



Study on Strengthening Regional Innovation Systems in Peru: Policy lessons.

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**Study on Strengthening Regional Innovation Systems in Peru:
Policy lessons.**

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ABSTRACT

Upon initiating a Dialogue with the European Commission's Directorate-General for Regional and Urban Policy (DG REGIO), Peruvian authorities expressed an interest in developing an initial study on "Strengthening Regional Innovation Systems in Peru: Policy Lessons" with institutional support from the Peruvian Ministry of Foreign Affairs and the regional governments of Cusco and Tacna.

The study aims to conduct a strategic assessment of the Regional Innovation Systems (RIS) in the Peruvian regions of Cusco and Tacna, identifying the main actors within each region's system: regional government, universities, research centers and enterprises, as well as identifying their level of cooperation and coordination in order to encourage further development of innovation strategies and joint projects.

The work is based largely on the "Regional Innovation Strategy" (RIS) methodology and its updated version (RIS3) on "Innovation Strategy for Smart Specialization" designed and used by the EC. This proposes an analysis of the R&D carried out by academic and research institutions as well as the demands for innovation made by the business sector, analyzing their possible interaction and coordination, with the support of policies and instruments designed by regional authorities.

SÍNTESIS

En el marco del inicio del diálogo entre las autoridades peruanas con la Dirección General de Política Regional y Urbana-DG REGIO de la Comisión Europea, se manifestó por parte peruana el interés por desarrollar un primer estudio sobre "Sistemas Regionales de Innovación en el Perú: Lecciones de Política", contando con el apoyo institucional del Ministerio de Relaciones Exteriores de Perú y de los Gobiernos Regionales de Cusco y Tacna.

El estudio tiene como objetivo realizar un diagnóstico estratégico de los Sistemas Regionales de Innovación (SRI) en las regiones peruanas de Cusco y Tacna, identificando los principales actores que forman parte del sistema en cada región: Gobierno Regional, universidades y centros de investigación y empresas, y sus niveles de colaboración y articulación, que podrían posibilitar el desarrollo posterior de estrategias de innovación y de proyectos conjuntos.

El trabajo se basa en gran medida en la metodología "Regional Innovation Strategy" (RIS) y su actualización (RIS3) sobre "Estrategia de Innovación para la Especialización Inteligente" diseñada y utilizada por la CE, mediante la cual se analiza tanto la oferta de I+D prestada por las instituciones académicas y de investigación, como la demanda de innovación requerida por el sector empresarial, y sus posibles conexiones y articulaciones, apoyados por políticas e instrumentos diseñados por las autoridades regionales.

I. EXECUTIVE SUMMARY

Upon initiating a Dialogue with the European Commission's Directorate-General for Regional and Urban Policy (DG REGIO), Peruvian authorities expressed an interest in developing an initial study on "Strengthening Regional Innovation Systems in Peru: Policy Lessons" with institutional support from the Peruvian Ministry of Foreign Affairs and the regional governments of Cusco and Tacna.

This study, funded by the European Commission and carried out by a team of European and Latin American experts from the Spanish foundation CIDEAL, has allowed a collaboration with the DG REGIO in the field of regional policy and innovation to begin building on the experiences and good practices of the European Union in this area.

The study aims to conduct a strategic assessment of the Regional Innovation Systems (RIS) in the Peruvian regions of Cusco and Tacna, identifying the main actors within each region's system: regional government, universities, research centers and enterprises, as well as identifying their level of cooperation and coordination in order to encourage further development of innovation strategies and joint projects.

The work is based largely on the "*Regional Innovation Strategy*" (RIS) methodology and its updated version (RIS3) on "*Innovation Strategy for Smart Specialization*" designed and used by the EC. This proposes an analysis of the R&D carried out by academic and research institutions as well as the demands for innovation made by the business sector, analyzing their possible interaction and coordination, with the support of policies and instruments designed by regional authorities. We have also taken into account the recent experience of developing regional innovation strategies in regions of Chile (Proyecto RED), co-funded by the EC.

The study began in August 2013 with a period of preparatory work (existing documentation, contacts with public institutions, agencies, experts from the region, etc.) followed by fieldwork carried out during the month of September in Cusco, Tacna and Lima, which serves as base for most national institutions dedicated to research, development and innovation (R&D&I). We subsequently developed the analyses which make up the chapters of this study and maintained interactive contact with regional actors via videoconferencing, e-mail and other means, allowing for a participatory follow-up to the study.

In both regions activities were carried out to inform, raise awareness, and to train and mobilize stakeholders: meetings with leaders from the regional government; seminars in universities, research centers and business sectors; workshops on R&D&I, interviews with entrepreneurs, leadership from universities, technological institutes and research centers; and participation in technology trade fairs.

In Lima meetings were held with the Multisectoral Working Group organized by the Peruvian Ministry of Foreign Affairs, which convened major state agencies as well as representatives from academic institutions and the business world responsible for creating innovation policy and tools at a national level.

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As part of the study we also contributed to the organization and content of the International Seminar on Innovation and Territorial Development, held December 11-13 in Lima and organized jointly by the Ministry of Foreign Affairs and the EU.

At the same time a video was created on the process of preparing the study and the participation of stakeholders from Cusco and Tacna.

