCyT has proposed a demand-based innovation model in the framework of an emerging Bolivian Innovation System. This model recognizes the key role of universities within interactive innovation process shaped by the local demand and the need to enhance local knowledge production processes by making them transdisciplinary, participatory, and socially inclusive. In this general context, particularly public universities are challenged to develop more open collaboration dynamics with socio-productive actors.

The cluster development initiative at UMSS created communication channels that allowed building common agendas of collaboration and made the socio-productive

demands visible to academic and governmental actors. Although the technology gap between research centres and the absorptive capability in the productive sector has limited the dynamics of the collaboration programs implemented, the programs helped firms to survive, improving their current productive processes in accordance to sectorial regulations. Open dialogue arenas gave important inputs to build more democratic research agendas at universities. The success of cluster development in Bolivia will depend of the capacity to build closer and long-term relationships based on the principles of complementarity with industrial sectors.

The intermediary role of UMSS-UTT managing innovation processes has been recognized by governmental bodies thanks to its ability to leverage existing networks and to identify researchers capable to attend to social needs, to understand productive sector dynamics and to be able to share knowledge with policymakers at national and regional levels while working on ST&I research and policy proposals. UMSS-UTT also played a role as a manager of funds giving an institutional umbrella to cluster initiatives, which are mostly trust-based on informal relationships. UMSS-UTT promoted co-evolutionary processes of interaction within innovation where institutional barriers were penetrated and common arenas of dialogue were shaped. Its actions further legitimized university activities in society, giving a chance to make them more participative and democratic. However, the UMSS-UTT experience suggests that greater resources are needed in order to improve the absorptive capacity of the productive sectors allowing an effective use of the university research efforts to address socio-productive demands. Institutional and national intellectual property regulations are also needed to foster the democratization of knowledge and to privilege endogenous knowledge production aimed to promote inclusive development ambitions.

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4.4 Paper 3

Cluster initiatives for inclusive innovation in developing countries: Food Cluster Cochabamba, Bolivia

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Abstract

This paper presents the case of the Food Cluster Cochabamba, which was created by a public university as a mechanism to increase the relevance of its research activities in the context of a developing country. This experience enhances the role of university technology transfer offices in emerging innovation systems; it moreover, explores the role of clusters as university mechanisms to develop inclusive innovation processes in developing countries.

Keywords: Cluster Development; Inclusive Innovation; Developmental University; Innovation Systems; Bolivia.

Introduction

In 2008, the Technology Transfer Unit (UTT) at Universidad Mayor de San Simón (UMSS) created the Food Cluster Cochabamba. It was created in the framework of an innovation program at UTT in partnership with the Sustainability Innovations in Cooperation for Development (please visit www.sicd.se) supported by the Swedish cooperation agency (Sida). Cluster development at UMSS emerged as an adoption and contextualization of the globally promoted cluster concept and experiences deeply studied during the last two decades. Rocha (2004) explained that this increased interest in clusters is the presumed impact of cluster on firm performance, regional economic development, and country competitiveness.

Cluster development was adopted at UTT as an interacting mechanism to increase the incidence of the research activities at UMSS in the local socio-economic development. This proposal was based on the experience gained at UTT between 2004 and 2006 implementing offer-pushed models of interaction, after which became evident the passive nature of the local industry, in terms its will to collaborate in research activities with the public university. Acevedo, Céspedes, & Zambrana (2015a) explained that several meetings with and interviews to industrial representatives revealed:

- Self-sufficient attitude coming from the large firms in terms of seeking university collaboration;
- Medium size firms more interested in collaborating with university research centres, but lacked the funding to invest in research activities, and expressed concern about intellectual property issues;
- Small and micro firms were interested in getting support from the university. Nevertheless, they were characterized by no clear demands (as individual firms and as SME

associations) in terms of research needs, lack of funding, low level of training, short term vision focused almost completely on marketing, and low level of collaboration with other institutions due a generalized attitude of distrust.

Thus, based on empirical experiences, UTT launched a cluster development project as a pilot platform at UMSS to develop non-linear collaboration approaches incorporating the concept of innovation systems both inside and outside the university. The food sector was chosen to be the first cluster experience at UMSS because the relative high concentration of university research resources oriented to the food field, a long food industry tradition in Cochabamba and the prioritization of the food sector in regional development agenda. According to SITAP-UDAPRO (2015), looking at the manufacturing industry in the Cochabamba region, the food and beverage sector involves the 19% of all the economic units, is the second large sector in those terms. This sector is formed by 1% large sized enterprises, 4 % small and medium enterprises (SMEs), and 95% Micro enterprises.

This paper presents the experience of the Food Cluster Cochabamba promoted from a technology transfer unit in a public university in Bolivia. The experience was analysed from the perspective of a developmental university approach for emerging innovation systems with inclusive aspirations. This is a participatory action research based on eight years of practical experience of the author on cluster development at UTT (2007-2014) and five years experience as Cluster Facilitator in the Food Cluster Cochabamba (2008-2012).

In terms of (McIntyre, 2008), participatory action research is characterized by the active participation of researchers and participants (in this case entrepreneurs, university researchers, and government servants) in the construction of knowledge; the promotion of self- and critical awareness that leads to individual, collective, and/or social change; and an emphasis on a co-learning process where researchers and participants plan, implement, and establish a process for disseminating information gathered in the research project.

Concept Framework

National and Regional Innovation Systems

The concept of National Innovation Systems (NIS) has become very popular in developing countries as an ex-ante concept framework to foster innovation policies in development agendas. The concept has been constantly evolving in the last decades. This study adopts the following definition:

The national innovation system is an open, evolving and complex system that encompasses relationships within and between organizations, institutions and socio-economic structures which determine the rate and direction of innovation and competence-building emanating from processes of science-based and experience-based learning. (Lundvall, Vang, Joseph, & Chaminade, 2009)

Most of Latin American countries are currently in process of designing and implementation of strategies to increase the dynamism of their emerging innovation systems. Thinking about countries in the south, authors like (Arocena & Sutz, 2003; Cozzens

& Kaplinsky, 2009) highlighted the relevance of inequality and poverty reduction issues associated with the dynamics in NIS. In fact, they recommended, in order to a positive impact of ST&I practices over inequality and extreme poverty reduction, that innovation and learning processes must be reinforced by more inclusive and democratic practices for development. In this context, the concept of inclusive development enriches innovation and learning processes by giving attention (explicitly) to the otherwise marginalized groups in economic growth and development. Johnson & Andersen (2012) defined inclusive development as a process of structural change, which gives voice and power to the concerns and aspirations of otherwise excluded groups. It redistributes the incomes generated in both the formal and informal sectors in favour of these groups, and it allows them to shape the future of society in interaction with other stakeholder groups.

Looking at the implementation of the national innovation strategies, they are highly linked with the regional dimension, mainly following the organizational structures (geographical and political) within the country borders. Therefore, specific regional institutional capabilities are considered as integral components of strategies developed in the framework of emerging NIS. Herliana (2015) considered that in realizing NIS effective and productive, and significantly contribute to national economic growth, is necessary to strengthen Regional Innovation Systems (RIS). On that issue, Asheim & Coenen (2005) argued that RIS can be thought of as the institutional infrastructure supporting innovation within the production structure of a region. They described functional RIS in terms of interactive learning practices between:

- The regional production structure or knowledge exploitation subsystem, which consists mainly of firms, often displaying clustering tendencies.
- The regional supportive infrastructure or knowledge generation subsystem which consists of public and private research laboratories, universities and colleges, technology transfer agencies, vocational training organizations, etc.

Looking to developing countries, Cimoli, Primi, & Pugno (2006) highlighted the incidence of the informal sector in the Latin American economy. They argued, this sector emerged as a refuge or subsistence strategy for the marginalized groups, but it contributed to reinforce, or generate, the exclusion and social tensions. The informal sector is characterized by low productivity, use of obsolete technologies, non-qualified work, and enterprises of reduced size.

The empirical studies of Cooke (2008) highlighted that RIS are not 'implemented' by policy but rather they evolve through processes of incremental and sometimes even quite 'disruptive' institutional change by markets and the institutional support system.

Clusters development

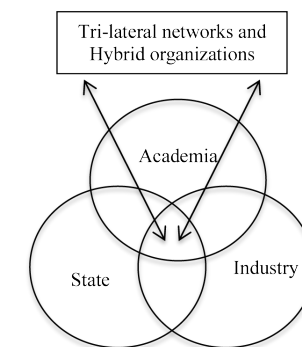
According to Porter (2000) "*clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate.*" B. Asheim, Cooke, & Martin, (2006) called to Porter's

studies explaining that there are a number of advantages to be gained with respect to the key activity of innovation by operating in a cluster.

- They allow rapid perception of new buyer needs.
- They concentrate knowledge and information.
- They allow the rapid assimilation of new technological possibilities.
- They provide richer insights into new management practices.
- They facilitate on-going relationships with other institutions including universities.
- The knowledge-based economy is most successful when knowledge resources are localized.

Altenburg & Meyer-Stamer (1999) studying Latin American experiences elucidate that clustering seems to enable firms, especially small and medium-sized enterprises (SMEs), to grow and upgrade easily. Nevertheless, Bas, Amoros, & Kunc (2008) highlighted the difficulty with the cluster concept is to define which organizations are involved, based on what they share, how they influence one another and how they give a group of dissimilar actors some interactive, systemic characteristics. On this question, the UTT at UMSS started clustering processes using the Triple Helix model of innovation (university-industry-government) as an essential working framework for systemic interaction approaches. Leydesdorff & Meyer (2003) explained the Triple Helix model of university-industry-government relations tries to capture the dynamics of both communication and organization by introducing the notion of an overlay of exchange relations that feeds back on the institutional arrangements.

Figure 4.6 The Triple Helix Model of university-industry-government relations



Source: Etzkowitz & Leydesdorff (2000)

UTT promoted the triple helix in cluster development because it easily generated a framework of understanding with non-academic partners. The concept also offered relationships within an equalitarian balance between the three main actors involved in Cluster Initiatives. Sölvell, Lindqvist, & Ketels (2003) defined Cluster Initiatives (CIs) as organized efforts to increase the growth and competitiveness of clusters within a region, involving cluster firms, government and/or the research community. Clusters

conceived under this institutional framework can be able to discuss and to build closer collaboration along the cluster lifecycle. Andersson, Schwaag-Serger, Sörvik, & Wise (2004) on *Cluster Policies Whitebook* described cluster's lifecycle in terms its organization in long-term evolving relationships: i) agglomeration, ii) emerging cluster, iii) developing cluster, iv) the mature cluster, v) transformation.

Despite the deep studies performed highlighting the relevance of clusters on regional economic growth, when it comes to the question of the contribution of clusters on inclusive development the debate is just beginning. Trojer, Rydhagen, & Kjellqvist (2014) based on their empirical experiences in Africa suggested that cluster based learning could improve the position of firms and farmers in value chains of different reach (local, national, continental or global), which, if consciously done, could address income gaps and reduce the number of people living in absolute poverty.

Food Cluster Cochabamba

Background

The Food Cluster Cochabamba emerged as a pro-active mechanism from UTT directed to the demanding actors of the food and beverage sector in the Cochabamba region. The cluster was focused on micro, small and medium enterprises (MSMEs), which according to SITAP-UDAPRO (2015) represent 95% of the manufacturing economic units in that sector. Cluster activities have been financed by the Swedish cooperation (Sida) in the framework the UMSS Innovation Program, approved since 2007 at UTT. This funding allowed the mobilizing of human resources, organizing training activities, equipping an auditorium, and office facilities at UTT, as the cluster meeting point.

At the beginning, the UTT director's experience on local developing projects allowed identifying and setting an initial contact with the main institutions in the food sector (outside of the university). At the same time, his position in the university made possible to gather and sensitize a starting group of researchers towards new dynamics and non-isolated mechanisms of collaboration within the food cluster.

The cluster started its functions by organizing a first wide workshop where a critical mass of sectorial representatives discussed and generated a shared vision of the cluster and built a six months agenda of collaboration. This group was composed by: MSMEs, public servants, researchers from UMSS, representatives of regulatory institutions in the food sector, and local MSME chambers. The vision generated for the Food Cluster Cochabamba was stated as follow:

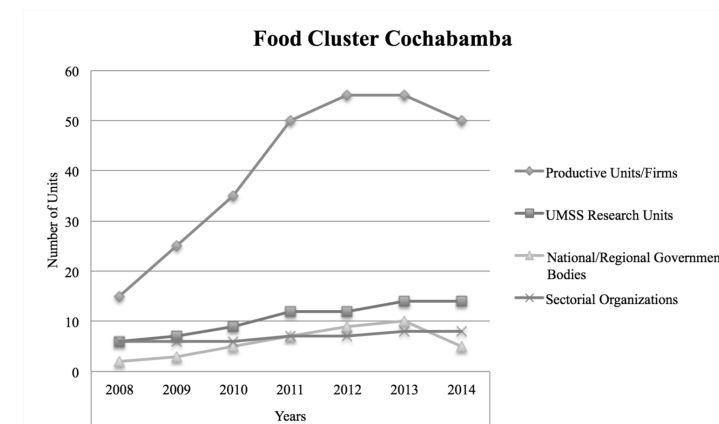
To become the Food Cluster of reference in the region, generating and applying technical knowledge to create added value through innovation, improving the competitiveness of firms in the region by trilateral and responsible collaboration based on trust between university, industry and government benefitting society and environment (UTT, 2008).

The activities in the Food Cluster Cochabamba coordinated by a 'cluster facilitator' and supported by a management team at UTT. Workshops were repeated periodically, twice a year, for identifying demands from the productive sectors and proposing alternatives of collaboration, influenced by the dynamic changing political context in Bolivia. The main actors involved in the food cluster are:

- Productive units and MSMEs from the food and beverage-manufacturing sector. Their production is mainly focused on Andean cereals based products, baking processes, dairy products, processed fruits, functional food, and non- alcoholic drinks.
- Academic units (UMSS) such as research centres, laboratories of services, pilot plants, researchers, scientific students communities, and pre-graduate programs.
- Government bodies at the national and regional levels. These entities were focused on promoting the national innovation system, supporting programs to the manufacturing sector in general and the food and beverage sector in the region.
- Regional institutions in charge to regulate the local selling of food products, NGOs, MSME chambers and associations of producers.

The cluster was open in its conception, to any actor interested in collaborating within cluster dynamics, mainly not creating any barriers for the large number of informal micro-enterprises in the sector. In this context, cluster relations were mostly trust-based between the university and firms, and some agreements were signed between the UTT and government bodies, if needed. The number of actors involved in CIs has been growing in time. Therefore, in order to have an annual approach of this tendency, cluster members all those organizations were considered participants of any CI, as it is shown in the following figure.

Figure 4.7 Evolution of members by type of organization in the Food Cluster Cochabamba 2008-2014



Source: Based on UTT (2015)

In addition, periodical transdisciplinary meetings were organized at UTT in order to discuss and operatize the short-term agenda and CIs prioritized the search for synergies (designing projects, organizing training programs, finding additional resources). The cluster facilitator was in charge to promoting dialogue within a transdisciplinary

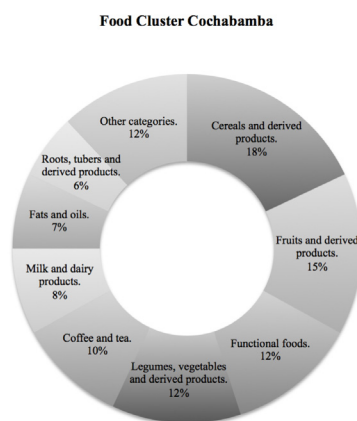
context, sometimes translating the needs of the productive sector into research problems, seeking for the government participation in CIs. The UTT's team supported the management of CIs both inside and outside of the university.

Up to now, CIs in the Food Cluster Cochabamba have been organized according the guidelines presented in the survey developed by Sölvell et al. (2003), where the CIs studied were linked to six main objectives: research and networking, innovation and technology, policy action, commercial cooperation, education and training, and cluster expansion.

MSMEs in the Food Cluster Cochabamba

The Food Cluster Cochabamba was mainly oriented to support micro-small and medium-sized enterprises (MSMEs) of the food sector within the Cochabamba region. According to UTT (2015), the group of firms which participated in cluster initiatives in 2014 were composed by 74% micro (1-9 employees), 22% small (10-49 employees), and 4% medium-sized firms (50-249 employees). These firms were characterized by their heterogeneity within their manufacturing activities and informality, consistent with the descriptions offered by Parrilli (2007) about SME cluster development in Latin America. He described those firms as micro and small craft working with obsolete technology and manual techniques of production, with no division and specialization of labour, low-quality non-standardized goods for low-income consumers in local markets. The following figure shows the manufacturing distribution of cluster firms according the classification of production, published by the national food regulating entity SENASAG (2003):

Figure 4.8 Manufacturing production in the Food Cluster Cochabamba



Source: Based on UTT (2015).

Firms in the cluster represent the diversity of food production in Cochabamba region. Most of them process Andean cereals (such as quinoa, amaranth, and cañahua) using them within baking processes based on mixed flours. Other cluster firms process a large variety of fruits from the tropical region (mainly marmalades, dried fruits, and

pulps). The milk and dairy sub-sector appears in sixth place; nevertheless, it is important to point out its relevance in the cluster, because these firms were in need of a relative higher investment and use of technology, additionally the cluster is linked to the largest milk association involving about of 1,400 producers.

Cluster firms and producers are the engine of the Food Cluster Cochabamba. Cluster Initiatives emerge since common demands and their relevance become visible for the other institutions (government-university). Therefore, the ability of the productive actors and the cluster facilitator to find consensus, and generate clear and concrete demands is key, as starting point. University and government bodies in the cluster prioritize actions (in terms of resources allocation) for those CIs that are relevant or are able to involve to the majority. Therefore, cluster firms and producers are fostered to collaborate one another. Acevedo et al. (2015a) pointed out during the first years of cluster development productive units and firm's participation was highly linked to the interest of local associations and MSME chambers to participate in cluster dynamics. However, cluster forums were focused on giving a voice mainly to productive units and firms because association and chambers compete each other for a sectorial leadership according to their own agendas. However, they have proved to be good partners in specific CIs emerging from open discussions between producers and firms (e.g. food safety and marketing supporting programs).

Each CIs had an *advisory board* integrated by voluntary entrepreneurs and producers who led the discussions with other institutions. All these activities were supported by UTT (infrastructure, office facilities, assistants and professional staff) and moderated by the cluster facilitator.

In this context, it has been possible to establish a permanent "Food Safety Certification Program" which supports firms gathering several institutional efforts (UMSS, MSME chambers, producer associations and SENASAG). It included 20% reduced costs for laboratory analysis, technical advising, auditorium and desk facilities, and pre-graduate students' assistance, training courses on Good Manufacturing Practices (GMPs), administrative support. According to UTT (2014), hitherto, 30 firms have been certificated, there were analysed 850 parameters in the university laboratories, organized 11 training courses linked to GMPs, and were liked about 65 students to support certification process inside the firms.

Regarding innovation and research activities, with the support of UTT, firms have been able to attract research funding for three projects so far, two of them fully funded through university research contests and one co-financed between government body (ProBolivia) and university. These projects were developed based on the firms' demands within a constant dialogue between entrepreneurs and researchers, both visiting each other. Additionally, cluster firms have been able to develop 43 exclusive short research projects mobilizing about 260 pre-graduated students supervised by researchers in research centres. Students developed these projects together with the entrepreneurs with practices jumping between the productive infrastructures and the research centres at UMSS. Most of these projects were focused on marketing studies for new products,

equipment design and improvement of production processes. Nevertheless, the weak absorptive and invest capabilities have limited the effective use of most of these studies.

It has been evident during in the food cluster that these interacting processes allowed MSMEs and productive actors share information one another and with other institutions involved, increasing their organizational networks. They have increased their access to research resources at UMSS (infrastructures, equipment, laboratories, researchers, pre-graduate students), common demands now are considered in research projects and are able to get full funding from the university while individual needs receives special treatment in research centres supported by pre-graduate students. On the other hand, MSMEs and producers are able to generate concrete demands and communicate them directly to researchers and government servants at different levels. Cluster firms and producers, through the UTT as intermediate agent, have been able to be properly informed and prepared to take advantage of government supporting programs to foster innovation, entrepreneurship, and competitiveness.

UMSS research units in the Food Cluster Cochabamba

The Food Cluster Cochabamba emerged as a pilot mechanism of interaction promoted by the technology transfer unit at UMSS. By 2014, this experience has been able to involve researchers and pre-graduate students from 14 different research units from the faculties of S&T and Agronomy linking around of 30 researchers and 400 pre-graduate students after 7 years of collaboration. Cluster Initiatives have been practical and concrete arenas to develop Triple Helix approaches of interaction and Mode 2 processes of knowledge production. These experiences were the foundation for the creation at UMSS of a multidisciplinary cross-faculty team of researchers named “UMSS Innovation Team”, where university research experiences are shared and discussed in relation to emerging innovation systems in Bolivia. These experiences along university research policy transformation at UMSS were described and characterized by Acevedo et al. (2015a) as a “developmental university” approach. Arocena, Göransson, & Sutz (2015) pointed out developmental universities are characterized as universities that provide effective incentives to include in their research agendas problems whose solutions can lead to the democratization of knowledge.

Two core institutional research guidelines, “*sovereignty and safety over food production*” and “*technology, production, and industrial development*” (DICyT, 2012), have legitimized food cluster activities by linking them with other institutional efforts oriented to support national development goals. In this context increases the possibility to allocate university research resources in CIs. It has been possible, so far, to support three research projects (two fully funded, and one co-funded with a government body), as well as to allocate supporting equipment in six research centres in order to enhance laboratory and technical services to MSMEs.

The Food Cluster Cochabamba as a permanent interaction platform for university researchers with MSMEs as well as with government servants has had an impact on the research agenda. Thus, it has been possible to incorporate cluster activities and

new services for MSMEs into annual activity plans in the research centres. Therefore, cluster entrepreneurs have been openly welcome to visit frequently the university research centres linked to the cluster and obtain available relevant information as well as discuss technical issues with researchers. All these activities coordinated by the cluster facilitator at UTT.

Besides these modest efforts, mostly volunteer-like and lack of resources allocation, UMSS has not been able to guarantee the use of the research contributions where it is important that find institutional synergies in the region to improve the absorptive capability of the MSMEs in the cluster. These experiences developed in a pilot level reflect the analysis of Sutz (2012) suggesting that underdevelopment can be very partially but not inaccurately characterised as an ‘innovation as learning’ systemic failure. Therefore, it is needed to coordinate a systemic response to the problem, because besides its good will UMSS has lot of limitations too.

Government bodies linked to the Food Cluster Cochabamba

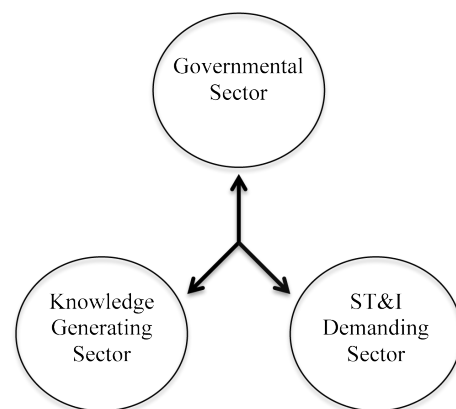
After a dramatic period of socio-political crisis, in the last ten years Bolivia has been started a reforming process oriented to the reduction of extreme poverty and to increase the participation of the traditionally excluded social sectors in the decision-making processes. This process has been characterized by the reforms promoted by the central government, such as a new political constitution, nationalization of key industries on the exploitation of natural resources, labour regulations, and the generation of long-term development agendas. At regional and local levels, governments have been characterized by their lack of resources allocation for productive supporting programs, internal labour instability at the operative level, and reduced organizational scope. The Food Cluster Cochabamba has been able to transcend and manage the political fluctuations mainly because it was hosted at the UMSS. Public universities are relatively more stable institutions, which prevail in the long-term. Because of its long history along social claims, UMSS was perceived as politically neutral or pro-social claims institution. Therefore, UTT has been able to generate a relaxed dialogue atmosphere for discussions between the cluster members.

The Food Cluster Cochabamba started by inviting several secretariats from the local municipality and the regional government, all of them involved in food regulation and supporting programs to increase the competitiveness of the sector. Their participation in cluster activities reduced the ambiguity in sectorial regulations needed for selling food products in the local market. Their collaboration allowed cluster firms to participate in several fairs promoting the local manufacturing production. In 2010, cluster activities were included in the annual activity plan of some secretariats at the local municipality and regional government. That disposition allowed government servant to participate frequently in cluster meetings but not included funding allocation to support cluster activities. Recent regional strategies of development have included cluster development, named “Complejos Productivos”, as a core strategy to support prioritized productive sectors in Cochabamba. This strategy responds to systemic approaches proposed by the central government in the framework of a long-term de-

velopment agenda and emerging national innovation systems. Regional government bodies have recognized pilot cluster experiences at UTT as relevant local references for dialogue processes and participative knowledge production linking university research units with socio-productive actors.

Looking at the central government level, the Food Cluster Cochabamba has been able to build a more dynamic relationship with the Vice-Ministry of Science Technology (VCyT) in the framework of the emerging national innovation system. The VCyT is the government body in charge to design and implement the strategies to make the system more dynamic. Acevedo, Céspedes, & Zambrana (2015b) characterized the national innovation policies, published in 2013, as demand-pulled system with inclusive ambitions, resulting from a wide participatory process of construction.

Figure 4.9 Institutional relations within the Bolivian System of Science, Technology and Innovation, synthesized scheme.



Source: Acevedo et al. (2015a)

The plan recognizes protagonist role of universities in processes of knowledge generation. However, additionally proposes an inclusive approach, where the role of indigenous groups and other social movements is highlighted in both, demanding of ST&I and knowledge generating sectors. The VCyT recognized the Food Cluster Cochabamba as regional reference for systemic approaches of collaboration. The Food Cluster Cochabamba has been in the National Research Network promoted by the VCyT, where according to VCyT (2012) are linked around 35 researchers from diverse research centres linked to the food sector in the whole country. Since 2012, it has been possible to include five MSMEs from the food cluster in the annual meeting of the national research network, where firms are able to make their demands visible for the national research community looking for expand their networks of collaboration. Additionally, international agreements managed by the VCyT have allowed cluster members access to financial resources to send representatives to participate of international conferences organized by CyTED Iberoeka linking them with other researches and entrepreneurs in other Latin American countries.

Other important contributions come from ProBolivia, a decentralized agency of the Ministry of Productive Development, which recently established supporting programs for innovation aimed to create funding contests, innovation centres, and productive clusters (*complejos productivos*). The Food Cluster Cochabamba is able to participate actively in those programs through the UTT at UMSS. In 2013, the Food Cluster Cochabamba gained funding resources to strengthen the capabilities of one research centre in building semi-industrial equipment for the food sector. This project aims to respond the claims of the entrepreneurs in the cluster about the oversized and expensive equipment available in the market. Therefore, the project links 3 research centres and about 15 entrepreneurs for the design and build of two prototypes, an automatized oven for the bakery industry, and a lyophilisation equipment for the dairy industry in the cluster. The implementation of the project implied several administrative challenges because of the heavy normative structures of the government and the university. Nevertheless, this experience opened the path for coming financing collaborations for research activities from any public decentralized agency to UMSS.

Intermediary Agent

The Technology Transfer Unit (UTT) is an operative unit where one of its main functions is “to develop at UMSS institutional competences and capacities for studying, promoting and actively participate in systems and processes of innovation at the local, regional and national levels” (UTT, 2006). The UTT plays the role of intermediary agent in the Food Cluster Cochabamba. Trojer et al. (2014) highlighted the role of intermediary agents supporting cluster development for inclusive development in Africa. They explained that linking actors is not enough within innovation processes. Intermediary agents often need to translate between the actors to match supply and demand, as well as spreading information and mediating in conflicts while plays neutral role in the innovation system.

The role of UTT as intermediary in the Food Cluster has been essential for the cluster survival. UTT provided basic financial resources to the cluster for mobilization and organization through its innovation program. It was in charge of managing and spreading information across the cluster members. Its infrastructure facilities offered a neutral atmosphere for dialogue between the producers, entrepreneurs, researchers and government servants. The UTT has supported cluster members to transformation concrete productive demands into research projects looking for funding resources inside and outside the university. Because the cluster is based mostly on informal relations trust-based, UTT gives to cluster a formal representation when it comes to apply for resources and subscribing agreements between the organizations involved. This formal representation also contributes to the cluster be more inclusive, because an important part of micro and small entrepreneurs and producers in the region are not yet part of the formal business sector. Cluster activities help informal entrepreneurs to regularize that condition by orienting and offering reduced costs in laboratory analysis of their products. In that context, UTT also supports the management of financial resources through the university administrative system. Finally, UTT manages knowledge pro-

duction and its diffusion emerging from cluster initiatives according to the vague university regulation.

Cluster Facilitator

Ingstrup & Damgaard (2013) define cluster facilitators as individuals or a team of individuals, who are seated in a formal cluster secretariat within a cluster, facilitating and coordinating cluster development through trust building in order to promote cooperation and sharing of activities and resources among the participating actors of the cluster. The Cluster Facilitator of the Food Cluster Cochabamba was provided by UTT. After my early experience developing on the strategic guidelines of UTT, I was invited to be cluster facilitator. I worked as cluster facilitator of the Food Cluster since 2008 to 2013, and my following comments come from that specific perspective.

One my main challenges as the cluster facilitator was to become a central node in the cluster network, who links all cluster members at the personal level. As cluster facilitator, I was in charge to listen the debates, understand the different perspectives emerging from transdisciplinary processes of interaction, and guide them into creative alternatives for collaborative solutions. This task requires a high sense of empathy to understand the personal perspective of each member and a high motivation towards the collective welfare, while the dynamics of interaction between the actors shape the cluster identity. It was also part of my tasks, to keep the cluster open for new members, and look for new members who are relevant for on-going cluster initiatives (CIs).

The cluster facilitator is in charge of information managing, making information accessible for cluster members (contacts, activities, projects, supporting programs, business opportunities, and results). Furthermore, I was in charge to follow the procedures needed to ensure the allocation of resources (financial, goods, and services), committed by the institutions (university, government, producers, etc.) for the execution of CIs. This task, in an environment of mostly informal relations, requires trust building within cluster relations, enhancing the competitive atmosphere between socio-productive actors. In fact, according to (Mesquita, 2007) trust in the facilitator, in turn, affects trusting beliefs of MSMEs' leaders toward each other, since such trust acts as a substitute for the initial lack of trust between parties. Facilitators are not out to mediate distrust from the entire relationship; rather, they help lead clustered firms in the pursuit of joint collective efficiencies in demarcated business areas and help them achieve greater levels of competitiveness. Additionally, my experience says that trust building is also about sharing human values between the cluster members. Accordingly, it was my role to spread the cluster values explicitly and take care of their respect in the behaviour of cluster members.

Finally, another important role as cluster facilitator was to promote Mode 2 practices in CIs and knowledge production, particularly promoting pro-active and constant interaction between researchers and socio-productive actors. The open attitude of the researches made easier to break initial institutional barriers allowing entrepreneurs feel comfortable visiting the university research centres and vice versa. Nevertheless, the

scarce resources available in developing countries represent a challenge for innovation and learning processes. This means that cluster facilitators have to be extremely creative looking for other networks collaboration to achieve the goals proposed.

Cluster facilitating functions as part of the Technology Transfer Unit (UTT) at UMSS, enhances both the internal developmental university approach and its role in cluster development in emerging regional innovation system.

Concluding remarks

The Food Cluster Cochabamba emerged as a pilot experience promoted by the Universidad Mayor de San Simon (UMSS), Bolivia. It was created as a non-linear approach to orient research activities at UMSS into innovation systems dynamics for supporting socio-economic development. Cluster development offered important insights for reforms in the university research policy within a "developmental university" approach. This experience has been able to gather an initial critical mass of small socio-productive actors showing initial positive results. Triple helix based interaction has been able to make socio-productive demands visible for university and government actors in the cluster. Cluster initiatives mobilized resources mainly from the university but also from other partner in the cluster (government, entrepreneurs, institutions) towards solving common demands. Despite, government bodies were not being able to allocate financial resources to the Food Cluster initiatives, new national reforms and supporting programs are emerging under the framework of a National Innovation System linked to a long-term development agenda "Patriotic Agenda: Bolivia 2025". Both, university research policies and government innovation policies prioritize inclusive development ambitions.

Traditionally, clusters have been thought to create competitive advantage of some industrial groups over others based on collaboration to upgrade their technology and innovation capabilities. However, when it comes to the use of public resources in developing countries, poverty and inequality reduction are priorities. Therefore, based on the early experience of the Food Cluster Cochabamba, this study proposes to think about clusters as a mechanism where innovation and learning processes seek inclusive development ambitions.

Cluster development can support significantly poverty and inequality reduction as mechanism for the democratization of knowledge, by contributing to reduce knowledge gaps in specific productive sectors. Clusters can be used as open mechanisms expanding the access and opportunities for low-income socio-productive actors in a region.

- Access to: knowledge, technology, research resources, relevant information, funding resources, networking, support programs, technology based solutions, etc.
- Opportunities to: express their demands, survive, collaborate, learn, innovate, partnership, develop specialized skills, generate added value, increase competitiveness, increase absorptive capacity, create sustainability, etc.

Cluster for inclusive development can be a practical alternative to collaborate and make efficient use of the scarce resources available in universities and government programs, in the context of developing countries.

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4.5 Paper 4

Re-reading Inclusive Innovation Processes: cluster development, collective identities and democratization of research agendas

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Abstract

The paper proposes a re-reading of collective dynamics and inclusive innovation processes in the Food Cluster Cochabamba, Bolivia. The cluster was created at a university platform, a meeting point, for linking public university research activities with other inter-institutional efforts (private or public) to respond to social and production needs in the Cochabamba region. The paper starts by recognizing the weak institutional structures in Bolivia and highlight the relevance of the political dimension for the food cluster development dynamics. It is thus possible to make visible complex aspects and institutional logics of tension linked to the construction of collective identities, decision-making processes, knowledge production and collective actions. The presentation of an innovation project identified by the involved actors in the form of an Automated Oven for Bakery Processes offers insights on how inclusive innovation approaches and university cluster development in Bolivia are also efforts of bottom-up transformation of local social relationships.

Keywords: Inclusive Innovation, cluster development, collective identities, emerging innovation systems, developmental university, politics, mode 2, Bolivia.

Introduction

The Universidad Mayor de San Simón (UMSS) launched its Technology Transfer Unit (UTT) in 2004. UTT was one of the first of its kind in Bolivia operating in a public university. It emerged as an institutional attempt of increasing the activities of university research results and orient research capacities towards current society challenges. At the beginning, 2004 to 2006, UTT was inspired by traditional linear models of interaction, either offer-pushed or demand-pulled.

It was quickly recognized by UTT staff, appropriate environment conditions were required, such as, dynamic production structures to adopt models of interaction efficiently. Production structures are dramatically weak in Bolivia. One aspect of this context can be reflected in the relatively low research investments carried out from the industrial sector side (around 6% of the country's Gross Expenditures on Research & Development). This in turn has an impact on the absorption capacity of industries as well as low demand of knowledge from local universities. One impact is a systematic isolation of universities, particularly when it comes to research agenda definition falling into the inertia of their own institutional dynamics and interests. Arocena & Sutz

(2010) have recognized similar tendencies in several Latin American countries: *"The lower the market demand for knowledge, the more severe this condition, in particular for the endogenous production of knowledge. The problem of knowledge for peripheral regions is that this situation inhibits knowledge generation and use"*.

In 2007, the UMSS Innovation Program was launched at UTT recognizing the relevance of the *National Innovation Systems* (NIS) approach with support of the Swedish International Development Cooperation Agency (Sida). The definition presented by B.-Å. Lundvall, Vang, Joseph, & Chaminade (2009) on NIS in developing countries was taken as a theoretical reference. The UMSS Innovation Program aimed to develop institutional competences and capabilities for studying, promoting and actively participating in innovation processes at the local, regional and national levels (UTT, 2006).

In general, during the last decade, diverse and isolated efforts promoting institutional and cultural transformations has increased at UMSS in order to systematically link the university knowledge production with society needs. The concept of *developmental university* (Arocena, Göransson, & Sutz 2015) has been used to offer a contextualized theoretical framework to support these initiatives at UMSS and to draw an ambition for institutional transformation. Arocena, Göransson, & Sutz (2015) explained, *developmental universities* are committed specifically to social inclusion through knowledge and more generally to the democratization of knowledge along three main avenues: democratization of access to higher education, democratization of research agendas and democratization of knowledge diffusion.

In this paper we will discuss some food cluster experiences, since it was one of the more complex experiences gained at UMSS from the systemic perspective. 'Cluster development' at UMSS was understood as a process of building open-university platforms to foster innovation and learning processes by linking university capacities with other regional/national efforts and resources (public and private) to respond to social and productive needs in the food sector.

This paper presents reflections and learning experiences gained between 2008 and 2015 in the Food Cluster Cochabamba. Our methodological approach is closely linked to a mode 2 approach (Nowotny, Scott, Gibbons, 2010) and inspired by action-research (McNiff, 2013) by making a critical self-reflection of the practices performed. Both authors have participated in the development of the Food Cluster Cochabamba in different roles since 2008.

It is also important to emphasize that this period in time was marked by an unstable national social-political-economic context. Transformations in the country resulted in the current Plurinational State of Bolivia. The autonomous condition of UMSS, as public university, was key for allowing the Food Cluster Cochabamba operation without great difficulties within such conflictive context in the country.

In this specific context, the study takes as a starting point the prevalent weak normative institutional structures in Bolivia, which is also of concern to university research activities in particular. Therefore, when it comes to systemic innovation processes fos-

tering interactions between academic and non-academic agents in society, most actors operate tensioning the edges of their institutional structures. In chapter following the introduction general characteristics of the Food Cluster Cochabamba are presented making focus on the intention of enabling a transdisciplinary arena, where it will be reasonable to expect conflicts in decision-making processes. In this context, the recognition of collective identities formation seemed to play a key role on making the political dimension visible for later discussion. The next chapter presents a concrete case of inclusive innovation anchoring the discussions in this paper and especially so the re-reading of innovation processes. Discussion in the last chapter looks for enabling more adequate pluralist-democratic processes in future cluster dynamics, in particular, aiming for inclusive innovation processes.

General Characteristics of the Food Cluster Cochabamba

Our understanding of the political and politics

Following what is stated above, the will is identified as crucial in the founding moment of any innovation initiative within the cluster. However, in an environment where interactions and interdependence among a variety of actors are fostered (e.g. academics, industry, government, civil society, etc.), a high possibility for conflicts exists, since the processes involve decision-making, establishment of a common agenda and scarce availability of resources. These are aspects easily recognizing the presence of a political dimension in the innovation processes, which usually becomes blurred when it is misunderstood as mere technical issues to be managed. We are thus suggesting a re-reading of innovation processes. It is valuable to make a distinction between 'the political' and 'politics'. Mouffe (2013) explained, *the political* to refer to the dimension of antagonism, which can take many forms and can emerge in diverse social relations. *Politics*, on the other hand, refers to the ensemble of practices, discourses and institutions that seek to establish a certain order and to organize human co-existence in conditions, which are always potentially conflicting, since they are affected by the dimension of *the political*. The 2 concepts belong to the onto-epistemological level allowing us to understand the nature of the knowledge production evolving in innovation processes.

Cluster background

The Food Cluster Cochabamba is a university platform created at UMSS for linking its research capacities with the food sector needs in the Cochabamba region. The Technology Transfer Unit (UTT) assumed the role of facilitation in the cluster, supported by resources coming from its UMSS Innovation Program. According to (UTT, 2015), active cluster members have increased from 15 firms in 2008 to 55 firms by 2014. Some characteristics of its members are presented below:

- According to its size: 74% are micro enterprises (1-9 employees), 22% small enterprises (10-49 employees) and 4% medium-sized enterprises (50-249 employees). All belong to the group of Micro, Small and Medium sized Enterprises (MSMEs).
- According to its production specialization: 18% cereals and derived products, 15% fruit and derived products, 12% functional foods, 12% legumes, vegetables and derived

products, 10% milk and dairy products, 7% fats and oils, 6% roots, tubers and derived products and 12% other categories. This characterization follows the normative presented by the National Service of Agricultural Health and Food Safety (SENASAG, 2003).