We would like to highlight the following key results from the study:

- 1.** The strong growth of the Peruvian economy in recent decades has not been accompanied by an improvement in competitiveness and productivity on the whole, or by the diversification of economic activities toward higher added-value exports and products guaranteeing the sustainability of growth. The design and implementation of public policies, as well as a greater investment in human resources and knowledge assets at both national and regional levels, would help maintain the growth momentum. This is an urgent task for public policy, as obtaining returns from this type of investment takes time, and helps determine the future competitive edge of the business sector.
- 2.** In the Cusco and Tacna regions there is little mutual understanding among key innovation actors: regional governments, academia and business sectors. There is a certain distrust along with lack of dialogue and communication between them, and almost non-existent interrelations. Therefore, neither of these regions have developed innovation systems capable of producing knowledge that is propitious to innovation. However, there is a discussion forum in Cusco devoted to R&D&I, and in Tacna paths toward inter-institutional communication are beginning to be forged.
- 3.** Both regions show interest in working toward the institutional strengthening of a still-incipient regional R&D&I governance. For some years Cusco has had a Regional Science and Technology Council (CORCYTEC) led by the regional government (GORE), made up of representatives of that government as well as leading academic, research and business organizations; there has been a certain degree of enthusiasm and some experiences in the implementation of joint activities, but the Council lacks the human and financial resources to ensure its permanent institutional sustainability.
- 4.** Tacna has not yet institutionalized CORCYTEC, but it is recommended that it do so as soon as possible. To date the degree of cooperation which exists in Cusco is not present in Tacna, except for the offer by the Jorge Basadre Grohmann National University to further an emerging collaboration through a joint forum on R&D&I, with participation from the Chamber of Commerce and the regional government.
- 5.** Cusco has a Regional Competitiveness Plan 2011-2021 in which it defines its development vision and sets its objectives, policies and activities for different areas, specifically in R&D&I. However, there is no monitoring or evaluation of the Plan. Tacna does not have a Competitiveness Plan to date, and the Plan

Basadre—in which aspects of research and innovation play a secondary role—is still in its development stages.

- 6.** It is necessary to strengthen the collaborative ties between regional actors as well as national institutions and agencies behind R&D&I policies and tools in order to develop, adapt and implement better-determined policies and tools for benefitting the region. It is essential to establish a joint dialogue between the Multisectoral Group (piloted by the Ministry of Foreign Affairs) and the representatives of CORCYTEC in Cusco and the Tacna Forum in order to share study results and identify policies and tools for support and joint collaboration.
- 7.** Cusco's regional government has an organized institutional structure in which the Economic Development Bureau plays an important role in supporting the actions of R&D&I of CORCYTEC, but it is limited by its multiple responsibilities as well as by its lack of human and financial resources. Tacna's GORE has a fragile structure in which the only relevant political role is played by the Vice President, and it lacks human or financial resources and follow-up of its proposals.
- 8.** Both regions are characterized by a high level of informality in their business sectors, exceeding 50-60% (no reliable statistics). It should be noted that while informality is not necessarily a condition that is incompatible with innovation and entrepreneurship, it is incompatible with the implementation and development of a regional system of innovation. This structural element is a fundamental challenge for public policies of R&D&I in Peru.
- 9.** Another important feature of business in both regions is that it basically consists of micro-enterprises and, to a lesser extent, of SMEs. We have found that in Micro and Small Enterprises (MSE), innovation is not integrated into management as a systemic process, and therefore as a key growth and company-expansion factor.
- 10.** Both regions show a high concentration of formal production activity in very few provinces. A regional strategy of innovation should be formulated so as to reverse the territorial inequality that currently exists. Therefore it is recommended that it actively include local governance.
- 11.** The companies interviewed in Cusco and Tacna have interesting profiles in terms of innovation. Virtually all entrepreneurs state that during the last three years they made innovations in products and, to a lesser extent, in processes and marketing. Their justifications for making these innovations were mainly to improve the quality of the products and/or services, increase the flexibility of processes, and reduce costs.
- 12.** The main problems faced by the entrepreneurs interviewed in developing innovations are the lack of information about the R&D&I supply, financial capacity, the lack of qualified human resources, the lack of specialized suppliers, and, finally, the lack of public aid.

- 13.** It is important to note that the majority of the interviewed entrepreneurs did not know that universities could potentially support them in the development of possible innovations. They know of their educational role but not about their role in the field of research. However the vast majority of entrepreneurs would agree to work with universities.
- 14.** ICT—Information and Communications Technologies —should be incorporated as a fundamental pillar of promoting competitiveness and innovation in the regions. We have found that employers are unaware of the benefits of the use of ICT in their businesses.
- 15.** Public universities, San Antonio Abad of Cusco and Tacna’s Jorge Basadre Grohmann, play an important role in academic education, providing an important supply of human resources development in the respective regions.
- 16.** However, the research being carried out by both universities is still minimal given the financial resources they have received from the Canon Act. Legal provisions enormously limit the normal use of these funds. This is compounded by the need to improve universities’ management tools.
- 17.** Cusco and Tacna have university departments and public research centers that undertake important research projects in areas of food, agriculture and human health. They participate in a degree of knowledge transfer to small farmers and peasant organizations. However there is no link between research and the business sector working in these fields. This is due to both parties’ lack of knowledge as well as the absence of interface mechanisms for connecting and adapting the research process to the demands of the business sector.
- 18.** There are specific possibilities for developing some pilot experiences linking research institutions, promoting the development of medium-range technologies, and business activities that can contribute to key innovative processes for the regions. Examples include the improvement of alpaca fiber for the textile industry in Cusco and the production of oregano for export to European markets in Tacna. Both regions could also boost development of the tourism sector.
- 19.** We recommend:
 - A.** Working intensively to strengthen institutions and to build management and innovation capacities in order to ensure sustainability in the construction of Regional Innovation Systems of Cusco and Tacna.
 - B.** Developing the regional capacities of government, academia and business sector to produce and promote regional innovation agendas and policies in the medium and long term that are not at the mercy of political change.
 - C.** Investing in the training and development of qualified human capital that can nourish the regional and local private sector’s skills in technology, organization, management and promotion of innovation, etc.

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- D.** Building capacity of the regional and local agencies charged with managing resources—either their own or decentralized—applied to R&D&I programs.
- E.** Strongly encouraging linkages between academia and business, with emphasis on applied research to contribute to resolving local businesses' medium to long-term problems. Public policies can serve as catalyst for collaborative projects of innovation, as well as being a tool for identifying and expressing businesses' demands.
- F.** Increasing public incentives for private financing of investments in R&D&I at a national and regional level.
- G.** Strengthening EU cooperation in innovation, as—given the good practices and experiences in European regions—it can contribute to the development of regional innovation strategies, support the design of public policies, and open channels of cooperation between European and Peruvian regions, as well as between the main regional stakeholders (universities, research centers and companies).