- Three associations were also closely linked to the food cluster dynamics: The Chamber of Small Industry and Productive Manufacturing of Cochabamba (CADEPIA), the Association of Milk Producers (APL) and the Eco-Fair Association. Potentially, their members might mean a network of more than 2000 small production units.

This critical mass of firms was considered as the cluster core, since the vast majority of activities have been focused on strengthening their production and learning capacities. Representatives related to government bodies in the food sector and qualified researchers were periodically encouraged by UTT to participate in cluster activities (e.g.: Vice Ministry of Science and Technology, regional government secretariats, regulatory agencies, university researchers, teachers, students, etc.).

At the beginning, the Triple Helix model of Innovation was used schematically in order to spread the notion of the innovation system approach in a simple way between academic and non-academic actors. The proposal in the book "The Triple Helix: university-industry-government innovation in action" (Etzkowitz, 2008) was taken as a reference. This model has become rapidly spread in the Bolivian society and nowadays can be found in the everyday vocabulary of managers of science, technology and innovation.

Clustering process and 'collective identities'

At the beginning of this clustering process, the UTT organized activities focused on generating arenas for face to face interaction between academics, policy makers and firms, to know each other, to make the main needs of the food sector visible, and discuss potentials for collaboration. These activities were mostly organized at the university campus, in an attempt for UMSS to show a renewed attitude and willingness to participate more actively in regional development processes. Such activities included:

- Workshops for planning and evaluation of general cluster activities, twice a year.
- Guided visits to university research centres related directly or indirectly to the food sector.
- Visits of researchers to cluster firms, when demanded.
- Round-table sessions to discuss specific problems and possible joint actions in small groups of interested (cluster firms, researchers and policy makers).
- Regular meetings for tracking the execution status of activities in progress.
- Organization of short courses on common demands prioritized (e.g.: good manufacturing practices, food safety regulation, information and communication technologies, marketing, basic management tools and quality control, etc.).

These activities helped the cluster members to become familiar with each other, to produce some early results keeping the group motivated. At the same time, an open space was enabled at the university campus based on UTT's infrastructure, where cluster needs could permanently be discussed and taken into account in university research

agendas. In this context, it was obvious that clustering processes were also about building a type of long-term social relationship between diverse cluster actors.

During the first 3 years of operation, repeated efforts for establishing a cluster vision were made, in order to inspire the collective action of its members. However, we can easily recognize, that during the discussions in meetings and workshops, a process of defining a 'collective identity' prevailed. In each meeting there were always, mostly implicit, discursive struggles between the different actors to define the 'reason' or to which 'cause' the cluster agenda should respond, since there were no similar references in Bolivia. There is still not a closed consensus in this respect. But this can be something positive in the long run recognizing its always contingent construction. There was, however, repeatedly an agreement about the character of the 'outside' of the cluster, which helped to identify cluster members inside and rapidly increase the number of members involved.

The cluster firms are always encountering strong competition from the production coming from large transnational industries, particularly those products introduced via smuggling into the domestic market. This is a critical situation for several productive sectors in Bolivia, and both university and government representatives are not objecting such arguments, as they aim to strength the development of the local industry.

One way to interpret this demarcation is by using the idea of a 'constitutive outside' as a collective identity of the cluster. A *constitutive outside* was originally proposed by Henry Staten (1984), who referred to a number of themes developed by Jacques Derrida. Staten's work remarked the fact that the creation of an identity always implies the establishment of a difference. Chantal Mouffe took such reflection in the field of politics to show its relevance for the constitution of *political identities*. She argued: "*once we understand that every identity is relational and that the affirmation of a difference is a precondition for the existence of any identity – i.e. the perception of something 'other' which constitutes its 'exterior' – we can understand why politics, which always deals with collective identities, is about the constitution of a 'we' which requires as its very condition of possibility the demarcation of a 'they'. This does not mean, of course, such a relation is by necessity antagonistic. Indeed, many us/them relations are merely a question of recognizing differences. But it means that there is always the possibility this 'us/them' relation might become one of friend/enemy. This happens when the others, who up to now were considered as simply different, start to be perceived as putting into question our identity and threatening our existence... What is important to acknowledge here is that the very condition of possibility of the formation of political identities is at the same time the condition of impossibility of a society from which antagonism can be eliminated*" (Mouffe, 2013).

We can here recognize a political dimension present in our dynamics of clustering all since its start. Its recognition can be useful to identify exclusions and to handle the always-possible emergence of antagonist positions in conflict under more democratic arenas in pluralistic context, as is aimed in inclusive innovation system dynamics.

Making demands and problems visible

As mentioned above UTT facilitated general meetings, workshops and round-tables, systematically serving to collect demands/needs as a base for the construction of short and medium-term agendas of the cluster. Cluster firms expressed their problems orally through general descriptions for open discussion. The problems were not presented in a technical way but mostly exposed from their impacts for firms and society in order to sensitize other cluster members (researchers and policy makers) and therefore included in the cluster common agenda. Barbehön, Münch, & Lamping (2015) studies concluded that narrating problems is a medium for struggle and contestation, in which socio-historical factors such as power relations and social norms play an important role. This is clearly a critical stage of potential conflicts in the cluster, since different interests, claims, logics and capabilities are under discussion. But primarily socio-historical aspects need to be considered. This is even more critical when it comes to the food sector, rooted with the very foundational forms of reproduction of life, cultural representations and community weavings of the Bolivian society.

Thus, cluster dynamics allowed recognizing the different dimensions and complexity of problems, enabling open discussions and building bridges of collaboration between the heterogeneous capacities distributed. By putting a plurality of voices in dialogue on the problems, divergent questions can emerge triggering new alternatives, ways of solution and spaces of potential collective action. In order to be prioritized, problems usually were exposed highlighting their *use-value*, from their relevance to satisfy needs of cluster members and society in general. These relations are built in a context of scarce resources and open dialogue between relatively autonomous organizations like public universities. It has been one determining stage in this inclusive innovation approach, based on increasing the democratization of the university research agenda at UMSS.

Often, additional resources are required for mobilization, exchange of information, building relationships and frameworks of understanding with interested social actors. Current competing research funds at UMSS often assume that researchers already have accurate knowledge about problems in society. Therefore, problems frequently arise from the perspective and personal interest of the researcher, perceiving social actors as beneficiaries, recipients of generated knowledge rather than as agents with an important role throughout the process (before, during and after the research project).

An Inclusive Innovation Approach - Automated Oven for Bakery Processes in the Food Cluster Cochabamba

In this section, we present a concrete case of the Food Cluster Cochabamba on inclusive innovation processes. It was executed between the years 2012 to 2015 with the support of the national government, university resources and active participation of cluster firms. This case is relevant for and anchoring the discussion in this paper as it involves a wide range of collaborative efforts under a systemic approach. At the same time its political dimensions are easily visible and the main characteristics are possible to translate to experiences in other contexts.

Background

During the first 3 years of the cluster development (2008-2010), one of the most echoed claims among the members was linked to improve the participation of local firms in the domestic market. One alternative emerged looking at the program of 'provision and distribution of complementary school feeding' run by municipal governments. That program aims to deliver breakfast mainly for public schools in all municipal districts. It offers a variety of liquid and solid portions for students, according to nutritional and technical specifications. Frequently, large companies have the capacity and are selected to do this kind of job in most municipal districts. Participating in this program represented challenges for MSMEs in the food cluster involving aspects such as:

- improvement of nutritional quality,
- development of productive technology,
- increase of production capacity,
- capacity in logistics, distribution and preservation of food,
- secure supply sources of fresh raw material,
- opening of current public buying legislation for small producers offers,
- access to financing,
- and the need to establish strategic alliances.

First cluster actions on this issue supported firms to certify mandatory food safety standards. Researchers, pre-graduate students and special prices for laboratory services supported cluster firms on that goal. Particularly important were pre-graduate students, working on undergraduate internships and projects, moving between cluster firms and university research centres. Gradually, the accumulated information revealed that a majority of the enterprises linked to the cluster carried out baking processes. The poor quality and inefficiency of their ovens use to compromise the quality of products and production capacity. In general, these ovens were reconditioned in Bolivia with parts made in Brazil or Argentina. The UTT team organized visits of researchers to the cluster firms to know general characteristics of the ovens. Some of them were:

- Low production capacity of the oven.
- Non-uniform distribution of heat into the oven.
- Inaccurate control devices for variables such as temperature, humidity and time.
- Few safety and alert devices for handling, particularly for one of the companies whose operators were blind.

Thus, ovens and bakery processes were identified as practical and concrete fields to work collectively. Sensitized by this experience, the Centre for Food and Natural Products (CAPN) addressed in 2012 one of its new doctoral students towards studying bakery processes based on the local production of raw materials and industry capacities. The aim was to take the food cluster firms as its main platform of researching and application of results.

Joint Agenda Setting

Once the oven issue was identified and prioritized, the UTT team gathered all the information and started by designing a project to attract resources. In September 2012 an opportunity was identified in competing funds launched by ProBolivia, a government development agency with the support of European Union resources. It was created with the aim of contributing to social inclusion, fostering innovation and diversifying the national production.

ProBolivia launched a funding program of up to 80% for innovation projects in strategic sectors prioritized by regions. Although the food sector was prioritized for the Cochabamba region, the bakery sub-sector was not in the funding program. The ProBolivia call was focused on strengthening honey, chocolate and exotic fruits. Therefore, the UTT team proposed the alternative of presenting the project in the metal-mechanic sector, which was quickly accepted by the cluster members. The project was approved, with UMSS providing the institutional representation, UTT administration support, and financed by ProBolivia (80%) and by UMSS (20%). The project was approved with the objective of strengthening the technical capacities of PDTF for research and prototyping semi-industrial machinery, as well as supporting innovation processes in the Food Cluster Cochabamba. The project execution formally involved two research centres, namely the Program of Manufacturing Technology Development (PDTF) and the Centre for Food and Natural Products (CAPN). The project was shaped by the following components:

- Acquisition of welding equipment and training of PDTF's technicians on semi-industrial machinery design and building. This equipment complements the already installed capacities at PDTF.
- Design of an automated oven according to the needs identified previously in dialogue between the firms of the Food Cluster Cochabamba and researchers from the CAPN. It was proposed to use the '*Mode 2 - knowledge production*' developed in Gibbons et al. (1994); Nowotny, Scott, & Gibbons (2010) as methodological approach.
- Construction of a prototype of the oven once the design was optimized and validated by cluster firms and researchers involved.
- Installation of the prototype in the pilot plant of the CAPN for testing and complementing functions with the existing equipment and services offered to food firms.
- Development of pilot tests of technology transfer to local metal-mechanical industries, facilitating the availability of the oven design in the local market *without restrictions of intellectual property*.

There were the difficulties to overcome during the execution of European Union funds as heavy administrative structures of government and university, which caused challenging delays. However, experience and institutional efforts positioned UMSS and UTT as a regional benchmark for ProBolivia as key partner for implementation of other innovation programs in Cochabamba in the development agenda (i.e. sectorial innovation centres, production networks, science parks and specialized training programs).

Science-based and experience-based knowledge production and prototyping

Waiting for budget allocation, the PDTF linked 2 groups of pre-graduate students to determine the technical parameters and prepare a preliminary design. They belonged to the school of Industrial Engineering in the course of Design for Industry, modelling and simulation. For this purpose, periodic meetings were organized with firms and researchers of CAPN and PDTF, as well as visits to cluster firms.

Once funds were allocated, one student of the Electro-Mechanic program in his last semester was hired to work exclusively to develop the final design and the oven prototype at PDTF. The student also used this project as his thesis project. UTT facilitated an interactive dialogue between the student consultant and a transdisciplinary team of specialists linked to the cluster:

- 2 Mechanical Engineers from PDTF.
- 2 PhDs and 1 MSc in food technology from CAPN.
- 1 doctoral student in food technology from CAPN and 1 on innovation systems from UTT
- 4 MSMEs of the food cluster specialized in bakery and Andean pseudo-cereals.
- 1 administrator, 2 facilitators and 1 general coordinator from UTT.

The design process and prototyping involved planned periodical technical meetings with researchers, including the PhD students studying bakery process, as well as following and tests of the functions with entrepreneurs from the cluster. These meetings allowed the designer to link science-based and experience-based knowledge, while maintaining its functionality for cluster firm requirements. Condori Rocha (2015) described the general characteristics of the prototype turbo-forced-oven of variable rotation as follows:

- The oven has a capacity of baking 120 kg of product on its trays.
- It uses a forced type burner.
- It has a cooking chamber with a closed-circuit recirculation system.
- It offers a rotation system of trays, whose distances between trays are adjustable.
- It counts with a humidification system (steam) to ensure the quality, texture and appearance of the product.
- The oven is easy to assemble with indoors made of stainless steel and the outside of carbon steel, after a previous treatment to prevent its corrosion.
- It provides automated control system for temperature, humidity, airflow, time and tray rotation.
- It offers functions of care, safety and comfortable conditions for handling heat isolation, noise, signalling, alarms and control panel.
- All parts were built in Bolivia and the final cost in the local market is optimized.

The prototype is available to be tested providing services to the cluster firms and researchers at the CAPN pilot plant. Therefore, incorporation of precision-measuring

devices for experimentation and data collection of its performance (e.g.: register temperature curves, humidity, air-flow, energy efficiency, etc.) is considered.

Conclusions

After the construction of the prototype the project was satisfactorily completed for ProBolivia. However, from a cluster perspective, more time is needed to reach its final goal, that is to be available for its re-production in general and use by cluster firms in particular, completing the innovation process.

In summary, the project linked

- international cooperation funds administered by a government development agency,
- resources from a public university,
- knowledge production between academics and the expertise of cluster firms.

The project was also used for a pre-graduate thesis, with specific impacts according intellectual property rights (IPRs). According to university regulations all immaterial goods, research and thesis projects produced are intellectual property of UMSS, which means the prototype design is of public goods. In our case, both the material goods (the prototype) and the intangible goods (the knowledge produced in collaboration) can be considered as a common produced within the cluster dynamics, seeking for its rapid absorption, re-production and availability for society. All drawings are accessible to any national metal-mechanic firm to re-produce. The design can be developed further, but without gaining IPR of its original form developed at UMSS. The drawings continue to be commons and available for national firms, which was a measure previously agreed, when the document of the project was presented to ProBolivia.

Relationships built between the food cluster members and the metal-mechanic technicians during the project made visible the strategic potential of the metal-mechanic sector in the region and not only for the food sector. Therefore, UTT started efforts to enable a new cluster platform at UMSS to increase the capacities of metal-mechanic firms to produce and re-produce technology locally. This cluster platform would involve and mobilize a range of disciplines at UMSS as well as manufacturing experiences around the capacities already installed at PDTF.

Final Reflections and General Conclusions

The experiences and results presented above describe institutional efforts from a public university to cultivate closer relations with other agents in society to foster inclusive development within an autonomous regime. Adopting a co-evolving approach proved to obtain better results in building more dynamic long-term relationships among diverse society actors (including academics, entrepreneurs, policy-makers, civilians, etcetera) compared to previous linear approaches at UMSS.

According the inclusive innovation case of the oven, the tailor-made prototyping incorporates important novelties and improvements by its own in comparison with the ones available for MSMEs in the domestic market. The oven experience pushed the

PDTF research centre towards improving its capacities on design and prototyping of industrial equipment in semi-industrial scales. In a similar way, this experience improved UTT management capacities on innovation processes and administration of governmental funding. Nevertheless, in this paper we attempt to focus on the whole process of innovation, not only on the products (material or immaterial) and results, but on the type of relations that emerged under this kind of system approach.

The innovation practices seem to be located at the edges of the institutions involved, where the will has a key role on successful collaborations. By recognizing the dimension of 'the political', intrinsic in all human relations, we are able to re-read innovation processes also as the possibility for transformation of social-relations (which are always contingent constructions). Thus, to work with development of more adequate 'politics' to foster pluralistic democracy is key for problem-solving knowledge production. This aspect has a particular relevance in Bolivia, in a context of an emerging innovation system pulled by the demand side, which recognizes indigenous knowledge as an important source for inclusion and society *trans-formation*.

We identify collective identity formation as an important element in the clustering process. On the one hand, it makes visible actors positions and mobilizes affections towards shared causes or intentions, facilitating trust building. On the other hand, the notion of a constitutive outside as an effort to unveil the existing shortages, knowledge gaps (ignorance) or exclusions taking place, thus visible for handling. It also reduces the problem of essentialist identity claims, always contingent, aiming to reduce internal barriers for collaboration and inclusion necessary to overcome challenges collectively in a more democratic and pluralistic environment.

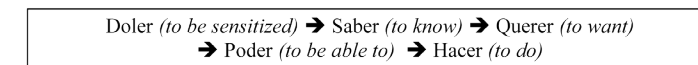
From the inside of the process as facilitator of the Food Cluster Cochabamba, the use of the Triple Helix model is relevant for giving schematically an initial systemic approach, calling for the presence of government, university and industry representatives. Nevertheless, its discursive overuse resulted in a reinforcement of internal differences and self-affirmation upon essential roles of actors (university, government, industry) in the fostering of growth and a knowledge-based economy. Our experience shows that the public university, some groups of producers and diverse forms of social movements involved (e.g.: ecologists, indigenous, organic producers, etc.) described challenges from logics not necessarily aligned to state or market predominant purposes. On the other hand, on issues like attracting the support from more relevant actors, the Triple Helix model presented discursive limitations. When focusing on three main actors in the model, it reduces the visibility of other relevant actors called to collaborate. From time to time cluster members felt not being recognized as part of the innovation process in the cluster and often suggesting to the facilitators to incorporate more helixes in the model. It is not a minor issue to consider plural-democracy and trust-building ambitions in the Food Cluster Cochabamba. This is linked to the increased form of Triple Helix into Quadruple Helix model, in which the forth actor can vary in the literature, but is mainly identified as civil society. Therefore, in this early stage of cluster development, we suggest to cluster facilitators at UMSS, once a critical mass of diverse actors is involved, to support collective identities formation based on the notion of a

constitutive outside, as always contingent constructions, fostering collaboration and trust building to overcome shared challenges.

The clustering process seen from its political dimension, in the context of emerging innovation systems in Bolivia with inclusive ambitions, highlights its relevance as a process based on social relations to promote also a social-cultural transformation. The experiences of Trojer, Rydhagen, Kjellqvist (2014) in East Africa as well from Bolivia emphasize cluster initiatives to create an initial platform for interaction and mutual learning between universities, firms and farms and governmental bodies.

From the innovation processes in the food cluster we find important similarities in the first part of the logical sequence for social change proposed by Monedero (2009). This sequence is presented in the figure below.

Figure 4.10 First part of the progression for social change



Source: Adaptation of Monedero (2009).

Monedero (2009) recognized that any social transformation involves first of all a process of awareness. Following Monedero's thinking we will review each of the stages in context.

- '*Doler*' (to be sensitized): This aims to generate a sense and touching emotionally to the collective, that is, expand their sensitivity, calling for empathy. In this way, the desire to solve the problem/demand/challenge shared while re-creating social-relationships. We believe it is relevant in this phase to also include the idea of cultivating 'compassion in action' developed by Goleman (2015) on Dalai Lama's reflections. Compassion in action not only means alleviating suffering but committing to rectify mistakes, oppose to injustice and to defend human rights. Equality, transparency and accountability are also identified as principles that exemplify compassion in action. It is emphasized that violence is not necessary. This is particular important in Bolivia, where the structural failures of the system and visible injustices are often confronted by the use of violence.
- '*Saber*' (to know): It means transforming sensitiveness and awareness in adequate knowledge that gives insights about its possible causes and effects associated. This knowledge is produced from the articulation of available knowledge from both researchers (academic) and cluster firms (experience), in order to improve the characterization of challenges/problems/demands in greater complexity. Knowledge articulation can be facilitated by each actor humbly recognizing its incomplete knowledge, in order to facilitate their openness to listen to other actors' contributions. It is in this phase where an epistemic plurality in dialogue increases the possibility to visualize divergent questions on the problems. Divergent questions enable divergent answers, as well as new alternatives of collaboration - a key characteristic of innovation.
- '*Querer*' (to want): It refers to the fact that articulated knowledge production has generated a collective will for action and commitment with the alleviation of problems. A will that is based on a principle of hope, a belief that what exists in the present does not entirely determine the range of possibilities for the future. There is no necessarily linear or cumulative relationship between the present and what can be expected for the future. In this phase available knowledge and will contribute to decision-making about the

inclusion of specific paths and alternatives of collaboration in the cluster agenda. It is important to remember the contingent character of decisions made, alternatives chosen and priorities, when it comes to inclusion and democratic ambitions.

- ‘Poder’ (to be able to): It is understood as an improvement of the initial conditions (material or/and immaterial) now making possible one or more alternative solution. It may come from adequate knowledge availability (experience, technology, research results, prototyping, training), commitment of resources (material, immaterial, public, private, etc.), changes in context (political, normative, economic, etc.), efforts produced collectively, or a mix of them, becoming opportunities of action towards solution approaches.
- ‘Hacer’ (to do): It is understood as the satisfactory intervention in society, production and re-production of the solution alternatives, the consolidation of the innovation process. In the experience presented, this phase in particular exceeds the capacity of the university and requires strongly the other agents’ involvement and commitment, especially the users to close the cycle.

Finally, with respect to the presented logic-sequence we want to clarify it is not a sequence of steps to follow. It is rather visible stages, in dynamic interactions and temporal overlapping exists, all crossed by processes of interactive learning. However, its use serves to visualize core phases and contribute to a deeper development of more adequate handling of cluster dynamics and democratization of university research agendas at UMSS.

Acknowledgement

Our deepest appreciation goes to the Universidad Mayor de San Simón (UMSS), the Sustainability Innovations in Cooperation for Development (SICD) and all the actors involved in the Food Cluster Cochabamba. At the same time, our special recognition to M. Condori’s contribution and commitment, leading the process of design and prototyping. Finally, our sincere thanks to ProBolivia and Sida agencies, the main supporters of the cluster initiative on which this paper is based.

Abbreviations

APL	Association of Milk Producers
CAPN	Centre for Food and Natural Products
CADEPIA	Chamber of Small Industry and Productive Manufacturing of Cochabamba
NIS	National Innovation Systems
IPRs	Intellectual Property Rights
PDTF	Program of Manufacturing Technology Development
ProBolivia	Promoting Bolivia
MSMEs	Micro Small and Medium sized Enterprises
SENASAG	National Service of Agricultural Sanitation and Food Safety
Sida	Swedish International Development Cooperation Agency
SICD	Sustainability Innovations in Cooperation for Development
UTT	Technology Transfer Unit
UMSS	Universidad Mayor de San Simón

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4.6 Paper 5

The emergence of the “UMSS Innovation Team”: potential for university research culture transformation and innovation community building

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Abstract

In this paper, we show the way in which bottom-up collaboration initiatives at a public university are co-evolving in developing new relations and forms of socially inclusive knowledge production. The experiences emanate from a university innovation program in Bolivia, generating trans-disciplinary interaction platforms for cluster development and the democratization of the university research agenda. After eight years of collaboration (2008-2015), cluster development has shown co-evolving dynamics, with changes in research practices and the involvement of researchers committed to inclusive innovation. The emergence of the so-called “UMSS Innovation Team”, an open multidisciplinary network of 35 researchers, has led to a culture transformation in research practices at the Universidad Mayor de San Simón (UMSS). The type of relations established between researchers, policy makers, entrepreneurs and other social agents has shown the potential to shape what we have termed an ‘innovation community’.

Keywords: Innovation systems, cluster development, innovation community, developmental university, Bolivia

Introduction

It is widely recognized that wealth concentration, income inequalities, climate change, environmental degradation and social exclusion are among the greatest international challenges facing us today. The contemporary magnification of those problems has been linked to power relations in development and economic growth processes involving state structures, and to the capitalization of advanced knowledge and innovation. As is often the case, major impacts affect less privileged social groups. Nevertheless, these challenges have presented a diverse range of activists and academic collectives, as well as national and international organizations, with the common incentive to discuss alternatives and act to reduce destructive impacts.

The Bolivian case has revealed itself as highly sensitive to these international challenges. Most of the intense social conflicts during the first decade of this century have been linked to claims regarding the recovery of material autonomy for national natural resources (e.g., water, energy, land, etc.) and made visible the need for expanding democratic forms of inclusion and participation, especially for the country’s traditionally marginalized groups, the indigenous people. While improvements have been made,

most of these challenges require more long-term attention, discussion, and solutions. However, the present debates have been successful in problematizing the neoliberal development agenda from many perspectives, highlighting the importance of strengthening local decision-making and action capacities.

The contributions of scholars such as Arocena & Sutz (2014, 2017) are important in this context. They provide in-depth discussion of the end of development understood as a ‘place’ (or ‘level’), as well as a ‘path’ (or ‘ladder’). On the one hand, a place or level is occupied by the so-called ‘developed’ countries. On the other, a path or ladder entails transition by other so-called ‘developing’ countries. The researchers argue that the dominant development paradigm can be summarized by stating that highly industrialized capitalist countries have already climbed the development ladder, while developing countries attempt to climb the same ladder to ‘catch up’, mainly by means of insertion into a global order ruled by markets and comparative advantage. However, ‘kicking away the ladder’ (c.f., Chang, 2002) has been a major concern for dominant industrialized countries, whose frequently successful aim is to prevent this ‘catch up’ process taking place.

One proposed solution is that so-called ‘developing’ countries distance themselves from orthodox catch-up paradigms, and create new ones in their place. Ekdahl & Trojer (2002) argue in favour of strategies fostering situated solutions. Current national development policies in Bolivia are influenced by notions such as “Development as Freedom” (Sen, 1999) and “Living Well/Vivir Bien” (Farah & Vasapollo, 2011). The first one, development as freedom is used as a core concept in the United Nations Development Program (UNDP) aimed at promoting sustainability and equity in human development agendas. The latter is presented as a synthesis and translation of ‘suma qamaña’ and ‘sumak kawsay’ in Aymara and Quecha, local languages. Living Well/Vivir Bien is used as a way of grouping numerous indigenous aphorisms in Latin America. Previously adopted by a diverse range of social movements, it was introduced into the Bolivian constitution in 2009 to steer national development policies. Both concepts can inspire new alternative paradigms aimed not at ‘catching up’ but at bringing dignity to people’s lives and building sustainable relations between humans and nature.

A central concern of this paper is to discuss how the role of advanced knowledge and innovation can improve contributions to social inclusion and sustainability in Bolivia. We highlight the relevance of the public university as a central institution where important changes and new dynamics can be fostered. In keeping with this, we present insights gleaned from experiences at the Universidad Mayor de San Simón (UMSS) on building a multi-disciplinary innovation network (the “UMSS Innovation Team”) within a systemic framework. Implemented in 2008, this initiative co-evolved with other bottom-up efforts. Its aim was to transform the culture and dynamics of university research culture, laying the groundwork for what might be termed an ‘innovation community’.

In the following chapters we examine how some cluster developments are shaping a platform whereby new research practices are promoted in public universities, creating the necessary space for bottom-up inclusive innovation processes. A systematic innovation approach has promoted co-evolutionary links between research activities, cluster dynamics, and socially inclusive knowledge production. The study is based on an action-research approach supported by information from semi-structured interviews with researchers from one university directorate and five research centres, who have participated in the whole cluster development process. Both authors have held different positions within the Technology Transfer Unit (UTT) – the unit responsible for management and facilitation of innovation activities at the university.

University research background at UMSS

The Universidad Mayor de San Simón (UMSS) is one of Bolivia's eleven public universities and part of the Bolivian University System (SUB) coordinated by the Executive Committee of the Bolivian University (CEUB). Created in 1832, it is founded on the principles of autonomy, democracy and co-government. UMSS is the second-largest public university in Bolivia, with approximately 75,000 students and 2,500 teachers in 2015. Research is one of the university's three core functions, along with education (undergraduate and postgraduate), and social interaction or services to society (the so-called 'third mission'). The Directorate of Scientific and Technological Research (DICyT) coordinates scientific research activities at UMSS.

Initially, the research environment at UMSS was characterized by isolated efforts in heterogeneous research centres driven by volunteer-like actions in precarious conditions. Some research centres developed skills to attract resources and consolidate, while others closed in the last decades. However, research activities have gained importance during the last 15 years thanks to the sustained support of international cooperation agencies and the recent allocation of government funds from hydrocarbon taxes (IDH). This support has allowed for the introduction of modern scientific equipment, improved physical infrastructure, training for postgraduate (MSc and PhD) researchers at international universities, as well as strengthening a central research management and support system at DICyT. According to a report entitled "Universidad en Cifras 2012" (UMSS, 2012), the research capacities at UMSS consist of:

- 42 research university units: 33% located in the Faculty of Science and Technology, 21% in the Faculty of Agronomy, 17% in the Faculties of Medicine and Biochemistry, and the rest in other faculties.
- 219 university researchers: 18% hold a PhD degree, 35% hold a MSc degree and 47% are graduate students. Of these, 42% belong to the Faculty of Science and Technology, 16% to the Faculty of Agronomy, 15% to the Faculties of Medicine and Biochemistry, and 26% to other faculties.

Clearly, most of the university's research capacities are concentrated in the Faculty of Science and Technology and the Faculty of Agronomy. Nevertheless, for all their efforts, attempts at technology transfer to society have met with limited success. In the last 15 years, research activities have shown a marked interest in increasing the social

relevance of research results. The creation of the Technology Transfer Unit (UTT) in 2004 was influenced by linear models of university-society interaction. To succeed, however, these linear models require certain structural conditions, and dynamic systems are put in place to promote supply- or demand-driven relations. As is the case in many other developing countries, weak market demand of knowledge in the Bolivian context is a structural problem (Arocena & Sutz, 2010) affecting linear dynamics. In 2007, UTT launched the "UMSS Innovation Program" – as a new approach aimed at strengthening the university's capacities to participate in innovation systems. A few years later, the concept of *innovation systems in developing countries* presented by Lundvall, Vang, Joseph, & Chaminade (2009) was adopted as a relevant concept framework at UTT. The Innovation program at UMSS began creating pilot platforms for cluster developments and other innovation initiatives, linking academics (researchers, teachers and students) with local small- and medium-sized enterprises and government agents. We will discuss some specific aspects of this program in the following chapters.

DICyT used these experiences among others to formulate a university research concept framework document, entitled, "Marco Conceptual: la investigación en la Universidad Mayor de San Simón, 2012-2021". This document establishes:

Research at UMSS is a significant activity aimed primarily at contributing to the regional and national development processes, through the generation of useful knowledge and analytical capacity. This activity also intends to contribute to the general progress of scientific knowledge. (DICyT, 2012)

In the same document, research activities at UMSS are committed to supporting socio-economic development goals, in a similar fashion to those already established at the national level. These are prioritized as:

- Sovereignty and safety in food production.
- Development of technology for production and industrial activities.
- Protection and improvement of health.
- Production, distribution and rational use of energy resources.
- Habitat and human settlements.
- Social development and citizens' participation.

Additionally, innovation, environmental care and the retrieval of local knowledge are thought to intersect with all of the above. In terms of competition for funds at UMSS, financed either by IDH or by international cooperation, research proposals in all fields must either involve a social representative as partner or respond to a specific social need, with identified beneficiaries.

To give a contextualized theoretical framework, as observed by Acevedo, Céspedes, & Zambrana (2017), the concept of a 'developmental university' is used to support those efforts and to draft a vision for institutional development in the context of an emerging national innovation system. Brundenius, Lundvall, & Sutz (2009a) define the developmental university as one that is open and engaged in interaction with different groups in society, including industry, and whose operations are not guided by profits. Its central aim is to contribute to social and economic development, while at

the same time safeguarding a certain degree of autonomy. Later, Arocena, Göransson, & Sutz (2015) describe such universities as committed specifically to social inclusion through knowledge via three main avenues: democratization of access to higher education; democratization of research agendas; and democratization of knowledge diffusion. Accordingly, the developmental university is characterized by its commitment to inclusive development by means of three interconnected missions: (1) teaching; (2) research; and (3) fostering the socially valuable use of knowledge.

The UMSS Innovation Team

Background

In 2007, the UMSS Innovation Program was launched at UTT with financial support from the Swedish International Development Agency (Sida), and technical support from the Swedish cooperation platform, Sustainability Innovations in Cooperation for Development (SICD). The program was created with the objective of developing institutional competences and capabilities for studying, promoting and actively participating in innovation systems and processes at the local, regional and national levels (UTT, 2006).

This program started by focusing on two strategic action fields. The first of these was aimed at fostering an internal research culture transformation, whereby trans-disciplinary knowledge production can address (and solve) problems in society. The second, external action was aimed at generating more permanent interaction platforms with agents in society, generating new kinds of relations fostering inclusive innovation and learning dynamics. These actions included the following objectives:

- To sensitize a critical mass of academics (researchers, teachers, students) to new research practices, encouraging them to participate in innovation processes and to learn from a systemic approach to interaction. This led to the emergence of the UMSS Innovation Team.
- To enable sustainable platforms to foster non-linear interactions (university, industry, government, other social groups and institutions), inspired initially by the notion of ‘cluster development’, resulting in collaborative innovation and learning processes addressing specific production sector demands. The Food Cluster Cochabamba and the Leather Cluster Cochabamba were created in 2008 as pilot initiatives to support micro-, small- and medium-sized enterprises (MSMEs).

The UTT took a facilitating role in both components of the innovation program, which showed co-evolving dynamics as the number of activities and actors increased. The focus of this paper is the first component: the emergence of the UMSS Innovation Team and its dynamics between 2008 and 2015. It is also important that we first describe some features of the second component.

Cluster development takes place on university platforms using UTT’s infrastructure, facilities and facilitation support. Centred on MSMEs, this includes various sectorial actors (e.g., government bodies, regulatory agencies, NGOs, etc.), and makes use of alternative collaborations with the university to solve specific sectorial demands in the

Cochabamba region. The following table gives the number of members involved in 2008 and in 2015 for both clusters.

Table 4.1 Number of active members involved in dynamics of the Food and Leather Clusters at UMSS for years 2008 and 2015

	Food Cluster Cochabamba		Leather Cluster Cochabamba	
	2008	2015	2008	2015
Firms	15	45	11	50
Research units at UMSS	6	4	5	4
National/Regional government bodies	2	3	2	5
Sectorial organizations	6	5	6	3

Source: Based on UTT (2009, 2015)

Note: The statistics is based on information available at UTT, looking at those members, who have participated at least in one cluster activity during the year besides of planning activities.

Both clusters work as operative tools to foster more socially relevant research agendas in the university, while generating collaborative relations with non-academic actors engaged in knowledge production processes and improving firms knowledge absorption capacities. Cluster dynamics are inspired by “Mode 2 knowledge production” developed by Nowotny, Scott, & Gibbons (2010). In this approach, Mode 1 knowledge production represents the traditional (disciplinary) approach, while Mode 2 promotes greater dialogue between science and society across the full knowledge production process, thus maintaining the quality and relevance of the university’s research results. Mode 2 has always existed, and Mode 1, which began during the scientific revolution in the 17th century, is incorporated into Mode 2.

To date, cluster development attempts at UMSS can be closely related to the notion of “socially inclusive knowledge production” (Brundenius, Lundvall, & Sutz, 2009b). This term is used to highlight purposeful action towards knowledge production, with the explicit aim of solving some of the most pressing problems of those ‘excluded from common facilities or benefits that others have’. This aim can be extended to production support, notably for SMEs, who find it particularly difficult to acquire ready-made solutions in the world market and may benefit from a more ‘tailor-made’ approach to their knowledge needs. The problem at hand is that this type of problem solving faces not only a lack of financial resources necessary to purchase available solutions but also, frequently, the nonexistence of such solutions.

The Emerging UMSS Innovation Team

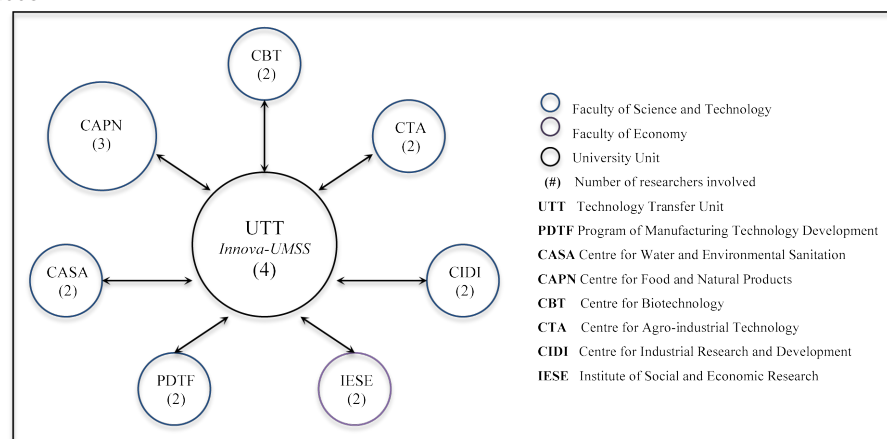
A period of sensitization led by UTT was followed by the creation of the first innovation initiatives: the Food Cluster Cochabamba and the Leather Cluster Cochabamba. In 2008, their dynamics attracted an initial multidisciplinary group of 15 researchers,

most of whom were involved in both clusters. These researchers belonged to seven different research centres (the majority from the Faculty of Science and Technology and one from the Faculty of Economy). They participated in workshops, meetings and discussion tables, as well as hosting guided visits to their respective research centres and collaborating on short-term projects with cluster members. These activities were focused on meeting the cluster's demands by either taking advantage of previous research results or using the university's existing capacities. The aim was to unite the group and benefit from 'low hanging fruits'. The researchers thus lent their support to:

- training courses (marketing, good manufacturing practices, product design, administration, local regulation).
- advisory support, laboratory services, access to scientific information,
- supervision of short-term research projects, mostly handled by undergraduate students.

All of these facilitated and supported the UTT innovation program. The following figure illustrates the starting group of researchers involved in cluster dynamics as a UTT-centred internal network. A researcher is considered 'active' if he/she is participating in more than one activity generated in the cluster during the year.

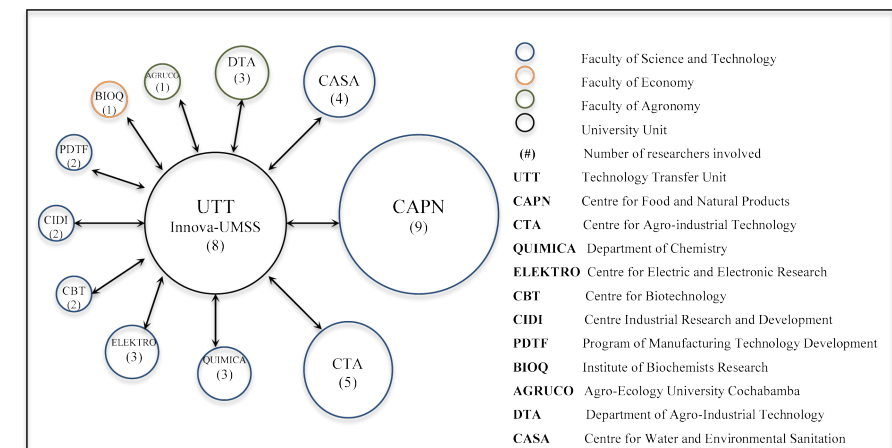
Figure 4.11 UMSS Innovation Team network linked to innovation system dynamics fostered by UTT in 2008



Source: Based on UTT (2009).

By 2015, cluster arenas allowed for the group to grow to 35 researchers, spanning 11 research centres and 3 faculties. The particular demands and activities prioritized in both clusters have had an impact on relations with university research centres. These have consolidated existing relations with some research centres by involving more researchers, formalizing agreements, and improving their research competences regarding specific production sector dynamics. Prioritized activities have also extended their reach to new research centres as a function of their competence and relevance to a specific problem or demand. The following figure illustrates the augmented network:

Figure 4.12 UMSS Innovation Team network linked to innovation system dynamics fostered by UTT in 2015



Source: Based on UTT (2016).