II. REGIONAL INNOVATION SYSTEMS: GENERAL CONSIDERATIONS

The Regional Innovation System (RIS) is based on the premise that the region is the driving territorial unit in which different economic agents operate. It is the point of departure for channelling those elements which permit the production of knowledge and innovation needed to guarantee economic growth and welfare.

The RIS comprises several subsystems of stakeholders involved in a collective learning process; it also includes linkages between the agents that configure those systems. These subsystems comprise:

- Universities and public and private research centers as knowledge-producing entities;
- Businesses that harness this knowledge and bring it into the production framework;
- Technology centers, capital goods and firms offering advanced services as agents supporting innovation;
- Agents that finance innovation;
- Different public bodies and development agencies that operate within different subsystems and contribute to spearheading the processes.

The different agents and elements must be inter-connected, interacting to drive the dynamics of the innovation process. Similarly, these subsystems are positioned in a common social, economic and cultural framework within the territory or region. At the same time, RIS should be conceived as open systems attached to other innovation systems on national, macro-regional and other levels.

It is crucial to use a broad definition of innovation which includes both technological (products and services) and non-technological (processes, organization, marketing, social innovation, among others) elements, especially in order to study those territories where low and mid-range technologies prevail.

The idea is to study RIS from an operative perspective that can provide a portrait of the observable behaviour of the agents, institutions and other elements involved in knowledge production, in mechanisms for learning and for producing innovation as well as their subsequent dissemination and use, and in governance mechanisms.

Analysis focused on RIS from European countries provides a knowledge base or a benchmark, since these systems usually have fewer shortcomings that justify public intervention, and in many cases it is the market that dictates the behaviour of the participating agents. This approach allows us to analyze regional innovation systems of less developed regions and detect problems by comparing them to RIS characteristics of developed regions of European countries.

On the whole, in regional innovation systems in developing and less competitive countries more emphasis is placed on those systems made up of urban regions with a strong presence of manufacturing and knowledge-intensive sectors that show degrees of success in their endeavours.

Among the greatest difficulties for carrying out RIS studies in these countries are: lack of information or difficulty gaining access to data regarding the key issues of RIS; issues regarding the main regional indicators of R&D&I (science and technology infrastructure, resources for business innovation, productive structure, business context, etc.); interactions between agents; the type of governance; the real performance of the institutions; the type of innovation; and others.

For these reasons, we must resort to qualitative methods that allow better access to the knowledge the agents have—especially in the business sector—and how they interact dynamically. In the same vein, the absence of impact assessment studies of national and regional innovation programs and lack of contrast between the outcomes obtained by the different programs, are detrimental to regional level learning capacity and constitute a significant block to RIS development.

One of the basic conditioning factors for configuring an RIS is model of policy and budget decentralization that each country has. The weaknesses of national innovation systems in developing countries are more frequently repeated in regional innovation systems. This means serious shortcomings such as low investment levels in R&D&I, the principally public character of this investment, the low-tech level of these innovations and the lack of connection between the worlds of business and knowledge.

Shortcomings in the institutions and governance of RIS in developing countries and regions have repercussions in the still delicate stability and management capacity of governmental bodies in charge of implementing regional science and technology policy. Local capacity to carry out quality control and implement innovation policies are still in their early stages.

Knowledge infrastructure is fragile and more oriented toward human resource training and technical capacitation than research and promoting of technological development for the regional productive system. Human capital, which contributes greater technical skill, is often drawn to more attractive opportunities offered at the countries' urban centers or abroad.

The private sector is not aware of the value that their relationship with local research centers could have and is leery of national and regional policies.

The diversity of territorial levels—national, regional, sub-regional and municipal—represents a risk of division and scattering of efforts geared toward promoting innovation.

Strengthening an RIS is a long-term process that must have the backing of productive sectors with possibilities of developing clear comparative advantages in the future. Moreover, this process must have the strong support of regional governments and the decisive participation of the private sector.

III. THE INNOVATION ECOSYSTEM IN PERU: ECONOMY AND NATIONAL INNOVATION SYSTEM.

III.1 Brief overview of the Peruvian economy and support for R&D&I.

The Peruvian economy has increased its GDP by an average of 6.3% since 2002, and is one of the Latin American economies with most growth in the first decade of the 21st century. Inflation is no longer an endemic malady, holding at between 2% and 4%. Investment has grown significantly, and Gross Capital Formation has been placed at an average of 19% during this decade with highs of 22.5%, such as in 2008.¹

The Global Competitiveness Index for 2013 - 2014 places Peru in 61st place out of 148 countries, taking it 22 places above its 2008 - 2009 ranking. Peru is ahead of Colombia (69th) and Uruguay (85th), but still far from the first three Latin American economic titleholders, Chile (34th), Mexico (55th) and Brazil (56).²

However, if we disaggregate the indicator, we will be able to see how the results in the section on innovation factors are nowhere near positive. Of 148 countries, Peru stands at 97th place regarding basic innovation indicators. It scores (table 1) the worst in available scientists (120th), company spending on R&D&I (118th) and in the quality of its research institutions (116th) In all of these indicators except for quality of scientific institutions, Peru has dropped its placement from the 2008-2009 report.

Table 1: Disaggregation of innovation competitiveness in Peru (2013 – 2014)

The Global Competitiveness Index in detail

INDICATOR	VALUE	RANK/144
12th pillar : Innovation		
12.01 Capacity for innovation.....	2.8.....	103
12.02 Quality of scientific research institutions	2.8.....	116
12.03 Company spending on R&D.....	2.6.....	118
12.04 University-industry collaboration in R&D	3.1.....	110
12.05 Gov't procurement of advanced tech products	3.2.....	99
12.06 Availability of scientists and engineers	3.4.....	120
12.07 PCT patents, applications/million pop.*	0.2.....	88

Source: Universidad del Pacífico: "Apuntes sobre el ecosistema nacional de Innovación en el Perú: Avances del periodo 2011 – 2013" (Lima, November 2014). Based on GCR (2013 – 2014)

Therefore, the growth that Peru has experienced since the beginning of the 21st century is extensive and due mainly to exogenous factors. Liberalization policies

¹ " OCDE Reviews of Innovation Policy: Peru", Peru 2011 , p. 65.