UTT improved its competences and increased its technical team in facilitating cluster development. In 2013, with the support of Sida, UTT started a postgraduate program to study innovation systems and cluster development in Bolivia. The program currently has two PhD students, and is launching a national master's program in the same fields in 2018.

The UMSS Innovation Team (including UTT) currently includes:

- 9 PhDs, 4 PhD students, 25 MScs, and 5 engineers.
- 11 directors, 27 researchers, 2 teachers, 2 cluster facilitators and 1 administrative assistant (all at UMSS).
- 15 women and 28 men.

From 2010, as the number of team members increased, UTT began to organize specific activities for each. Lectures, seminars and annual meetings were organized to discuss both theoretical and practical approaches to innovation processes for inclusive development. Recently, local and international experts including academics, policy makers and other leaders have been invited for annual meetings. Equally important is the organization of fairs at the university campus, where researchers and entrepreneurs present research results, new products, services, working demands (firm internships, laboratory assistance, research needs, etc.) and potential innovations, as well as alternate collaborative ways to overcome shared challenges. These fairs are open to both the academic community and the public, increasing visibility and reinforcing the importance of collaboration and trust building for inclusive innovation and learning processes.

In 2015, a group of four researchers from different disciplines (food technology, biochemistry, metal mechanical and informatics-electronics) started a training course

on innovation management. The course included visits to Swedish technology parks, incubators, clusters, co-working arenas, policy makers, and prominent innovation research centres. The course included a training session in Sweden and updating sessions in Bolivia. The aim was that these researchers would go on to become agents of culture transformation in their own centres, and lead new initiatives within the UMSS Innovation Team. In 2016, the team increased in size, employing three new researchers (chemical of non-metallic materials, energy and agro-industrial technology).

It is worth highlighting the support offered by the institutional authorities for research centres, faculties, and rectors, all of which are key elements in the UMSS Innovation Program. The support has allowed motivated researchers to include clustering activities in their annual activity plans, as well as providing the minimum resources necessary to continue with their work.

Some co-evolutionary experiences within the innovation processes

In this chapter, we examine the knowledge of co-evolutionary experiences within innovation processes from the perspective of researchers who have participated in cluster development from its early stages. The data was mainly obtained from semi-structured interviews performed in 2016. We present aspects of how new research competences and cluster dynamics co-evolved at UMSS. First, however, we introduce some historical aspects of the relation between research centres and the university central research directorate, together with some lessons learned regarding improvements in socially relevant research.

The University Directorate of Scientific and Technological Research (DICyT)

In the late 1970s, a national university congress proclaimed that research and social interaction activities should be developed in all public universities alongside the traditional role of education. The universities subsequently created a central research directorate. In the case of UMSS, its central research directorate (DICyT) emerged with a lack of resources and a low institutional presence. Research centres activities were mostly coordinated at the faculty level.

Research centres at UMSS were formerly born of isolated research projects, becoming research programs as they grew in resources and activities. Later, some were formally recognised as research centres based on a critical mass of researchers, accumulated equipment and basic infrastructure. During the 1990s, research activities were increased alongside resources from international cooperation. At that time, researchers and their international partners usually managed resources without the mediation of DICyT. Some institutional weaknesses at that time were instability, repetition, and lack of an institutional vision for research activities and their diffusion. At that time, the first documents on university research regulation and evaluation criteria emerged. Similarly, technology transfer allowed for increased financial resources and sustainability for research centres.

After 2000, DICyT was able to gain an increased university presence, generating administration competences for international resources allocated to university programs. In particular, Sida supported building a university research management system and specific research programs (e.g., international PhD training, equipment, and infrastructure). DICyT thus generated management competences to centralize research activities and resources at UMSS, including resources from various international co-operation and national government funding.

High-quality, socially relevant research has always been a main concern of the university. Beyond the university's borders, demand for more socially relevant research has increased in the last decade. DICyT currently leads the university planning processes for strengthening the research system, which is organized in close relation to national development goals. Nevertheless, efforts to facilitate the use of research results have had a limited impact. The main actions promoted by DICyT, together with the lessons learned, are summarized in the following points:

- Socio-economic fields were prioritized within the university's research agendas. These fields have a close relation with the national development agenda and recognize Living Well/Vivir Bien as a core concept to environmental sustainability and inclusion. This approach has been accepted by university researchers, who are often not fully aligned with state or market interests, but who are always committed to improving national social conditions.
- Competing for research funds at UMSS requires a) responding to a social need (within the prioritized socio-economic fields), and b) identifying a specific social partner or beneficiary. Problems to overcome regarding this include: a) fragmentation of research resources; b) requirement to meet social demands by improving relevance assessment and support mechanisms for researchers; c) ways of generating knowledge accumulation processes and improving selection of social partners or beneficiaries; d) establishing an emergency fund to respond quickly to crisis situations affecting society (e.g., environmental contamination, natural disasters).
- Research evaluation has improved, with the aim of reaching international standards. Research results have been published in indexed journals and support given to researchers to participate in international networks. However, it remains the case that social impact qualifications and incentives for local networking need further improvement.
- ICT infrastructure at UMSS has been improved, including access to scientific databases (Perii). The aim is to expand the infrastructure to include a more diverse range of research fields and internationally recognized academic databases. At the same time, efforts must be made to improve the availability of verified local information generated for decision-making processes.
- PhD students who belong to a sandwich program involving UMSS and an international university are appointed as university researchers after completing their postgraduate studies. PhD students at UMSS should be challenged to lead multidisciplinary research and postgraduate programs, with incentives in place to improve their research activities.
- Annual diffusion of material, with research results presented as offers of knowledge to society. Institutions interested in these offers appear sporadically, although they are often unable to invest due to lack of resources. Lately, the UTT, operating out of the Faculty of Science and Technology, has shown significant results in university-society collabora-

tions linked to an innovation system approach. There are other successful but isolated examples of university-society collaboration. Unfortunately, the cumbersome institutional structure at UMSS slows the self-learning process and hinders the adoption of new paradigms in the university research system.

Historically, the main ambition of the DICyT has been to promote an international-standard research culture at the university to support social development at both local and national levels.

Researchers' experience within cluster development and innovation processes

In this section, we share the main insights drawn from interviews carried out with researchers from five research centres, all of whom have participated in the UMSS Innovation Program since its early stages (cluster development and UMSS Innovation Team). In general, questions were aimed at getting to know more about researchers' personal experiences of innovation processes, perceived changes in research practices, lessons learned, and ways to improve socially inclusive research practices within the cluster platforms in the future.

- *Centre for Food and Natural Products (CAPN)*: This centre has a number of researchers involved in cluster dynamics through research activities and laboratory services. Research activities linked to the Food Cluster (2008-2012) influenced important components of the proposals presented at the subsequent bilateral research cooperation with Sida (2013-2017). It was decided to strengthen research capacities and services for bakery and nutrition processes, privileging the use of native pseudocereals in Bolivia (e.g., quinoa, kaniwa, amaranth wheat and others) and forging closer links to local MSMEs within the cluster platform. As a starting point, two PhD students were asked to perform research on identified local needs. Before 2012, PhD training in the centre was generally motivated by science. Both students were pursuing their PhD studies at UMSS and Lund universities. CAPN have also addressed the question of which national and international resources are needed to build a pilot plant and laboratory facilities with sophisticated equipment for measuring the quality of flour and bakery products (new purchased equipment, and an oven built at the university as part of a food cluster project). Interactions with firms allow CAPN to meet local demand and re-establish some practices that were formally part of the centre's agenda (e.g., 20% discount for the analysis of cluster firms; support for undergraduate research on innovation projects within the food cluster). In the past, for all their good will, researchers commonly failed to identify specific social demands in the absence of interaction platforms. To foster research activities linked to local demands, researchers require more 'freedom' (flexibility in regulation and evaluation; availability of resources) to formalize and legitimize these practices at the university level. So far, these activities have shaped researchers' networks, fostered collaborations that have overcome challenges posed by a restrictive bureaucracy, and facilitated practical answers. More mechanisms are required to improve trust building with social stakeholders. Similarly, more resources are required from government, industry or others engaged in local knowledge production to establish fruitful relations. One of the doctoral students at CAPN received training on innovation management in order to support innovation processes from inside the research centre.
- *Centre for Bio-Technology (CBT)*: This centre within the Faculty of Science and Technology, while relatively new, has quickly acquired a range of specialized equipment, as well as highly qualified researchers from a spectrum of diverse disciplines. In the past,

interactions with concrete social demands were sporadic and mainly aimed at developing water treatment processes using microorganisms. However, participation with tannery industries in the Leather Cluster has inspired some research projects to establish a more sustained collaboration. These projects developed less environmentally aggressive leather hair elimination based on bioprocesses instead of traditional chemical procedures. Two undergraduate students were involved in these projects, which were carried out with the supervision of a PhD researcher from the centre and the participation of local tannery firms. This is a sensitive issue for local stakeholders, as the municipality of Cochabamba and other regulatory organizations are increasing restrictions on tannery firms. CBT is currently running more projects for the tannery sector and collaborating with firms to carry out pilot studies to validate knowledge production and facilitate its exploitation outside the university. To implement new production procedures, industry capacities to utilise knowledge must improve and become more flexible. The university's socio-economic goals steered CBT's research agenda towards meeting local demand. Evaluation of this process, however, is still more focused on budget execution than on scientific quality.

- *Centre for Water and Environmental Sanitation (CASA)*: This unit has a long tradition within the Faculty of Science and Technology. It has participated in both cluster developments supporting water analysis and water management training. In 2015, the leather cluster created a specialized laboratory focused on the characterization of wastewater with Sida funding. A specialized researcher is formally in charge of this initiative, with support from an assistant and an undergraduate student hired by UTT. The aim is to support tannery firms within the cluster with measuring wastewater and following environmental regulations. Two researchers from the centre have received specialized training regarding these new services, both in the university laboratory and with field sampling. However, the research centre is unable to address the full range of industry requirements.
- *Department of Agro-Industrial Technology (DTA)*: This unit is located within the Faculty of Agronomy. DTA has a long tradition of working on applied research, particularly pilot plants. Its main activities and services concern milk and local fruits processing (e.g., jam, juices and dehydrated fruits, as well as a range of cheeses, yogurt, and other dairy products). The Food Cluster facilitation connected this centre with local firms (e.g., the Association of Milk Producers, APL) with a brief to improve the production and variety of dairy products. Research projects and training activities are focused on improving the practices of current firms, as well as developing new product variants. This work is done in collaboration with undergraduate students and other research centres of the Faculty of Science and Technology. The UMSS Innovation Program at UTT has supported the allocation of specialized equipment at DTA to improve milk quality analysis. DTA researchers have participated in the design of a lyophilizer, which was built at another university research centre (PDTF). This equipment, once optimized, will be installed in the DTA pilot plant to improve both services provided by firms and research carried out by students. One of the main ambitions expressed by the unit was their desire to link their capacities through the Food Cluster with those of rural communities in order to solve production challenges by means of innovation processes.
- *Program of Manufacturing Technology Development (PDTF)*: This centre has accumulated some important metal-mechanic equipment. Its activities have traditionally focused on training activities for undergraduate students and technicians from outside the university, as well as the design and production of high-precision mechanical instruments for both university research centres and industry. Prior to the cluster program, experience in designing and building complete semi-industrial equipment was rare. PDTF has developed automatized prototypes of semi-industrial equipment for both clusters, including

an automated bakery oven (Acevedo & Trojer, 2017), a lyophilizer for experimenting with sublimation processes (Food Cluster) financed by ProBolivia and two pneumatic shoe presser designs (Leather Cluster) (Sanzetenea, 2017). All these prototyping efforts were facilitated by UTT, fostering a close collaboration between researchers from other centres and interested MSMEs, and involving undergraduate students. These projects joined university resources with government and international funding. The experiences motivated the research centre director to promote a medium-term strategy to strengthen its research and services capacities, and to forge closer relations with the metal-mechanic sector in the Cochabamba region. The idea of establishing a metal-mechanic cluster was favoured at the centre, as it enjoys of an increased national visibility with ProBolivia – a government development agency. To this end, one researcher was trained in innovation management.

Discussion and Conclusions

The cluster development experiences of the UMSS Innovation Team in the context of the UMSS Innovation Program revealed that fruitful relations can be built around knowledge production, from the perspective of both demand and supply. Between 2008 and 2015, demand for knowledge production was mainly generated within cluster development dynamics, and supported by the UMSS Innovation Team. During this period, both co-evolving activities and the number of actors increased. The types of relations based on trust cultivation between the actors involved, university authorities support, seed funding from Sida and flexible dynamics of collaboration emerging from these processes have been key to maintain the initiatives functioning so far. Particularly, in a context of low resources setting such as in Bolivia.

The UMSS Innovation Team has grown as MSMEs have made their demands visible to cluster platforms and engaged research centres whose capacities match this demand. The inclusive approaches aimed at the democratization of knowledge production and supported by facilitators at UTT have given voice to MSMEs in terms of analysis, dialogue, new consensus (common agendas), and research practices. In this case, the focus is on supporting MSMEs (food and leather sectors), but it could equally take the form of any social movement, marginalized group or similar with the will to collaborate with UMSS.

A main challenge for university facilitators and researchers is balancing the differences in time perspectives that exist between MSMEs and a public university such as UMSS. On the one hand, MSMEs generally operate according to private sector logic. They perceive time as linear, and are more interested in activities with visible short-term results. On the other hand, researchers, who are also influenced at the personal level by a linear logic, operate according to middle- and long-term cycles set down by their institutions. An emerging innovation system may be seen as a process enabling platforms with a long-term goal of collaboration leading to both local and national development and new types of relations with society. Fostering collaborations beyond the traditional perspective of isolated 'projects' thus generates a cumulative impact on local production sectors. Research centres have developed several short-term measures (e.g., training courses, fairs, and short research projects with undergraduate students), as well as reorienting some research agendas and improving laboratory services to support

cluster dynamics in the medium and long term (e.g., PhD training, research projects and prototyping, allocation of resources, and acquisition of specialized equipment). Generating impacts at the research policy level remains a challenge, both within the university and in government bodies, in order to allocate more resources to support inclusive innovation system dynamics through the democratization of knowledge (in particular, reducing bureaucracy barriers and increasing competitive funding).

We can understand the UMSS Innovation Team as an open network of researchers whose practices aim for a bottom-up 'research culture transformation' (a term often used in university discourse). However, if we adopt the critical perspective of Bolívar Echeverría (2001), it may also be seen as an exercise in the cultural dimensions of research practices. Echeverría presents culture as a critical cultivation of identity. That is, the opposite of safeguarding, conservation or defence: to step outside and test the validity of individualizing sub-encoding. That is, to experience the danger of 'losing [our] identity' in an encounter with 'the other' performed in terms of interiority or reciprocity. These attitudes contribute to reducing initial essentialist identifications and encouraging collaboration and mutual learning, both of which are of great relevance when it comes to inclusion. At the same time, they acknowledge a degree of autonomy as a core value within the university.

Finally, concerning the future of the UMSS Innovation Program, the co-evolving initiatives and dynamics presented above might establish the basis for the emergence of an "innovation community" for inclusive aims. For that purpose, we find relevant to distance ourselves from conventional ideas of community as the expansion of individuals united by a common property (material or immaterial) around which is built a collective identity. Rather, we use the approach of Roberto Esposito (1998), a community (*communitas*) may be based on the notion of persons united not by a property, but by a *lack, a lack of the proper*. Thus, *fostering encounters (cum)* between a plurality of actors and capacities with an *obligation to give (munus)* either goods or services with respect to the others, generating a commitment of collaboration. In our case, we recognize, the shared lack can be knowledge -both incomplete knowledge or mutual knowledge gaps-. That perspective welcomes and contributes to unite a plurality of persons with diverse capacities in our community as a means to overcome their complex problems identified. Therefore, diversity is appreciated in our *innovation community*, driving its members to collaborate but with the commitment to share knowledge available and produce useful knowledge, which at the same time increases for all the community as it is used to solve their problems and not on the contrary way. Within this community approach, we foster freedom exercising, but not in terms of the usual expansion of the self. We are cultivating here a *welcoming approach* (Levinas, 2002) by fostering the capacity to disrupt totalizing tendencies of the self and pursuit the encounter with the other in terms of that same freedom.

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Abbreviations

AGRUCO	Agro-Ecology University Cochabamba
BIOQ	Institute of Biochemists Research
CAPN	Centre for Food and Natural Products
CASA	Centre for Water and Environmental Sanitation
CBT	Centre for Bio-Technology
CEUB	Executive Committee of the Bolivian University
CIDI	Centre for Industrial Research and Development
CTA	Centre for Agro-industrial Technology
DICyT	Direction of Scientific and Technological Research
DTA	Department of Agro-industrial Technology
ELEKTRO	Centre for Electric and Electronic Research
FCyT	Faculty of Science and Technology
IDH	Government shares from Hydrocarbon Taxes
IESE	Institute of Social and Economic Research
MSMEs	Micro, Small and Medium sized Enterprises
NGO	Non-Governmental Organization
Perii	Program of Strengthening Information Access for Research
PDTF	Program of Manufacturing Technology Development
ProBolivia	Bolivian Government Developmental Agency
QUIMICA	Department of Chemistry
SICD	Sustainability Innovations in Cooperation for Development
Sida	Swedish International Development Agency
SUB	Bolivian University System
UNDP	United Nations Development Program
UMSS	Universidad Mayor de San Simón
UTT	Technology Transfer Unit

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4.7 Paper 6

Public university and production of 'the common' for emerging inclusive innovation systems in Bolivia

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Abstract

This paper presents alternatives for enhancing public universities' participation in emerging inclusive innovation systems in low resource setting contexts. Reflections in the study are inspired by bottom-up inclusive innovation system approaches developed at Universidad Mayor de San Simón (UMSS), Bolivia. The concept of a "developmental university" is both contextually relevant and useful for such empirical approaches. Early experiences at UMSS enabled complex interactive dynamics between the university and other social actors engaged within cluster development (e.g.: regional government bodies, local MSMEs and sectorial associations and regulative organizations). Tensions emerged in agenda setting mainly between firms and government representatives revealed a relatively weak and as yet undefined position of public university in between their preeminent logics. During these early interactions, public and private institutions had their own distinct outlook regarding the way that public universities should operate (implicitly, this generally entailed the university playing a similar role as that of an external consultancy service). Nevertheless, university platforms enabled for cluster development led to long-term perspective and relations matured revealing several insights to light. So far, self-organizing and flexible forms of collaboration have driven cluster development processes to the production of commons (material and immaterial). Its analysis offers key elements for public universities aiming to build learning bridges and alternatives of collaboration with a broader number of social groups in the Bolivian context, but with similar potentials in other Latin American countries. The homologies identified between how cluster development evolved and other studies on social movements dynamics in Bolivia, pointed out to discussions on the production of 'the common' understood as a social relation, identified as an embedded socio-cultural capacity with potentials to enhance inclusive innovation system approaches and university democratization of knowledge ambitions.

Keywords: developmental university; production of the common; innovation systems; inclusive innovation; Bolivia.

Introduction

Globalization is a network system organized around trade, investment by transnational corporations, and financial trends, as well as movement of people and the circulation of information linking various civilizations (Ferrer, 2015). From the early 1980s, the globalization process has accelerated through the hegemonic consolidation of the

neoliberal project and the advancement of science and technology, with the latter recognized as a fundamental value for economic development in central countries. This conception has been widely disseminated by politicians and scholars during recent decades, promoting the emergence of an economy based on knowledge and driven by innovation (de la Mothe & Paquet, 1996). The contingent power relations, distribution of resources, reform measures, and established market dynamics have led to the emergence of a 'capitalist knowledge society'. For both central and peripheral countries, this global trend highlights the importance of developing national policies for science, technology and innovation, often in the context of budgetary limitations (Godin, 2006). As such, the establishment of a National Innovation System (NIS) (Lundvall, Vang, Joseph, & Chaminade, 2009) has taken on particular importance as a general conceptual framework for both the analysis and design of public policies. While this was initially focused on economic growth, it has since expanded to wider aspects of the development process, such as sustainability and inclusion.