² "[The Global Competitiveness Report 2013-2014](#)" World Economic Forum.

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have certainly facilitated a better allocation of productive resources, the attraction of more and better international investment and robust development of the external sector. Nevertheless, compared to emerging economies in its context and revenue level, Peru earmarks very few resources for R&D&I. In 2004 this investment barely reached 0.15% of the GDP, while Brazil's reached 0.90% and Chile's 0.65%. From that year on, investment growth rate in R&D&I grew in those two countries while it is estimated (reliable figures do not exist) to have stagnated or reduced in Peru.

As can be seen in table 2, compared to countries in its context, Peru ranks relatively low in most competitiveness indicators, with few exceptions.

Table 2: Ranking of competitiveness in Latin American economies (2011 – 2012)

Contexts	Brazil	Chile	Colombia	Mexico	Argentina	Peru
Overall	44	46	57	63	78	113
Favorable contexts						
<i>Competitiveness</i>	132	23	128	103	141	59
<i>Quality of education in maths and science</i>	127	87	83	126	113	135
<i>Quality of the educational system</i>	115	124	72	107	86	128
<i>Use of ICTs</i>	63	56	78	73	55	82
<i>Government spending on technology</i>	52	47	45	75	127	98
<i>Protection of intellectual property</i>	84	63	86	85	128	122
<i>Availability of risk capital</i>	52	34	49	78	129	38
Investment						
<i>Corporate spending in R&D</i>	30	60	76	79	72	118
<i>Excellence of the scientists in research institutions</i>	42	51	69	54	41	109
<i>University-Corporate collaboration in R&D</i>	38	44	43	45	48	103
<i>Availability of scientists and engineers</i>	91	29	77	86	75	102
Performance						
<i>Innovation capacity</i>	31	66	59	76	77	99
<i>Patents used per million inhabitants</i>	60	53	76	58	55	83

Source: Peruvian Ministry of Foreign Affairs: ["Examen de políticas de ciencia y tecnología e Innovación en el Perú"](#) (Study on Science, Technology and Innovation in Peru) Lima, 2012

Peru's economic growth in recent decades is essentially based on export of low-value-added mining and farming products. If the extra resources Peru receives for its production specialization in these current circumstances are not invested in sweeping transformations in the productive sector, a downgrading of highly volatile raw material prices could affect the progress made in recent years. According to the deputy minister for production,³ a mere 10% reduction in the price of copper would cause tax revenues to fall by 14% and that would be tantamount to 51.6% of total social spending of the Peruvian State.

³ Francisco Grippa Zárate, [Seminario Internacional Diálogo sobre Innovación para el desarrollo territorial en el marco de la cooperación UE – Perú](#) Lima , 11st December 2013

The main obstacle to the transformation of the productive fabric to take place is the composition of this fabric itself. Peruvian corporate structure is largely composed of micro businesses and independent workers. In 2006, it was this type of business that accounted for 99% of companies that paid corporate tax, 88% of employment, and contributed to GDP growth by 41%. On the other hand, 1.2% of both large and mid-cap firms made up for 11.8% of total employment and 58.5% of private sector contribution to GDP growth. Small businesses are between 2.6 and 15 times less productive than larger businesses⁴.

For the vast majority of micro and small businesses, often informal, it is very difficult to innovate and progress. Additionally, there is little contact between large and small companies and there is no phenomenon of large firms having a pull on smaller ones.

Regarding the evolution of productivity, it has been erratic. Labour productivity has been very low compared to other countries in the region. In 2008 it hardly reached its level of ten years prior to that. Even so, from 2002 to 2008 it grew by an average of 3.8% due to the greater allocation of labor input to more productive sectors.⁵ Influx of foreign capital as Direct Foreign Investment has allowed for more allocation of resources that can be seen in the global productivity growth of these factors, however, if structural modifications are not made in the Peruvian accumulation model, these peaks of productivity growth could disappear in the medium term.

III.2 The National Innovation Ecosystem of Peru.

This section is based on two recently conducted studies by both the OECD (*Review of Innovation Policy, Peru 2011*) and by ECLAC/UNIDO (*Peru: Science, Technology and Innovation Policy Review, 2011*). Universidad del Pacífico (Lima) has also contributed diverse updated data on R&D&I policy and instruments to this chapter.

We must point out the importance and influence of national innovation institutions, policies and instruments upon Regional Innovation Systems (RIS) still in their early stages. These help promote multi-level complementarity in their design and configuration.

We have briefly touched on the important successes of the Peruvian economy in recent years, as well as its structural weaknesses. Improvement of productivity on the whole and diversification of economic activities toward products and export items of greater added value are the key challenges to Peru's sustained growth and development in the medium and long term.

Therefore, greater investment in human resources and knowledge assets to broaden Peru's capacity for innovation could contribute to maintaining the growth curve. This is the urgent public policy task at hand, since securing results with this type of

⁴ OCDE, Peru, 2011, p. 99

⁵ OCDE, Peru, 2011, p. 100

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investment takes time and will determine future competitiveness levels for the business sector.

The experience garnered from European countries shows that a more proactive role on the part of the government in promoting innovation can help Peru develop a new competitive edge and mitigate the obstacles that stand in the way of this process.

According to the OECD, "Peru does not have an explicit STI policy with agreed strategic orientations. Rather, it has a multi-layered body of largely uncoordinated, more or less independently designed and implemented policies of various ministries and public institutions. With relatively few resources devoted to STI overall and weak integration of the innovation system, institutions pursue their individual goals." (OECD, 2011, p. 24)

The performance of innovation systems, as the experiences of European countries show, also depends on qualitative factors that boost production, acquisition, dissemination and application of knowledge and technologies and guarantee that public resources have an effective multiplier effect on private investment for innovation, whether it comes from new or existing firms. These factors include:

- Institutional structure and innovation governance that directs and implements the policies needed;
- Favorable conditions for public research institutions to flourish and transfer knowledge;
- Absence of legal and regulatory restrictions that have negative effects on the use of public resources to promote private investment in R&D&I;
- Supportive instruments and public incentive.

Significant improvements are needed in all of these areas to guarantee that the boosting of resource allocations for R&D&I projects is effective and that it contributes to increasing Peru's innovative capacity.

Different institutional, pragmatic and resource-oriented public policy initiatives have been adopted in the last ten years. Here we will summarize some of the main measures adopted.

The Science, Technology and Innovation Framework Act of 2004 conferred the National Science, Technology and Technological Innovation Council (CONCYTEC) responsibility for directing policy on STI and coordinating the so-called Science, Technology and Technological Innovation System (SYNACYT) that includes some twenty-odd public bodies. It is head of the National Scientific Technological and Technological Innovation Development Fund (FONDECYT) the mandate of which is to seek, manage, administrate and channel national and foreign resources.

Regional STI Councils (CORCYTEC) are a decentralization mechanism of CONCYTEC with a mandate to promote knowledge production between different regional economic and social agents to boost the country's competitive edge and improve the

standard of living. These are regional government bodies made up of representatives of the government itself, R&D&I sectoral institutes, universities, corporations and civil society (professional associations, NGOs) working to reach the consensus needed for regional capacity building in R&D&I issues. The following are highlights of their mandate:

- Put forward STI policies on a regional level;
- Organize regional STI scheduling;
- Support fundraising for scientific research, experimental development and innovation.

The Ministry of Production launched technological innovation Centers (CITEs) in 2000. With funding from the Ministry, private concerns and foreign cooperation organizations, these centers were designed to provide technological support to SMEs and producer associations, seeking to bridge the wide gap in technology transfer. CITEs serve as technology partners for companies, connecting the public, academic and business sectors to boost change, enhance quality, differentiate products and principally enhance efficiency for SMEs.

Additionally, two STI competitive funds were created and financed by both the Peruvian government and loans from multilateral financial institutions:

- a) The INCAGRO FUND (2001): promotes innovation, tech transfer and public-private collaboration in the farming industry;
- b) The FYNCYT FUND (2007): promotes a wide range of programs, the most important of which is aimed at capacity building for companies, universities and public research centers to research and innovate, and to promote collaboration amongst them. It was created with a USD 25 million loan from the Inter-American Development Bank (IDB) and a contribution from the Public Treasury of USD 11 million. When the contract expired in September 2013, the IDB signed a new contract titled the "Innovation for Competitiveness Project". This would continue to support the FYNCYT fund with USD 35 million and the Treasury would contribute USD 65 million. Through this program, the Peruvian government will implement measures aimed at increasing the export of high tech products and services as well as boosting public spending for scientific research, technological development and innovation for business, especially in the high tech sector.

In 2006 the Ministry of Economy and Finance created the FIDECOM fund with the aim of promoting productive innovation, and in 2007, charged the Ministry of Production with the operation of a public competitive fund using its resources. The fund benefits businesses, civil partnerships with productive aims, and formally established micro businesses that partner with academic organizations to develop productive innovation projects and knowledge transfer for innovation and business management.

The Canon Act, (Ley del Canon) approved and launched in the decade of 2000, defines Canon as the effective and appropriate sharing of regional governments in the total income and revenues obtained by the State in the economic exploitation of

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natural resources. In 2003, this Act was amended to allocate part of the resources transferred to the regional governments to finance investment projects intended to build research capacities at regional public universities. A 2005 amendment specified that said investment should be devoted to spending on infrastructure and facilities and can in no case be utilized to pay any sort of fees or retributions.

Financing through the Canon Act is fairly substantial. However, a segment of its resources is untouchable due to rigid regulations restricting its use, as well as the universities' inability to absorb the totality.

Despite certain recent initiatives launched by universities with higher R&D levels, as well the existence of perks for collaborating with funds such as the FYNCYT, the interaction between universities and the productive sector regarding research and innovation is just starting to take off.

With very few exceptions, the performance of Public Research Institutes (IPI) devoted to development and transfer of R&D, measured in terms of scientific production, patent register and collaboration with the productive sector, is extremely lacking. This is mainly due to the way they are managed, the financing of their activities (since little revenue comes from rendering services) and their internal administrative procedures.

The sustained economic growth of the recent decade has boosted demand for university degrees and the creation of some public universities, several technology institutes and private colleges. Most of the expansion of university studies in recent years was seen in private universities that enjoyed total legal, administrative and financial independence, in the absence of a national accreditation system to guarantee the quality of the study programs. Consequently, university excellence has not been a criteria included in university management. To date, no Peruvian university appears in any world rankings and grants for graduate studies are very low by international standards.

Perhaps one of the most pressing problems regarding the relationship between universities, businesses and innovation is the lack of interaction between the knowledge produced in the university and the business sector.

Peruvian enterprise, taken as a whole, is very diverse and has little tendency to invest in R&D&I. Over 90% of all businesses are micro-enterprises and only a small minority of companies (around 2%) carry out R&D&I activities; these companies are concentrated in a limited number of sectors.

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Among the principal factors which, according to the OECD, may explain a business sector's low propensity to participate in innovation activities we find:

- Aversion to risk;
- Deficient interactions between businesses and the national sources of knowledge, whether research institutions or universities, principally due to the fact that the supply of knowledge does not correspond with the demand of technical services, nor are there technological managers devoted to promoting this interaction;
- Lack of management and of personnel trained in R&D&I to design and implement innovation projects;
- Lack of capital markets and scarcity of financial institutions willing to attend to the financial needs of innovative entrepreneurs;
- Lack of public mechanisms which provide effective support for the promotion of private investment in R&D&I.

IV. METHODOLOGY APPLIED IN THE STUDY.

IV.1 Regional innovation strategy for Smart Specialization.

The methodology applied in this study is partially inspired by the European Union's *Regional Innovation Strategy* (RIS), applied in recent decades in many regions of Europe. That methodology has been improved and expanded upon in the process of designing new European Funded Operational Programmes 2014-2020 ("Research and Innovation Strategies for Smart Specialisations-RIS3").