In the case of Bolivia, there are increasing efforts to generate policies that consolidate the idea of an emerging national innovation system. Current national development plans designed to stimulate a Bolivian Innovation System were outlined influenced by the period of social revolution from 2000-2005. In 2009, these revolutions led to the establishment of a new national constitution called the Plurinational State of Bolivia. This period was marked by a discussion favouring the expansion of citizen's rights and the recognition of diverse democratic, economic and societal forms. It was a result of the indigenous-peasant people in articulation with other social movements emerging as important political actors at the beginning of the twenty-first-century in Bolivia.

Led by the Vice Ministry of Science and Technology (VCyT), the Bolivian Innovation System aims to foster innovation through the generation of participatory processes for learning and knowledge production that address national prioritized demands. In the national plan for science, technology and innovation (VCyT, 2013), the university, government and production sectors, as well as indigenous-popular sectors and other social movements, are recognized as both demanders and producers of knowledge within an emerging Bolivian inclusive innovation system (Acevedo, Céspedes, & Zambrana, 2015).

It is widely recognized that knowledge production by universities plays a key role in fostering inclusive innovation in developing countries (Brundenius, Göransson, & Carvalho de Mello 2017). In Bolivia, public universities account for 73% of national research centres and 61% of researchers (VCyT, 2011). These are mostly concentrated in two public universities: Universidad Mayor de San Andrés (UMSA) and Universidad Mayor de San Simón (UMSS). As part of the on-going international debate, and by linking innovation system approaches at UMSS with local historic-cultural elements, this paper aims to indicate how public universities can enhance the democratization of knowledge and the cultivation of social relations between actors (as subjects of knowledge) in the context of an emerging Bolivian inclusive innovation system.

The bottom-up innovation system dynamics at UMSS revealed tensions between government (public) and firms (private) organizations. Acevedo & Trojer (2017) describe how these tensions emerged in the early cluster development stages, with each side of the public-private divide having a distinct idea about the way a university should operate and contribute to society. Caught in the middle, the university was left in a weak and undefined position, despite the fact that the subject has been widely discussed in the literature, with some authors taking an explicit position within the dichotomy. Therefore, in the case of UMSS, I have attempted to highlight the importance of the political dimension within inclusive innovation processes as an open, on-going discussion in need of context specificity considerations.

This paper will first summarize the lessons learned from inclusive innovation experiences at UMSS between 2008-2015, followed by an examination of the main claims that have motivated recent social revolutions in Bolivia and their influence on social relations and development ideas. Next, inspired by the idea of a developmental university, we identify some links between the UMSS inclusive innovation experience and the production of 'the common' (understood here as a type of social relation with the potential to enhance university-society mutual learning and collaboration). Finally, core ideas are used to form a politico-ethical foundation of mutual understanding to foster future university-society relations with a broader range of institutions for 'inclusive development' ambitions.

Inclusive Innovation System Approaches at UMSS

Background

The dominant tendency to promote a knowledge-based economy creates a transformation agenda for the university, which is recognized as a strategic institution. Efforts are made to transform the university into an instrument that favours the reproduction of a capitalist knowledge society. Boaventura de Sousa Santos (2007) indicates two main processes that generally mark university transformation policies: the decrease of governmental investment in public universities, and the mercantile globalization of the university. The following two main levels of university marketization are highlighted:

- The first level involves inducing the public university to overcome the financial crisis by generating its own income, especially through partnerships with industry. The public university maintains its autonomy and its institutional specificity, while privatizing part of the provided services.
- The second level consists of gradually eliminating the distinction between public and private universities. The university as a whole is transformed into a company – i.e. an entity that does not produce for the market but rather becomes a marketplace itself for university management, study plans, diplomas, teacher training, evaluation, and research activities.

Other scholars have conceived this process as the emergence of *academic capitalism* (Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004) or *the entrepreneurial university* (Dzisah & Etzkowitz, 2011; Etzkowitz, 2008) fostering the capitalization of knowledge as its main strategy. However, Brundenius, Lundvall, & Sutz (2009) have

pointed out that universities in developing countries are particularly vulnerable to current trends toward privatization, which may threaten the quality of training. Similarly, internationalization may undermine the capacity to mobilize university systems for national developmental purposes.

Experiences of the UMSS Innovation Program

The Universidad Mayor de San Simón (UMSS), the second-largest public university in Bolivia, is located in the Cochabamba region. As for other universities, its research activities faced with two conflicting ambitions. On the one side, researchers seek to attain international standards of scientific quality. On the other, they aim to increase the relevance of their results meeting the needs of society. Despite some isolated efforts within UMSS research centres, social representatives have increased their claims for a more visible relevance, with university research expected to have a greater impact upon local social challenges.

In this context, the Technology Transfer Unit (UTT) was created at UMSS in 2004 as an institutional effort inspired by linear models of linking research results with social users. The various attempts to transfer results to industry have provided empirical insight of the precarious structural production conditions in Bolivia. Looking at national research activities, just 4% correspond to experimental development (VCyT, 2011), what is reflected in weak effective demand of knowledge and poor absorption capacities of research cultivated in the production sector. Many developing countries experience a similar structural problem whereby weak knowledge demand is exogenously oriented, widening the mismatch between acquired capabilities and the opportunity to use them (Arocena & Sutz, 2010).

In 2007, the 'UMSS Innovation Program' at UTT was launched as a new approach aimed at developing institutional competences and capabilities for studying, promoting and actively participating in innovation systems and processes at the local, regional and national levels (UTT, 2006). Drawing on the work of Lundvall, Chaminade, & Vang (2009) in developing countries, this new approach was linked to the idea of innovation systems as a conceptual framework. The initial strategy adopted by the UMSS Innovation Program was oriented towards both supporting university research activities aimed at innovation dynamics and building university platforms for continuing interaction with social agents such as government bodies and other organizations, particularly local micro, small and medium-sized enterprises (MSMEs).

So far, these aspirations have taken the form of 'cluster development': university arenas intended to attract resources and foster common agendas, interactive knowledge production, and collaborative activities between the university and social actors. The food and leather clusters, in operation since 2008, were the first such pilot initiatives (Acevedo, 2015). A research network (the so-called "UMSS Innovation Team") co-evolved alongside the cluster development to promote innovation culture and practices within the university. The UMSS Innovation Team is an open multidisciplinary network involving 35 researchers who exchange experiences and develop collaborative mecha-

nisms to transform traditional research practices at UMSS. The main characteristics and potentialities of that co-evolving process are discussed in Acevedo & Zambrana (2017).

The co-evolution of the UMSS Innovation Team and cluster development quickly revealed the importance of social relations for innovation and learning processes. The innovation system approach exposed the dynamics of a plurality of actors finding ways of collaboration, requiring that they overcome common problems in a low-resource setting. Predictably, tensions emerged in decision-making processes. Conflicts occurred mainly between government bodies and enterprises, both of which have their own primary logics and dynamics. Government bodies' logics are closely linked to the state and the public sector, while enterprises are highly influenced by the market and private sector rationale. In the early stages of cluster development, best-positioned representatives from both sides sought to impose their own dynamics and logics on potential university collaboration. They viewed the university as a kind of external consultancy service, albeit with difficulties in resource allocation. The experience gained at UMSS and its concern (as a public university) for social inclusion drew attention to the political dimension embodied in bottom-up innovation system dynamics. The question thus arises, in dialogue with the on-going international debate: Can the public university's efforts towards the democratization of knowledge and participation in inclusive innovation systems be enhanced by developing its own collaborative logic and dynamics when building relations with other actors, particularly those benefiting marginalized groups in society, while maintaining a degree of autonomy?

The discussion of inclusiveness within innovation systems can be understood as position taking in favour of marginalized social groups. Such discussion involves articulating a plurality of forces for mutual learning and action aimed at solving specific structural problems affecting these groups, which in turn affect the rest of society. To date, cluster developments at UMSS have revealed important insights regarding long-term relations and trust building, mainly between university researchers, government representatives, and MSMEs operating in the food and leather sectors. Almost all outcomes from these two clusters have taken the form of 'commons' (material and immaterial goods) linked to participative democratic organization approaches, interactive knowledge production practices (inspired by Mode 2), and collective action fostered in cluster initiatives (see Acevedo & Trojer, 2017; Acevedo & Zambrana, 2017). All of them mediated and facilitated by UTT. Nevertheless, while seeking to expand these pilot experiences to benefit a broader range of social groups, it is important that we can dialogue with other relevant bottom-up local experiences enabling interactions and mutual learning.

Dussel (2011) argues, adopting the position of the less privileged as the starting point for analysis can reveal a broader perspective of the more challenging problems facing a society. When it comes to discussions on inclusiveness in Bolivia, it is important to recognize (or at least bear in mind) the historically marginalized groups within society. In this paper, insights obtained and experience gained by UMSS cluster development

are thus intentionally (but not inaccurately) linked with insights emanating from preponderant forms of collaboration in diverse and polyphonic massive social movements in Bolivia, particularly from experiences in Cochabamba region. This is done as a means to enable learning relations and collaborative paths that demand the best of each for shared goals.

UMSS as a Developmental University

An important milestone was achieved in the organization of the research system at UMSS with the document entitled “University Research Concept Framework 2012-2021” (DICyT, 2012). Based on the accumulated efforts of university research centres, and influenced by their increased claims of social relevance, the university research directorate (DICyT) provides the following definition:

Research at UMSS is a significant activity aimed primarily at contributing to the regional and national development processes through the generation of useful knowledge and analytical capacity. This activity also intends to contribute to the universal progress of scientific knowledge (DICyT, 2012).

In the same document, research activities and resources (international and national) are organized initially around six main socio-economic research fields, which are in line with the priorities described in the long-term national development agenda, within the limit of university capacities.

- Sovereignty over and safety in food production.
- Technology, production, and industrial development.
- Protection and improvement of health.
- Production, distribution, and rational use of energy resources.
- Habitat and human settlements.
- Social development and citizen participation.

Innovation, climate change and the retrieval of local knowledge are also considered as cross-cutting dimensions to all the previously mentioned research fields. According to Acevedo, Céspedes, & Zambrana (2017), these advances in university research policy can be discussed as a ‘developmental university’ approach to enhance university participation in emerging inclusive innovation system dynamics.

Brundenius, Lundvall & Sutz (2009) define the developmental university as an open institution interacting with different groups within society, including industry. However, the developmental university does not operate in order to make a profit. Its major aim is to contribute to social and economic development, while safeguarding a certain degree of autonomy. Arocena, Göransson, & Sutz (2015) describe such universities as committed specifically to social inclusion through knowledge by the following means: (1) democratization of access to higher education; (2) democratization of research agendas; and (3) democratization of knowledge diffusion. Arocena & Sutz (2017) state that the developmental university is characterized by its commitment to inclusive development by means of the following three interconnected missions: (1) teaching, (2) research, and (3) fostering the socially valuable use of knowledge.

In this definition, innovation is deeply dependent on local social, political and economic relations. As such, it is directly affected by both the history and the particular institutional context of the countries or regions where it occurs (Scerri, Couto Soares, & Maharajh, 2013). While the idea of a developmental university embraces the spirit of the public university, it is also important to highlight the meaning of ‘development’ (as a problematized concept) in the Bolivian context. At the beginning of the twenty-first century, the promise of *development* was linked to the so-called “Washington consensus”. A neoliberal agenda has been problematized and re-shaped in the course of recent social revolutions and national constitutional processes. The following chapter summarizes some features of this discussion in the present geo-political climate.

‘Development’ perspectives in Bolivia

It is not possible to discuss such an important concept as ‘development’ in a Bolivian context without considering the current social, political, cultural, economic and productive conditions, as well as the long-term historical perspective. It is important, therefore, to recapitulate some recent historical events in which the yearnings for social transformation are evident. These yearnings nurture the construction of new paradigms transforming popular opinion and knowledge, thus problematizing the place occupied by the hegemonic conception of ‘development’.

In Bolivian history, globalization has benefited from weak governmental structure, which has frequently played the role of intermediary in the deployment and preservation of centre-periphery power relations. The difficulties experienced by various governments in recognizing and articulating variations in the social, economic and cultural elements of indigenous-peasant political organizations have been a recurring feature in the shaping of the country. Governments have concentrated their attention, rather, on more modern urban areas. Internal domination relations have been studied and widely discussed by several Bolivian thinkers such as, among others, René Zavaleta (2015) with his concept of ‘motley society’ (*sociedad abigarrada*) and Silvia Rivera Cusicanqui (2010) with her idea of ‘internal colonialism’ (*colonialismo interno*). Likewise, Gutiérrez Aguilar, Salazar Lohman, & Tzul (2016) are able to re-read twentieth-century Bolivian history from the perspective of historically marginalized social groups as “a history of women and men who, in a persistent and recurrent way, have been able to change the foreseeable becoming of events by opening their own horizons of emancipation”.

In Bolivia, the neoliberal project has been promoted by governments since the 1980s following the adoption of a series of reforms and disciplinary measures in the political, economic and productive spheres. During the first half of the 2000s, unable to fulfil the promise of ‘national development’, with a majority of sectors experiencing quite the opposite of this, these governments entered a period of profound crisis. Luis Tapia (2015) explains this organic, government-based crisis via four main elements: (1) fiscal, (2) representation, (3) legitimacy and (4) correspondence. He also notes that change was consolidated in the interrelation of forces surrounding the emergence of the following three core constituent powers that aspired to transform the established

state order: (1) the Coordinating Committee for the Defence of Water and Life in Cochabamba; (2) the inter-ethnic and political unification between the peoples of the Amazon, the East and the Chaco in Bolivia; and (3) the Aymara and Quechua peasant movements in the highlands and valleys founded on “Katarismo” ideology (for more information about *Katarismo* see Hurtado, 2016) as a political and organizational force leading to massive demonstrations and road blockades. The amalgamation of their social claims was a precondition for the opening of a constituent process in Bolivia.

Raquel Gutiérrez Aguilar (2015) introduced such changes from 2000-2005, although tensions remained between the country’s two main transformational horizons. First, a “national-popular horizon” focused on the reconstruction of the state and guided by the belligerent will, also expressed in other struggles, to build new terms of inclusion by modifying the command relations organized by and linked to the state. Second, a “community-popular political horizon” centred on the collective and systematic modification and rebuilding of the fabric of liberal political relations, legal formats and existing institutions. A central issue to the debate was the ‘collective re-appropriation of available material wealth’, including related decision making, management and usufruct. As such, it is assumed that the transformation should exhibit the common (non-private) essence of this ‘material wealth’ and its administration.

This subversive process came about as the possibility of a ‘Plurinational State’ took shape. Tapia (2015a) describes this model as one with both a pluricultural and plurinational political government, in which there is the mutual recognition of multiple heterogeneous political spaces. However, these could eventually be coordinated and even exist in complement to one another within the same multicultural political regime. In the new Plurinational State, the participation of *indigenous-peasant* peoples provides a sense of recovered dignity to social sectors traditionally excluded from the domestic distribution of political rights and wealth.

As a result of this active participation, the notions, drawn from indigenous aphorisms, of “suma qamaña” (*Aymara*) and “sumak kawsay” (*Quechua*) were used as the basis of an alternative way to problematize the neoliberal development agenda in the Bolivian context (for more on this concept, see Farah & Vasapollo, 2011; Schavelzon, 2015; Solón, 2016). This concept took a core position in the constitutive process approved by the national referendum of 2009. It was incorporated into current government development plans and translated into Spanish as “Vivir Bien ó Buen Vivir” (*Living Well or Good Living*). However, attempts to synthesize multiple indigenous conceptions (present in several Latin American communities) about their philosophy of life (*cosmovision*) will always compromise the original meaning. *Vivir Bien ó Buen Vivir* has been linked to ideas such as dignity, fullness, wisdom, coexistence and autonomy. It refers to concepts of balance, reciprocity and harmony within the cycles and spaces of nature (*Pacha*).

Huanacuni Mamani (2015) presented the concept as follows: “*Vivir Bien/Buen Vivir is the fullness of life. It is knowing how to live in harmony and balance; in harmony with the cycles of Mother Earth, the cosmos, life and history, and in balance with all forms of*

existence, visible and invisible, in a permanent respectful way.” Despite his excellent attempt to synthesize these different interpretations, it is worth noting that the words *Vivir Bien/Buen Vivir* (in Spanish) have been strongly linked to a particular government agenda in Bolivia that is aligned with the concept of sustainable development. Therefore, to distinguish the ‘work-in-progress’ nature of the concept, and to recognize the necessity of learning from ancient wisdom and local experience, we will use the most representative expressions in their original languages: “*suma qamaña and sumak kawsay*”. The aim is to promote a more open debate including a plurality of words, categories, conceptions, epistemologies and praxis. At the same time, this is an attempt to recover the non necessarily state- or market-centred nature of these conceptions embedded in the multi-coloured, polyphonic Bolivian culture that have the potential to nourish knowledge production processes for the purpose of inclusive innovation.

From an international perspective, numerous, frequently contradictory signals concerning notions of ‘development’ indicate specific agendas and the related flow of resources. Arocena & Sutz (2017) criticize the promotion of development as a ‘place’ and as a ‘ladder’. The current dominant development paradigm, they argue, is characterized by highly industrialized capitalist countries that have already climbed the ladder of development, while developing countries should try to climb the same ladder in order to ‘catch up’, with developed countries, mainly by means of full insertion into a global order ruled by markets and comparative advantages. Indeed, they observe, ‘kicking away the ladder’ (Chang, 2002) has been a quite successful concern of dominant industrialized countries in order to prevent other countries from catching up with them. They hence suggest ignoring catch-up paradigms and rather focusing on improving human lives by taking into account the role of knowledge in social relations and environmental problems.

The United Nations Development Program (UNDP) was chosen, in this study, from several similar international visions due to its legitimacy in providing international consensus and its ease of comparison with the aspirations expressed in Bolivia’s long-term development agenda. The UNDP explores the intersections between environmental sustainability and equity – two areas that fundamentally converge on issues of distributive justice – and seeks to embody international agendas and development goals. The UNDP bases its conception of development on that of Amartya Sen (1999), who defined development as “a process of expanding the real freedoms people enjoy”. Sen goes on to explain that the expansion of freedom is viewed as both the primary end (‘the constitutive role’) and the main means (‘the instrumental role’) of development. Similarly, Arocena & Sutz (2014) stress that the expansion of capabilities and freedom is conditioned by the interactions of people both with one another and with nature.

In this context, the definition of ‘inclusive development’ in studies on innovation systems generated in the Globelics international network should also be considered:

Inclusive development is a process of structural change which gives voice and power to the concerns and aspirations of otherwise excluded groups. It redistributes the incomes generated in both the formal and informal sectors in favour of these groups and it allows them to shape the future of society in interaction with other stakeholder groups. (Johnson & Andersen, 2012)

Finally, it is noteworthy that the Human Development Report for Latin America and the Caribbean (UNDP, 2016) recognized and included the approaches of *Vivir Bien/ Buen Vivir*. Similarly, there is almost complete equivalence between the main objectives sought by the national development agenda in Bolivia, “Patriotic Agenda Bolivia 2025”, and the “Global Agenda for Sustainable Development 2030” presented by the UNDP as general guidelines also useful to interlink bottom-up efforts. This brief outline shows the main ideas behind the current development agenda debates in Bolivia, which are not without their tensions and contradictions. Other lessons have also emerged influenced by the revolutionary processes in Bolivia surrounding political practices and social transformation.

‘The common’ as a social relationship

Valuable and vast literature has emerged on ‘commons’ as shared goods (material or immaterial), as a resource or resource system and as a property-rights regime by authors such as de Moor (2015), Hess & Ostrom (2007a) and Ostrom (2015). On the other hand, commons are often linked with a community-level. Here, our discussion does not focus directly on those aspects; rather, it seeks to understand the production of ‘the common’ as a type of social relationship.