Smart Specialization is a process of entrepreneurial discovery through which a region identifies how it might benefit from specialization in a particular field of science and technology.

The European Commission suggests that the development of smart specialization strategies should serve to concentrate resources in the most promising areas of a region, according to the area's comparative advantages.

One of the strategies of RIS3 is to put into practice the concept of "Strategies of Smart Specialization". This begins with adopting a consensual vision of how the regional economy might be made more competitive and sustainable in the long term. This design process starts with defining priorities for the development of a sustainable knowledge-based economy on the basis of the strengths and potentialities of the region.

RIS3 is a key element in the reform of the European Union's Cohesion Policies adopted in late 2013 for the 2014-2020 period, which make it a requirement (an *ex ante* condition) for financial support in two of the thematic objectives essential to these Policies: strengthening R&D&I and increasing access to Information and Communication Technologies (ICTs). It encourages thematic concentration and reinforces strategic programming and results-orientation in projects and programs.

The first step is a self-evaluation to be conducted by the business sector, the science/knowledge/creativity sector, the government sector, and the interactions between these three sectors conceived as a whole: the Regional Innovation System (RIS). This process should lead to:

- Identifying existing potentialities and strengths;
- Detecting gaps and bottlenecks in the RIS;
- Involving relevant actors and institutions;
- Defining possible points of departure for processes of RIS3 development.

The RIS3 process is smart when it involves the whole triple-helix of the RIS. It encourages all stakeholders to join together in a shared vision. It links businesses, promotes multi-level governance, and helps to generate creative and social capital within the region. The process should be interactive, consensus-based and oriented towards the regions themselves.

The RIS3 exercise considers that businesses are the engine driving innovation.

Those responsible for regional policies should begin an informal evaluation process, inviting business representatives and leading regional entrepreneurs to participate.

Likewise, regional government authorities and institutions should be the first to be encouraged to conduct self-evaluations in order to assess the administrative sector in their region.

The leading institutions and representatives of regional science, knowledge and creativity are indispensable partners in selecting a limited range of goals and economic terrains in which targeted investment could improve the whole regional profile within global value chains.

To make a RIS3 process smart, the assessments made by leading regional institutions should be accompanied by the entrepreneurial advances made in regional innovation.

Within this European framework, to more specifically describe the characteristics of the regional innovation systems in the regions of Tacna and Cusco, the model developed by the Institute for the Management of Innovation and Knowledge (INGENIO) at the Polytechnic University of Valencia in Spain was taken as a point of reference. The following elements were taken into account:

- The productive sector: companies producing goods and services and emerging entrepreneurs from sectors of regional economic activity;
- The technological sector: companies dealing in capital goods and advanced systems, technological centers and institutes, R&D&I entrepreneurial associations, infrastructures supporting SMEs, companies' R&D&I departments, etc.;
- The scientific community: groups of university researchers, research and development centers, inventors, public and private research entities which support business R&D&I;
- The finance sector (particularly public finance): private entities (seed capital, risk capital, banks, savings banks), and parts of the public administration which offer or assign resources for promoting R&D&I in order to encourage regional competitiveness.

Methodological tools were chosen based upon the experiences of the participating consultants in European countries (Spain, France, and Scandinavian countries) and in Latin America (Chile, Brazil), where they demonstrated a greater contribution to regional and national authorities' comprehension of systems development and regional innovation strategies.

IV.2. Support instruments applied.

IV.2.1 Description of the demand for innovation in the regions of Cusco and Tacna.

In order to prepare the strategic assessment of the Business/Innovation relationship in the regions of Cusco and Tacna, a methodology of participatory and gradual construction was applied, during the course of which surveys, documentation and a

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review of primary and secondary source information were used to construct an assessment together with regional stakeholders.

The principle techniques applied were interviews with businesses, representatives of professional associations, and in the case of Cusco, representatives of an NGO linked to local productive development. A thematic seminar was also conducted in each of the regions, as well as meetings with representatives of the various public entities which sponsor regional productive development, such as the Regional Government, the Regional Tourism Bureau, CORCYTEC and others.

Specifically in the Cusco region the following fieldwork was carried out:

- Structured interviews with seven companies (economic sector listed in the table below);
- Interview with the President of the Regional Tourism Board;
- Interview with the President of the Regional Textile Board;
- Interview with the Representative of the Automotive Committee in the Chamber of Commerce in CORCYTEC;
- Interview with the Director of the Headquarters of the Center for Economic Promotion Cusco Sierra Exports;
- Interview with the NGO Guaman Poma de Ayala Center;
- Thematic seminar in Cusco: "The Productive and Entrepreneurial Sector".

Table 3: Companies interviewed in Cusco.

Number	Name of Business	Sector/Product
1	IND FAIMSUR	Metal and Mechanics/ Machinery for agro-industry, industrial baking, construction, etc.
2	SOL NACIENTE	Agro-industry/ Chocolate (100% Cacao)
3	COMPANIA AGROINDUSTRIAL SAN ANTONIO	Agro-industry/ Gourmet Coffee
4	CCAPAC	Furniture building/ Wooden furniture
5	LATINOAMERICANA ART	Textile/ Alpaca fabrics
6	COOPERATIVA ALPACA SUR	Leather and fur/ Clothing, toys and house wares from alpaca and sheep skins
7	PEZ DE PLATA	Jewellery/ Silver and gold jewellery with semi-precious stones

In the Tacna region the activities conducted to gather primary information included:

- 1) Structured interviews with twelve companies (economic sector listed in the table below);

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- 2) Group interview conducted with the head of the Chamber of Commerce, a grower and exporter of oregano (agro-industrial sector), two entrepreneurs in the field of software development (ITC sector), and a representative of the Institute of Technical Training;
- 3) Interview with the mayor of the Gregorio Albarracín district;
- 4) Interviews with representatives of public entities involved in the promotion of productive development: the head of Economic Development and the Director of the Regional Tourism Board;
- 5) Thematic seminar in Tacna: "The Productive and Entrepreneurial Sector".

Table 4: Companies interviewed in Tacna.

Number	Name of Business	Sector/Product
1	Estela y Compañía, S.C.R.L.	Agro-industry/Dried oregano leaves
2	Agroindustrias Gonzalez, E.I.R.L.	Agro-industry/ Virgin and extra virgin olive oil (95%) and avocado oil (5%)
3	Bodega Tacna, S.A.C.	Agro-industry/ Pisco (75%), apricot liquor (15%), and wine (10%)
4	Confección Es Claudia	Textiles/ School sports uniforms (30%), school uniforms (50%), institutional uniforms (20%)
5	Muebles Ronny, E.I.R.L.	Manufacturing in wood and metal/ Wood and metal furniture
6	Industria Pinos Sur, E.I.R.L.	Furniture building/ Wooden furniture
7	Samatours, S.R.L.	Tourism/ Travel agency and tourist services
8	Joyería Pineda	Handicraft/Gold and silver jewellery
9	Glorieta Tacneña	Tourism/Gastronomy
10	Fedesur, S.A.C.	Metallurgy / Metal furniture
11	Clinica Promedic	Health/ Medical services
12	IDW Sistemas Integrales	Information technology/ Software development

The number of companies interviewed was determined by the scope of the assessment of the Regional Systems in Cusco and Tacna in this phase of analysis, given the objectives established in this study. The following criteria were applied in the selection of companies to be interviewed: they should pertain to priority sectors in each of the regions, they should be active and legally constituted productive units, they should pertain to the size stratum which characterizes the regional business community (Micro and Small Enterprise), and they should be businesses with possibilities for growth and development (that is, small subsistence units of production were not considered).

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IV.2.2. Description of existing R&D on a regional level.

In order to prepare the assessment of R&D existing in the regions of Cusco and Tacna, various support instruments were used to compile statistical information, previously under-systematized, and confirm the validity of existing information on the basis of in-depth interviews with the principle centers for scientific research, technology and transfer in priority sectors or fields of future opportunity.

The principle instruments applied were:

- a) In the context of the study's launch, a Seminar was conducted to review the secondary information based on previous studies by the NGO Caritas in collaboration with the Regional Government of Cusco and the Plan for Competitiveness (Plan Concertado) among others.
- b) Networking: between September and November 2013, basic concepts as well as the scale and components of a regional innovation system were jointly analyzed, allowing for an assessment of the regional authorities' and technicians' understanding (both conceptual and practical) of relevant notions.
- c) Training day with regional governments and universities: materials and experiences were shared and connections made between Latin American and European institutions as well as with university experts in innovation and entrepreneurial culture.
- d) Interviews with qualified professionals and providers of R&D with professional technical training.

A total of 17 institutions offering R&D and 43 participants were interviewed.

Table 5: Listing of R&D offered by institutions interviewed in Cusco and Tacna.

Cusco	Tacna
Cusco Regional Government	Tacna Regional Government
San Antonio Abad de Cusco National University	Jorge Basadre Grohmann National University
Cusco Andean University	Tacna Private University
Global University	Technological Institute "Francisco de Paula González Vigil"
National Institute of Agrarian Innovation - Cusco	César Vallejo University
NGO Caritas	INDECOPI
Technological institute "Tupac Amaru"	Sierra Exportadora
SENATI	
INGENIMED S.A.C.	
Sierra Exportadora	

V. ECONOMIC OVERVIEW OF TACNA AND CUSCO REGIONS AND POLITICAL- INSTITUTIONAL ACTORS.

Table 6: Political and regional map of the Republic of Peru.



V.1 Cusco region⁶.

Located in the south-eastern part of the country, the Cusco region covers 71,987 square kilometers, or 5.6% of Peru's entirety, making it one of the country's largest. Cusco, the capital city, is located at 3,339 meters above sea level. It is divided administratively into thirteen provinces and 108 districts.

It is a very diverse region, with three distinct areas:

- The high Andes—located at 3,500 – 6,372 meters above sea level—represent 21% of the territory. Here livestock (sheep, llamas and cattle) and agriculture (beans, quinoa, native potatoes, fodder, etc.) are the main industries. There is a dense concentration of poverty and exclusion linked to the predominantly rural geography.

⁶ Based on the:

- Cusco regional government: "[Plan concertado de competitividad regional del Cusco \(2011 – 2021\)](#)" (December 2011)
- Peruvian Central Reserve Bank: "[Encuentro Económico – Cusco 2009](#)" Cusco 2009.

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- The Andean valley—located at 2,500 – 3,500 meters above sea level—represents 23% of the territory. It is the most economically dynamic region, with the bulk of the region’s tourist, agricultural, industrial and service activities.
- The Amazon valley— at 370 – 2,500 meters above sea level—makes up 56% of the region’s territory and is home to 18% of the population. The area has abundant energy sources and cultural, touristic and natural resources, all of which are little exploited.

In 2011 the population in the Cusco Region was 1,283,540. The highest population concentration is found in the provinces of Cusco (32.7%), La Convención (14%) and Canchis (8%).

Much of this population is engaged in informal labor and low-productivity activities, leading to a poverty rate of 83% (in 2007).

Depending upon the structure of the labor market, approximately five out of ten workers are independent and 26% fall into the category of non-remunerated family worker. This occupation is characterized by its low productivity and is primarily associated with agricultural activity. Micro and small businesses make up 15% of the employed population. Workers in medium and large companies are only 2% of the total.

The bulk of the employed labor force in the region is concentrated in the agricultural livestock raising sector (53.9%) characterized by high poverty rates (close to 70%). Trade and a range of other activities and services come together to make up 27.3% of the region’s employed, often self-employed or in informal working conditions.

In 2011 Cusco contributed 3% to the GDP, ranking eighth among all regions in Peru. The principal economic activity is mining and hydrocarbons, which represent 22.4% of GDP in the region, followed by construction (14.5%), trade (11%), agriculture, hunting and forestry (10.7%), manufacturing (8.6%) and other economic activities (32.6%).