Originally, this idea emerged as part of discussions on the social struggles and revolutions in Bolivia and in other Latin American countries by a network of researchers and activists lead by Raquel Gutierrez Aguilar. Their reflections are mainly inspired by the work of Bolivar Echeverria and Silvia Federici, who argue that “*in capitalist modernity, the economic system is based on capital accumulation, and does not ensure or guarantee the reproduction of life. Instead it imposes a form of reproduction: the reproduction of capital, not of life. Capital attempts to dictate and enforce a homogenised type of subjectivity, denying and nullifying our diverse and varied capacity of giving form.*” (Gutiérrez Aguilar, Linsalata, & Navarro Trujillo, 2016)

By examining the waves of protests, deliberations and rebellions between 2000 and 2005 in Bolivia, Gutiérrez Aguilar (2015) identifies two main transformation perspectives: *the national-popular horizon* and *the community-popular political horizon*. As she points out, waves of protests have revealed a particular form of the political that is usually rooted in the so-called social-natural dimension. Characterized by a collective commitment to the whole scale reproduction of human and non-human life, this is a starting point for interpretation. Gutierrez presents it as a kind of politics that does not seek to manage the accumulation of wealth but rather to limit it. A non-state-centred policy, it is not intended to confront the state, nor is it guided by strategies aimed at ‘occupation’ or ‘takeover’. Anchored in the defence of ‘the common’, it dislocates removes the capital and the state’s ability to command and imposition, and pluralizes and amplifies the multiple social skills required for public intervention and decision on public affairs making. It disperses power while enabling the re-appropriation of words and facilitating collective, universally relevant decisions on all issues that compete to all as they affect all.

This type of politics is linked to the logics of production of the common, both in terms of indigenous practices and struggles and in conjunction with modern concepts of property. The common is a critical category for expanding our understanding of struggles in Bolivia. In this context, production of the common is based on a fundamental premise: the common is not – or not exclusively – a thing, a good, or a set of tangible or intangible goods that are shared and used by many. *The common is produced*: it is made by many through the generation and constant reproduction of a multiplicity of associations whose collaborative relations continuously enable the production and enjoyment of a large quantity of material or immaterial common goods. The goods that are often called ‘commons’ – water, seeds, forest, the water distribution systems of certain communities, urban self-managed spaces, etc. – cannot exist without the social relations that produce them. That is, the people, organizational practices, collective processes, affective ties, mutually dependent relations, and reciprocity that shape them on a daily basis (Gutiérrez Aguilar, 2015).

The experience of recovering the communitarian systems of drinking water in Cochabamba city is often cited by way of example. In various ways, this project involved the inhabitants in the Cochabamba city, organized into neighbourhood assemblies. The process was studied in depth in Linsalata (2015), and is a recent example of how production logics operate in regard to ‘the common’. Gutiérrez Aguilar (2017) describes that experience as a dynamic system or political articulation with concrete ends. Neither completely closed nor open, the system is better described as ‘porous’: it seeks external support and, frequently, absorbs its logic. There is also a creative element relating to the production of novelties and problem solving. Its main characteristics may be summarized as: the presence of assembly; the systematic use of collective deliberation; the delimitation of those in the system or web who participate in the assembly and contribute to common decisions; and, finally, the institution of normative sets of obligations and commitments relating to ‘the common’ and its production, including user rights and guarantees.

Learning from this and other experiences in Latin America, the production of the common may be considered in terms of the construction of a sort of ‘social relationship’, which can be linked to a path of transformation in the form of *suma qamañal sumak kawsay*. As Gutiérrez Aguilar, Linsalata, et al. (2016) state:

The production of the common is above all a social relation, a social relation of association and cooperation that is capable of enabling on a daily basis the social production and enjoyment of concrete wealth as use values; that is, as material and immaterial goods that are necessary for the defence and the reproduction of life... The production of the common is founded on an ‘us’ that is at the same time inherited and produced, an ‘us’ which emerges from a practical sense of inclusion... being part of an ‘us’, is a productive activity of generating ties and goods that can be shared... The sense of inclusion and the relation of being part of lay the foundations of a common doing that reinvents, transforms and recreates the multiple expressions of ‘us’ who produce the common. (Gutiérrez Aguilar, Linsalata, et al., 2016)

The connections between the production of the common explained above and the cluster development experiences at UMSS, described in more detail in Acevedo & Trojer (2017), are evident. The capacity exists for generating diverse forms of self-

organization, relations, and mixed strategies of production, collaboration and resource allocation to overcome common challenges given scarce resources. The implementation of mixed strategies for social reproduction – a culturally embodied capacity – is presented as collective production that can be potentiated for inclusive innovation processes. The connection is particularly clear in this instance, given that Cochabamba city was the location where both experiences took place, with inhabitants expected to share most of the cultural and socio-political characteristics as a collective power (potencia). It can be linked as well to the primordial “ethos barroco”, an aspect with significant potential for social-transformation which Echeverría (2000) identifies as a main feature in the complex historic-cultural dimensions of how most Latin American modern-capitalist societies evolved.

Our main concern is to draw attention to learning possibilities that enrich the democratization of knowledge within universities and increase participation in emerging inclusive innovation systems. It is also relevant to highlight the fact that the production of the common, in this context, indicates *the reproduction of human and non-human life* as an ethical-political foundation for building productive, economic, political or social relations, while preserving degrees of autonomy and generating social fabrics that extend beyond the public-private dichotomy.

Knowledge articulation, production and reproduction

The UMSS Innovation Program has adopted the concept of the “developmental university” to foster institutional transformation through the democratization of knowledge. Arocena & Sutz (2014) proposed *democratization of knowledge* as a guiding thread towards inclusive development and as the key to understanding both innovation policies as social policies within innovation system dynamics. This idea is implicitly present in most public universities as institutional values aiming to become tangible via the democratization of its interrelated three main missions.

The type of knowledge produced and reproduced in society determines both how reality is interpreted and its transformation in everyday practices. A society is moulded according to its logics and categories. In the context of inclusive innovation, the democratization of knowledge production can build learning bridges between science-based and experience-based knowledge, as well as a rich plurality of other knowledges, on condition they provide concrete solutions to existing social problems.

To date, Mode 2 cluster development dynamics have been influenced by the contributions of Gibbons et al. (1994) and Nowotny, Scott, & Gibbons (2010). The co-evolution of science and society are key elements in orienting knowledge production within cluster development dynamics at UMSS, and Mode 2 involves open systems of knowledge production in situations where science and society have become transgressive. Science speaks to society, as it has done with success over the past two centuries. In this instance, however, society has the opportunity to speak back. The features of Mode 2 knowledge production according to Nowotny et al. (2010) include: application context, transdisciplinary elements, greater diversity of knowledge production,

a highly reflexive and accountable approach, novel forms of quality control, socially robust knowledge, and contextualized understanding of development.

In a similar vein, future initiatives for the democratization of knowledge and participation in inclusive innovation systems can be reinforced by approaches focused on strengthening knowledge production and learning capacities within oppressed or excluded groups. In his analysis of the struggles for emancipation in the geopolitical ‘global south’ (including the Bolivian case), Boaventura de Sousa Santos (2010) characterizes modern ‘Western thinking’ as ‘abyssal thinking’ that bifurcates social reality in the field of knowledge. He characterizes Western modernity as a socio-political paradigm founded on the tension between social regulation and social emancipation. In the field of knowledge, abyssal thinking consists in granting modern science a monopoly over the universal distinction between true and false, to the detriment of two alternate bodies of knowledge: philosophy and theology. The exclusionary character of this monopoly is at the core of the modern epistemological disputes between scientific and non-scientific forms of truth. These tensions between science, philosophy, and theology have thus become highly visible; however, they all take place on ‘this side of the line’. Their visibility is premised upon the invisibility of forms of knowledge that do not fit into any of these ways of knowing. ‘The other side of the line’ includes popular, lay, plebeian, peasant, or indigenous knowledges, which in most cases could become objects or raw materials for scientific research. These are not categorised as relevant or commensurable knowledges because they are beyond truth and falsehood. Thus, the visible line that separates science from its modern alternatives is grounded on the abyssal invisible line that separates science, philosophy, and theology from other knowledges rendered incommensurable and incomprehensible. The latter are deemed to meet neither scientific standards of truth nor their acknowledged alternatives in the realm of philosophy and theology (de Sousa Santos, 2016).

To this end, de Sousa Santos (2010) presents the concept of “ecology of knowledges”, whose basic premise is that all forms of knowledge have internal and external limits. The internal limits are related to restrictions on real-world interventions imposed by each form of knowledge, while the external limits result from the recognition of alternative interventions made possible by other forms of knowledge. Therefore, for ecology of knowledges, *knowledge-as-intervention-in-reality* is a measure of realism, not *knowledge-as-one-representation-of-reality*. The credibility of a cognitive construction is measured by the type of intervention in the world that either allows or prevents it. As any assessment of this intervention always combines the cognitive with the ethical and the political, ‘ecology of knowledges’ makes a distinction between analytical objectivity and ethical-political neutrality.

These concepts are essential to enable a more fruitful knowledge encounter in Bolivia. Sought improvements include greater degrees of inclusion; the recognition of a plurality of knowledges sources; democratization of knowledge; and alternative solutions revitalizing certain aspects of the role of public universities in society. We emphasize that the successful salvage of the plurality of knowledges and latent subjectivities in Bolivia requires that new paths and alternatives be identified, as means for innovation.

More actors with new words and concepts are needed to disrupt the linear continuity of what is possible and acceptable for actions that define our experience in the world.

Considerations regarding the Public University in Bolivia

Finally, to address the main aim of this paper, it is necessary to recapitulate and update some details on how the public university in Bolivia has evolved and its main foundations.

Evolution and institutional values

Bolivia's first university, Universidad Mayor, Real y Pontificia de San Francisco Xavier de Chuquisaca, was founded by the Jesuits in 1624 during the colonial occupation. It was one of the first such institutions in Latin America. Other public universities were created over the nineteenth and twentieth centuries once independence had been established and the new nation had become a state-republic. Since its inception, the public university in Bolivia had been a functional, oligarchic power whose influence extended to both state and urban areas. This situation changed significantly after the labourer-peasant national revolution in 1952. Salazar de la Torre (2015) characterizes this event as a milestone in the establishment of the nation-state in which the full inclusive expansion of citizenship was consolidated. The revolution turned the public university into a restructuring object, with its oligarchic character being replaced by a more democratic outlook based on autonomy and co-government, in solidarity with the popular-labour forces.

The historic moment marking the turning point of the modern public university in Bolivia occurred during the dictatorial reign of successive military governments from 1964 to 1982. During this period, the public university, along with popular grassroots movements, took on a role of active resistance. Guerra Mercado (2004) recapitulates the brutal repression endured by universities as they stood in defence of democratic freedoms and their unswerving intent to maintain their autonomy in the face of numerous attempts to repress it. Salazar de la Torre (2015) notes that this was the basis for the creation of an institutional identity linked to socialist and anti-imperialist ideologies – a stance that would endure. At the end of this period, the universities' autonomous status and co-government were recovered, and institutional values related to freedom, defence of democracy, and identification with the labour-popular sectors were consolidated.

However, following the onrush of the above-mentioned neoliberal project since the mid-1980s, public universities in the global south were subject to both hyper-private and hyper-public pressure (Sousa Santos, 2007). This led to a destabilizing of the universities' institutional essence, as well as creating a deep fracture in their social and cultural identity – a fracture reflected in paralysis masked as resistance to change in the name of autonomy and academic freedom. The university in Bolivia remains in this state of shock – a condition that has been exploited by small internal power groups seeking to subsume political institutional life into prebendary privileges and corporate logics.

With this in mind, the following sections will seek to reinforce a more robust deployment platform for public universities; that is, a collaborative base for an institutional position by which to navigate the above-mentioned public and private tensions. Finally, we will identify some key elements in the building of long-term social relationships within inclusive innovation system dynamics.

The 'public' character of public universities in perspective

The establishment of a public university involves both the state and society recognizing that a public framework is required to provide training in the known professional skills, as well as knowledge production that meets development demands and research into problems that arise. (Tapia, 2014).

Public universities operate in the public sphere. However, their differentiation from other public institutions is nuanced and somewhat confusing. This situation has not encouraged universities to stand firm in their interactions with other, better-defined institutions, particularly those linked with the state and the market – a tension that leaves the universities in an unstable position. When discussing the public and private sectors, we are talking, among others, about two different logics and interests that link back to the notions of state and market. The public nature of the university, however, connects us with a specific type of 'non-state' public. Rabotnikof (2008) characterizes this kind of public space as a mediation between state and society, a place of societal self-reflection, and a realm of community gestation. Such spaces are present, to some degree, as a fragile alternative to the rigid public-private dichotomy; that is, as a totalisation of the social.

Generally, in order to understand the public nature of the university and its articulation within a plural society, as is the case in Bolivia, it is necessary to agree upon some political definitions. To this end, we drew on Tapia's (2015b) paper "The Public Plurinational" to consider knowledge production processes in a public university and contrast them with behaviour observed in the UMSS cluster development. The following three pillars stand out:

- *The open and the deliberative*: the academic community opens itself to the political incompleteness of its deliberative processes, leading to complementarity with other communities. This is a horizontal articulation, entailing greater levels of complexity and responsibility through which the country is reformed and rebuilt as part of a joint process. A second aspect concerns the academic community opening itself to other parties' knowledge and feedback as part of the deliberation process, including mutual understanding and common decision making. Lastly, it involves the creation of open spaces in which the words of all interested parties can be heard, promoting discussion in a context of political, theoretical, cultural and epistemological pluralism.
- *Visibility*: the publicization of where and when university decisions are taken, including results and accountability. This also concerns other actors' rights to free organization, articulation of arguments, speeches, projects, expression and action, which translate into cognitive reflexivity and freedom of thought.
- *The common*: the product of knowledge that is produced, reproduced or accumulated by collective actions and decision taking. The common is constructed from the type of

relationship in which purpose, means, and the terms of usufruct are deliberated upon and co-decided. Production of the common is bisected by the recognition of differences, but mediated by the historical principles of equity, reciprocity, pairing and justice. The common in this context can be better understood with reference to the concept of 'production of the commons in common' described above.

While this plurinational perspective of 'the public' does not yet characterize the public university in Bolivia, producers and entrepreneurs, government agents, researchers and university students have all come together under the umbrella of the UMSS clustering initiative. This initiative was facilitated and supported both economically and physically by the university's Technology Transfer Unit (UTT), and cluster dynamics were quickly used to establish a kind of social enclave within the university. In turn, the newly formed joint space and its emerging dynamics (the cluster arena) acquired or inherited the public nature of the host institution, with its dynamics and organization based on the three pillars mentioned above:

- *Open*: unrestricted and free permission for the incorporation of any local or national agent seeking to participate. Researchers, professors and students from different research centres and schools within the university are encouraged to participate in cluster dynamics.
- *Deliberative*: a research agenda based on dialogue and convergence that prioritises activities of greatest import for the sector, as well as paired collective actions. Collaborations are sought according to the possibilities, competences, resources and capabilities of each actor.
- *Visibility*: Both formal and informal relationships are built with the aim of establishing trust. The university permitted clusters to attract and allocate their own resources, allowing them to act clearly, transparently and confidently, according to the means at their disposal. The aim is to provide an opportunity for mutual acquaintance, needs, capabilities, limitations, resources, rhythms and tempos for collaboration.
- Finally, *the common* has been implicitly defined from the outset, given the objectives of joint definition and collective knowledge. The concerted search for resources is carried out under the umbrella of the cluster, with the institutional support of UMSS (as lead guarantor and manager of resources) and the coordinated involvement of university research centres (data definition and usage conditions, prototyping, and other necessary adjustments). It should be also be highlighted that cluster members receive technical advice from university research centres when coordinating with the food and leather industry. In many cases, university staff are assigned exclusively to support cluster initiatives.

According to its regulations, UMSS claims ownership of the intellectual property and goods developed within its premises. However, the university also transforms this knowledge or goods into a type of common for society, which can be freely reproduced by beneficiaries of the cluster and the nation as a whole. However, the university lacks fully developed means for knowledge dissemination, accumulation and external access. It does not possess the mechanisms to support the implementation of produced knowledge. Greater commitment from non-academic actors is thus needed to foster the implementation of knowledge produced, completing the innovation process.

To date, the impact of these pilot cluster initiatives has been incipient upon the transformation of the local dynamics of the production sector. However, the clusters have come up with insights into building long-term relationships (fostered from the public university side) in instances where the sector's articulated needs and requirements converge around a common agenda. These clustering experiences can be understood as a mechanism by which the university legitimates certain aspects its public nature. As argued by Luis Tapia (2014), *"the public dimension of the university leads us to articulate a space of permanent public forum, in which the university constantly dialogues with dynamic actors or in open spaces with the population, so that they are the places where strengths can be articulated"*.

Autonomy and co-government

The Bolivian state granted 'autonomous' status to public universities in 1931, while recognizing its obligation to providing adequate resources to enable them to perform their tasks without intervention. This was a victory, mainly, for the student movement, as part of a wave of university transformations which began in Cordoba, Argentina in 1918 and spread throughout Latin America.

The current autonomous status of Bolivia's three major public universities can be summed up as follows. First, university autonomy has the function of inhibiting state, economic and social power over university functions. Second, autonomy is understood as freedom of thought, ideology and education, and a basis by which to develop the university's three main functions: education, research and social interaction. Third, economic, administrative and organizational autonomy given by the allocation of committed funding by the national government, as well as the establishment of the university's own governing regulations, with university representatives selected based on teacher-student co-government.

Neoliberal reforms initiated during the 1980s, however, have structurally weakened the exercise of this autonomy. This period saw a general reduction in the complexity of the political and budgetary structures of public institutions across the country. The degree of articulation between the university and social sectors was reduced. Sectors relying on labourers and peasants were also weakened by the reforms, and a sort of politically founded patronage network was built into the university. Corporate sector dialogue within the university declined, with attention shifting to issues related to the distribution of budgets, responsibilities, resource allocation, and the power to deliberate on common national or regional issues. As a result, the university space weakened, as did its ability to function as an open public space involving freedom of thought and the development and socialization of knowledge. Dazzled by the lights of Western science and technology, the public university also experienced a general decrease in the intensity of its academic reflection. As it drifted away from acquired experience and local knowledge, it looked elsewhere for its concepts, methods and categories – a shift in emphasis that is also linked to forms of assessment and the provision of research resources. As observed by Gandarilla Salgado (2014), Latin American scholars' ability to struggle and denounce injustice and oppression is better developed than the sharpness

of critical reflection required to question the presuppositions that serve to legitimize the existing social order.

Considered the ultimate form of democratic expression in public universities, co-governance was conceived as an attempt to grant political equality on university issues to professors and students alike. As argued by Tapia (2007), political equality aspires to social equality. The function of democracy is not only to represent the governing majority or those who represent it but also to ensure that both majority and minority parties participate in political life and governance processes. If democracy has equality as its organizing principle and, at the same time, if democracy is defined as a form of government, then equality implies participating in this government. If the idea of equality is to be taken seriously – i.e. the participation of all parties counts equally – then participation implies co-government with others. In the same vein, if equality is an organizing principle for government, then, for the government to be democratic, this equality should permeate the entire the political timeframe, not only one of its moments, namely the pre-governmental era.

Autonomy – a historic social victory – was consolidated through the exercise of co-government. This feature needs to be strengthened and expanded if the university seeks to restore institutional rights limited by the state, guarantee the reallocation of sufficient resources to perform its functions, and ensure its full integration in the national development processes. To this end, relationships must be restored and developed with workers and indigenous-peasants as strategic partners in processes relating to the deliberation, production, reproduction, accumulation and sharing of knowledge. Otherwise stated, the legitimacy of the public university in society must be ratified. To do this, the public university needs to strengthen its institutional development, functions and processes at all levels.

Final Reflections

The “developmental university” can be seen as a concept that aligns with the conditions, efforts and aspirations of UMSS, as well as most other Bolivian public universities. However, the notion of a developmental university requires discussing critically what is the notion of ‘development’, first as a horizon of desire in each specific country which later is translated in specific goals, agendas and actions from a diversity of social dimensions.

In the case of Bolivia, insights about the notion of ‘development’ emerge when studying Bolivia’s social dynamics between 2000-2005 – a turning point in the country’s history. The importance of Bolivia’s particular historical and cultural references should not be underestimated. Here, they manifest as the expression of a desire to re-shape important aspects of the current plurinational state of Bolivia via the introduction of *suma qamaña/sumac kawsay* into the political debate and engagement with international development perspectives. In these terms, ‘development’ is discussed in Bolivia as a path of social transformation with its own characteristics and ambitions. While this has led to some significant initial achievements, the emerging process of social

transformation requires continual discussion. Different social spaces and learning experiences must form the basis for an on-going process of update and (re)construction. In particular, public universities must remain as an open arena to debate and continuously update aspects of a national project of development.

At the same time, when it comes to direct contributions university-society in non-dynamic productive structures, cluster development based on inclusive innovation systems offer a bottom-up approach. In order to enable a broad perspective of collaboration and inclusiveness, public university can position itself beyond the public-private dichotomy, aiming to potentiate creativity in knowledge production processes.

In experiences described, co-evolving relations within clusters at UMSS have resulted mainly in the production of commons (goods and services). These experiences can be enhanced by insights coming from other experiences in the same region pointing out to the production of the common as a social relation with productive potentials based on collective action. It has been linked as well to an embedded socio-cultural capacity to implement mixed strategies of social reproduction, traditionally cultivated in several Latin American countries. The facilitating role of UTT can be key to develop more university competences and enable more paths of flexible collaborations and relations with a broader range of social actors.

In the context of an emerging inclusive innovation system, public universities are challenged to enhance their social impact. Traditional values and practices must be renewed and reinforced to generate contextualized forms of collaboration, especially those which benefit oppressed or excluded groups. In a similar vein, Tapia (2014) suggests that *“a public university exercises freedom as a collective self-government; hence, as it is public it is pluralistic; arguing that: what is public, while open to all, or an area of equality, necessarily contains and will contain pluralism, but pluralism that as it is deployed, exists and develops in a public realm, it is oriented to the production of the common”*.

Producing the commons in common can be a more adequate strategy for direct university-society contribution in context of precarious productive structures and low resource setting. Practical learning bridges are established with a plurality of groups, strengthening local social fabrics and enhancing local capacities for self-organization, production, articulation and use of knowledge. The public university can offer a neutral arena between government, industry, and society tensions facilitating community gestation.

Similarities identified between cluster development at UMSS and other transformation dynamics in Cochabamba can be linked as well to historical structural difficulties in Bolivia in ensuring the necessary conditions for material reproduction based only on capitalist type social relations. Public universities aiming for an inclusive development must therefore emphasize their commitment to the ‘reproduction of life’ (human and non-human) as a core ethical-political principle. The connecting line between the vision of development and ethical-political principles (shared with society) should offer a better position for public university cultivate relations and orienting actions and transformations in collaboration, at the same time degrees of autonomy are preserved. This

is, when it comes to productive activities do not forget material reproduction of life. This is also a foundational ethical-political principle shared with a number of national and international social movements and organizations that are facing the more diverse and challenging problems in modernity and can be used to build bridges of mutual learning and collaboration. It is also an explicit recognition that knowledge production that extends to society can never be deployed from a neutral ethical-political position.

This paper does not attempt to present collaborative models. Rather, its intention is to support critical reflections and foster alternative interactions in emerging inclusive innovation systems.

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PART III

CHAPTER 5

MAIN FINDINGS AND LESSONS LEARNED

It is a question of learning hope.
(Ernst Bloch, 1996)

5.1 Introduction

Contributions to inclusive and sustainable development in society take many forms. Based on the Technoscientific approach, this thesis focuses on the experience of UMSS, whose UTT has developed innovation system-inspired pilot strategies to enhance the direct contributions of research activities linked to societal needs.

This sub-section describes the relation of the six above-mentioned papers to the thesis' specific objectives (SO). Each SO is addressed in more than one paper.

(SO1) To analyse the evolution of the national innovation policies created to strengthen the Bolivian Innovation System.

Before analysing the concrete experience generated at UMSS, the evolution and current status of the national innovation policies are examined as a reference framework for dialogue with government efforts. Paper 1 discusses the emergence of specific policies to foster a national system of science, technology and innovation as a strategy for development. Despite the important efforts made, the study notes the difficulties encountered by the Vice Ministry of Science and Technology (VCyT) in leading actions with other ministries and in allocating the increased resources necessary for strategy implementation to achieve the required goals. A demand-pulled national innovation

system approach is highlighted, which, in conjunction with a long-term national agenda, expresses a commitment to participative, equitable and sustainable development.

(SO2) To analyse university-society knowledge production at UMSS under the light of the 'developmental university' approach.

The various ways of fostering the university-society knowledge relationship are the subject of on-going international debate. This paper offers reflections from a technoscientific standpoint, based on experiences at UMSS, in particular the lessons learned at UTT functioning as a University Innovation Centre. Paper 2 describes the main characteristics of UMSS research policies and capacities. It also introduces the main initiatives developed at UTT as part of the innovation system approach. In this context, the concept of a 'developmental university' is identified as context relevant for the critical discussion of experiences gained and as a means to foster the stated initiatives at UMSS. Following a discussion of the Food Cluster Cochabamba in Papers 3 and 4, Paper 5 presents an internal perspective of researchers' experiences of participation in inclusive innovation processes involving MSMEs as part of the cluster development process. Researchers linked to cluster development have shaped the critical mass of a university network of researchers (the UMSS Innovation Team), sharing knowledge centred around collaborative innovation system initiatives. To strengthen the UMSS Innovation Team's co-evolutionary relations with cluster development, better-defined concepts of culture and community were identified to facilitate discussions about the potential for research culture transformation and innovation community building. Paper 6, expanding on existing inclusive innovation processes and developmental university literature, uses experiences at UMSS and other local social transformation examples to highlight the production of 'the common' as a type of social relation that has been cultivated historically both in Bolivia and in most other Latin American countries. This type of relation is a cultural element that has yet to be studied in depth. However, it represents an opportunity to expand developmental university efforts to enhance local capacities for self-organization, collaboration, knowledge articulation, production and use, as well as a chance to build learning bridges between the university and numerous social groups. The main lessons learned in Paper 6 are synthesized to provide some basic guidelines for public universities to foster inclusive innovation system collaborations aimed at benefitting a more diverse range of social needs and groups, which are not always met by market- or government-related institutions.

(SO3) To develop inclusive innovation processes fostering co-evolutionary dynamics between the university, the government and different socio-productive actors, with a focus on MSMEs in the Cochabamba region.

Discussions in Papers 3-4 were enriched by my experience as a cluster facilitator of the Food Cluster Cochabamba between 2008-2014. Paper 3 describes the experiences gained in the Food Cluster Cochabamba and the main characteristics of the MSMEs and research centres involved. The food cluster is founded on an open university platform that takes the form of a bottom-up inclusive innovation system linking a number of university units, government bodies (national and regional), food sector MSMEs,

and related food sector organizations and associations in Cochabamba. Paper 4, meanwhile, presents a specific inclusive innovation experience of this co-evolutionary process. A political perspective is used to reframe the experience and elucidate some key elements, the in-depth discussion of which allows for appropriate treatment in a plural democratic setting.

5.2 Final Discussions and Conclusions

The implementation of an innovation system approach at UMSS is presented as an institutional effort to overcome the poor results of previous university-society interactions based on linear models. The innovation system initiatives developed in the framework of the UMSS Innovation Program at the UTT were the focus of this study. This sub-chapter synthesises the main findings and lessons learned, as well as offering some general conclusions to the study.

The study started by presenting a brief examination of the main policies behind a national innovation system, the political context, priorities and strategies of which were later analysed in the context of bottom-up initiatives at UMSS. National policies for science, technology and innovation were seen to promote an emerging national innovation system in support of national development agendas (2013-2025). The emerging Bolivian Innovation System is committed to social inclusion, sustainability, and diversification of a productive system fostering demand-pulled dynamics. The role of indigenous-peasants and other social movements is similarly emphasised in the national innovation system, both in regard to knowledge-demanding and knowledge-producing sectors in their interplay with the more traditional sectorial institutions, industry, and the university respectively. From this perspective, innovation can be understood as the capacity to link a plurality of national forces for the production and use of knowledge generating solutions for prioritized demands and to contribute to national development. To date, government bodies have had difficulty in allocating the necessary resources and mechanisms by which to implement the main components of the plan. However, government guidelines are considered in the thinking of this study.

At UMSS, our earlier UTT experiences (2004-2007) included several difficulties relating to linear university-society interactions (both offer-pushed and demand-pulled knowledge production). The following national research indicators provide some insight into these difficulties: a) just 4% of research activities correspond to experimental development (VCyT, 2011) and; b) until 2001, only 6% of the gross expenditure on R&D (in relation to GDP) came from business R&D (UIS, 2015 in Brundenius, Aguirre-Bastos, Ngoc Ca, Diyamett, & Dgedge, 2016). Recurrent efforts to promote linear interactions for technology transference in Bolivia have been constrained by the prevailing structural demand-side weakness. The low market demand for knowledge reflects the dangers of fostering a knowledge-based society using '*capitalization of knowledge*' as the main strategy for directly linking university research capacities with local beneficiaries (e.g., industry, or the range of civil society organizations).

In 2007, and in light of these experiences, the UTT launched the UMSS Innovation Program to encourage universities to actively participate in innovation systems, thereby enhancing the contributions of research activities to regional and national development processes. The main lessons learned presented here come from the early efforts at UTT (2008-2015). At this time, the focus was on testing innovation and learning processes generated as part of university cluster development platforms. Initially, these efforts were directed at MSMEs in the food and leather sectors, with the intention that they would expand in scope over time. The two clusters evolved as university open spaces for bottom-up initiatives linking MSMEs, university units, government bodies, and other social organizations. Cluster initiatives privileged the demands of MSMEs, with the UTT facilitating the innovation and learning processes (e.g., self-organization, agenda setting, collaboration, resource attraction and allocation, trans-disciplinary knowledge production, use of knowledge and diffusion).

Two specific aspects of the open discussions and evolving cluster development relations caught my attention, leading me to re-examine some of these experiences. On the one hand, as expected, tensions emerged among the actors involved. This was especially the case for MSMEs and government representatives, revealing the undefined position of the public university between existing public and private logics. On the other, it was highly apparent in the food cluster that despite MSMEs' interest in increased participation in the local market, important groups had developed a strong interest in enhancing the quality of food production using sustainable, ecological methods. One of their major concerns, for instance, is the effects of climate change on conditions in the rural, traditionally self-sufficient Bolivian communities on which food cluster firms depend for the provision of raw materials. These concerns are highlighted in both national development and university research policies ('food sovereignty' and 'food safety' goals). However, more effective actions (impacts) are needed to respond to these challenges on the ground. It was hence necessary to emphasize or reinforce a broader perspective for enhancing innovation and learning processes at UMSS, with the aim of generating alternatives to more traditional government- or market-centred logics.

Re-examining these experiences from a political perspective revealed that discussions about inclusiveness extend beyond actions aimed at including people in a marketplace with better opportunities and competition conditions (assuming equal opportunities prevail). More fertile discussions emerge from a sense of inclusion as a means to potentiate the capacities of people, as subjects of knowledge, to benefit from this same knowledge. These benefits may include, for instance, enhancements to sustainable production or the sense of living a more dignified life, especially for less privileged groups. Therefore, the interlinked ideas of: a) the *developmental university*; b) *democratization of knowledge* (based on the democratization of access to higher education, the democratization of research agendas, and the democratization of knowledge diffusion); c) *inclusive innovation systems* and; d) *inclusive development* were adopted as central concepts by which to sustain the discussion and promotion of innovation practices at UMSS.

As a state in which multi-cultural and multi-societal forms co-exist, it is easy to imagine the plurality of knowledges in Bolivian society. In this context, I was thus able to

critically analyse my own experience and insights with a view to enhancing the democratization of knowledge at UMSS, especially for inclusive innovation purposes. While seeking alternatives with which to fuel discussion, I found the contributions of Chantal Mouffe on plural democracy to be context-relevant. Mouffe (1993) argues that in order to radicalize the idea of pluralism, so as to make it a vehicle for deepening the democratic revolution, we have to break with rationalism, individualism and universalism. Only under these conditions will it be possible to apprehend the multiplicity of forms of subordination that exist in social relations and to provide a framework for the articulation of the different democratic struggles surrounding gender, race, class, sexuality, the environment and others. This does not imply a rejection of any idea of rationality, individuality or universality; rather, it affirms that these are necessarily plural, discursively constructed, and entangled with power relations. It means acknowledging the existence of the political in all its complexity: both the dimension of the 'we' (connoting the friend's side) and the dimension of the 'them' (connoting antagonism. It draws on the full range of implications of the 'pluralism of values' and confronts the consequences of acknowledging the permanence of conflict and antagonism. Relations featuring conflicts are seen neither as disturbances that cannot be eliminated nor as empirical impediments to harmony, as our subjective selves will never fully coincide with a rational universal self.

In successive contributions, Mouffe (2000, 2013) recognizes that divergences can lie at the origin of conflict. She suggests the establishment of a multipolar institutional framework that would create the necessary conditions for these conflicts to manifest themselves as agonistic confrontations between adversaries, as opposed to antagonistic struggles between enemies. Thus, inspired by Derrida, she states that an 'agonistic' pluralistic approach should envisage the pluri-verse in terms of 'hospitality': a space where an agonistic encounter takes place between a diversity of poles, which engage with no individual pretensions to superiority. This agonistic encounter is a confrontation where the aim is neither the annihilation nor the assimilation of the other, and where the tensions between the different approaches contribute to enhancing the pluralism that characterizes a multipolar world.

Making the political dimension of inclusive innovation processes visible in the food cluster thus requires appropriate treatment to ensure this visibility leads to development. That is, a pluralistic, democratic approach that generates alternatives and utilises plural knowledges. One insight regarding this relates to the fact that 'the production of commons' has been identified as the core food cluster form (influenced by Mode 2 knowledge production and the innovation system approaches).

The co-evolution of cluster development and the mobilization of a critical mass of researchers were hence the basis for the theory of an 'Innovation Community' aimed at strengthening future initiatives from a political perspective. The *innovation community's* focus is on shaping a collective identity around knowledge gaps, with collective solutions to problems reducing internal and external barriers to collaboration and inclusion (e.g., by weakening essentialist identifications). This idea was inspired by the notion of 'communitas' described by Esposito (1998) – a familiar perspective

for many organizational practices in Bolivia. All members of the innovation community are understood as subjects of knowledge. They are committed to sharing this knowledge, thereby enabling new paths of learning, new knowledge production, and collaborative problem solving. The innovation community is open to and interested in the full scope of the innovation and learning process, from highlighting problems to producing ‘real-world’ solutions. A plurality of knowledges is welcomed, and goals are defined collectively – an essential precondition in all low-resource contexts. Support for cluster development processes or other similar initiatives is based on the idea of breaking down isolation and offering alternatives to communities (or collectives) whose existing structures are grounded in principles of homogenization and exclusion. At the same time, this is an attempt to potentiate or enable capacities aimed at producing more flexible relations within cluster development dynamics, particularly for the public university, from a position centred on neither state nor market logics (but which nevertheless retains relations with both). This perspective is expanded in later papers, where the discussion is inspired by the inclusion of a wider range of social groups in public university innovation system dynamics.

In the final papers of this thesis, relevant historical and socio-cultural aspects are shown to contribute directly to local practices, nourishing the international discussion on inclusive innovation systems in developing countries. The innovation system literature explicitly recognizes that its policies and dynamics need to be context specific. In his early book, “National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning”, B.A. Lundvall recognizes the following: *“I do not recount any specific case stories even if we refer to relevant cases in order to illustrate some general points. Instead I have tried to present a theoretical perspective that might be used in the case studies and to discuss some of the most important subsystems in the system of innovation. The price I have to pay for choosing this more general approach is a loss in terms of historical richness, especially when it comes to the social and cultural dimensions”* (Lundvall, 1992). Years later, however, Altenburg (2009) observed that a considerable part of this literature fails to appreciate the particularities of developing countries, despite the fact that context-specificity is recognized in principle. In particular, the literature does not systematically address specific needs for poverty reduction and socially inclusive types of innovation.

Inspired by the more visible political dimension in innovation processes and the critical definition of culture (Echeverría 2001), I was able to unveil the strong links between how cluster dynamics evolved and the multiple forms of collaboration and problem solving embedded in Bolivian society. At this point, my main interest was in building learning bridges between the university and other groups in society for innovation. At the same time, I recognize that any discussion about inclusion in Bolivia must retain historically marginalized, indigenous groups as an ongoing central feature.

It was important to recognise the importance of the vast range of existing literature about ‘commons’ as shared goods, material or immaterial (Hess & Ostrom, 2007). Studies of social movements in Bolivia and Latin America discussing ‘the production of the common’ as a social relation have revealed an important critical dimension, expanding the understanding of our own experiences, which can be used to enable a

wider range of alternatives for university-society relations fostering inclusive innovation systems and the democratization of knowledge. The common is not – or not exclusively – a thing, a good, or a set of tangible or intangible goods that are shared and used by many. The common, rather, is produced. It is made by many through the generation and constant reproduction of a multiplicity of associations, whose collaborative relations continuously enable the production and enjoyment of a large quantity of material or immaterial common goods (Gutiérrez Aguilar, 2015). The production of the common is above all a social relation of partnership and cooperation that is capable of enabling social production and the enjoyment of concrete wealth on a daily basis; that is, as material and immaterial goods that are necessary for the defence and *reproduction of life* (Gutiérrez Aguilar, Linsalata, & Navarro Trujillo, 2016). From a public university perspective, the specific elements necessary for the social reproduction of (human and non-human) life can be understood as a platform for collaboration capacities, the definition of agendas, the deployment of learning bridges, the cultivation of productive relations, and the preservation of new capacities in society. The common is hereby identified as a key node of basic mutual understanding that articulates a plurality of social voices and actions for transformation, fostered by a number of worldwide social movements, organizations and institutions, the aim of which is to confront the more challenging problems of modernity. Nevertheless, in a context of the systematic dispossession and privatization of common wealth and production capacities, I have one final suggestion. That is: future analysis and bottom-up practices aimed at social transformation should be inspired by Spinoza’s approach that takes the *will for living* as the foundational force by which a positive perspective of political power (as obedience instead of domination) may be understood in the movement from *potentia* to *potestas* (Dussel, 2009).

The co-evolution of cluster development and the UMSS Innovation Team is also the result of internal transformation efforts by the UTT towards creating a University Innovation Centre aimed at developing university capacities to participate in innovation systems. Its achievements offer empirical evidence of an alternative path by which the public university can continue learning how to enhance its collaboration with different groups in society. This is a process that entails the cultivation of multiple, diverse and flexible relations for the development of contextualized learning and university-society knowledge production capacities. The public university can enhance its role as an institution for community gestation that is able to adapt itself to society, producing and renewing its capacities to build its knowledge relations and fulfil its inclusive development ambitions, while enjoying a certain degree of autonomy, thereby strengthening society’s own capacities to generate alternatives and implement knowledge-based solutions. My understanding of it, simply stated, is as a way of learning hope.

5.3 Scientific Contribution and Originality of the Thesis

A Technoscientific approach is applied empirically to a specific innovation system analytical framework with the aim of understanding the co-evolutionary university-society relations for emerging inclusive innovation systems in Bolivia. The importance

of the political dimension in emerging innovation system dynamics is underlined. The thesis is an example of the interlinked and recursive relations between theory and practice. It articulates a number of concepts and perspectives. Some of these are used to inspire practices, while others are used to enhance analysis and to enable improved practices in a social-cultural context specific to Bolivia.

5.4 Future Research

Requisite future research, in which I hope to be involved, concerns three main learning paths.

The first of these, at the macro level, concerns the evolution of the Bolivian Innovation System and its contribution to inclusive development. A closer participation in Latin American researchers networks on innovation systems (e.g., Globelics and its regional network, Lalice) is relevant to the local discussions.

The second one is inspired by the concept of a ‘developmental university’ and concerns the knowledge and production of alternatives to foster the democratization of knowledge at UMSS as well as the capacities of UTT to facilitate innovation system collaborations between the plurality of actors involved (e.g.: university research centres, government representatives, local enterprises and other diverse groups in society).

The third one focuses on developing alternate democratization of knowledge production processes for inclusive innovation at UMSS. This research field is inspired by the developmental university, PAR, Mode 2 knowledge production, and ecology of knowledges and feminist technoscience. The question arises: Is it possible to develop tools to facilitate dialogue between the plurality of knowledges involved – including science-based knowledge – for enhanced interventions on the ground and the gradual expansion of social capacities? To this end, I hope to contribute to enabling closer, long-term collaborations with different local social movements, particularly indigenous-feminist movements, with a view to facilitating institutional and social trans-formation.

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