Production in the food and agriculture industry is characterized by its use of traditional technologies, and when it incorporates technological advances, the average yields of certain crops such as potatoes and corn are very low, resulting in low profitability. Large sectors of the rural economy are characterized by production for home consumption.

The region’s main crops, according to the Gross Value of Agricultural Output 2011, were: potatoes, coffee, corn flour and cassava. The coffee and cassava production take place in the rainforest region while the other crops are cultivated in the mountainous regions.

The mining and exploitation of hydrocarbon is the most important activity in the region and contributed 22.4% to the GDP growth of Cusco.

The manufacturing sector contributes 8.6% to the Cusco's GDP. A more detailed analysis of this sector is included in Chapter VI.

Cusco is Peru's tourist destination par excellence, Machu Picchu being its iconic destination. The city of Cusco is the most cosmopolitan in the country and hosts a number of archaeological sites both within the city and in its outlying areas: it was the capital of the Inca Empire, the most important pre-Hispanic culture in this part of the continent.

In this regard, the Cusco Chamber of Commerce notes that tourism is an umbrella for ten subsectors, including hospitality, travel agencies, tour operators, restaurants, museums and various modes of transport (air, road, rail and river).

V.2 Tacna region⁷

The Tacna region accounts for 1.25% of the Peruvian territory and consists of four provinces and 27 districts.

In 2007 the population was 289,000, making up 1.2% of the total population of the country. The urban population is 91.3% of the region's total.⁸

Important productive sectors include mining, transport, communications and to a lesser extent, construction. Trade as well as service, commerce, agricultural and livestock raising and manufacturing sectors are notable for the number of jobs they provide but produce below the national average, perhaps due to the dominance of the mining sector. However in recent years, the region's vitality is mainly due to growth in tourism from Chile and the services such a demand generates.

Most employment is concentrated in micro businesses with very low productivity. An enormous proportion of the overall product is generated by a small number of large companies.

In terms of labor productivity Tacna ranks above the rest of the country, but its evolution in the 2004-2011 period has been slower due to lagging growth in mining. Still Tacna is the fifth most competitive region in the country, improving its position in recent years.

Main agricultural products include olives and oregano. The region is the top producer, nationally, of oregano⁹ and olives destined for Peruvian and international markets. Cultivation is concentrated in the High Andes, where the so-called "minifundio" (small farm) dominates, and exports are mainly to the Brazilian, Chilean, Argentine and Spanish markets.

⁷ Based on the "Informe Económico y Social de la Región de Tacna" Peruvian Central Reserve Bank (April 2013)

⁸ National Statistics and Informations Systems Bureau (April 2009)

⁹ The oregano production in 2011 was 46% of the national production BCRP (2013)

Mining is a primary activity both regionally and nationally. Between 2001 and 2011 this sector accounted for 17.8% of total regional production.

Manufacturing output only represents 9% of the regional wealth in the period 2001-2011, while nationally this kind of production represents 17%. However, in this period the sector has grown at an average of 6.1%, indicating the existence of a clear potential for further production.

As in the whole country, the corporate structure is mainly composed of micro and small enterprises that have grown extensively in this last period, but have challenges to face, such as informal structure and smuggling.

A more detailed analysis of the production and business structure of the manufacturing industry in the Region of Tacna is in chapter VI of this study, on the demand for innovation.

Regarding industrial policy, existing mechanisms are basically the Tacna Free Zone (ZOFRATACNA), the Center for Technology Innovation (CITE) and the Industrial Park of Tacna.

In terms of individual activities in the service sector, tourism stands out generating productive chains of demand for related goods and services, such as, among other things, food, transport and the building of infrastructure. This can contribute—directly and indirectly—to the creation of employment and income, while also generating foreign currency.

Tacna has a portfolio of tourist attractions that could allow it to attract tourism related to nature, culture, beach-going, adventure sports and hot springs, among others. This sector also suffers from a high degree of informality and the inadequate quality of hospitality services.

Nonetheless the region is on the receiving end of an important flow of tourists—both from Peru and abroad—who have an average overnight stay of 1.4 days. In 2011, 400,000 tourists arrived in Tacna, of which a little over 280,000 were Peruvian and the rest were foreigners, mostly from Chile.

The increasing flow of tourists is due in part to the sustained growth of tourism services in the region, mainly from the Chilean region of Arica, who seek health services (such as optical and dental facilities). They come for the higher level of service, the better variety, and more competitive prices that Tacna offers.

V.3 Political and institutional stakeholders.

V.3.1. Regional government and the Cusco Regional Competitiveness Plan (2011-2021)

The Regional Economic Development Bureau is the agency that reports to the Regional Government of Cusco under the supervision of the Regional General Administration. This body is responsible for directing, coordinating, arranging, controlling, supervising and evaluating actions to achieve comprehensive, sustained and balanced economic development in the region in order to generate opportunities for development, increased employment and wealth for the regional society in general.

The Associate Bureau for Competitiveness comes under the supervision of the Economic Development Bureau, which is responsible for the regulation, management and execution of competitiveness policies in various sectors, among them industry, agro-industry, tourism, handicrafts. These policies, governed by law, should generate comparative advantage and both internal and external competitiveness based on innovation, the generation of new ideas and products.

The Cusco Region Competitiveness Plan, prepared in 2010 by the Regional Government of Cusco with the participation of economic and social actors in the region, established technology and innovation as key factors for competitiveness in the region in order to:

- a.** Promote the development of a culture of innovation and encourage research;
- b.** Strengthen the expansion of information services about technology, research, technical standards, patents and inventions;
- c.** The need for universities and vocational schools to be accountable for generating knowledge, supported by scientific investigation and technology that contribute to regional economic development;
- d.** Promote and disseminate technological innovation, research and information services for business development;
- e.** Promote and build capacity for scientific and technological research to encourage regional business innovation;
- f.** Strengthen and support innovative partnerships in the Cusco region;
- g.** Strengthen regional CORCYTEC;
- h.** Strengthen regional technological institutes;
- i.** Promote the modification of the norms governing the use of Canon Act resources so that universities dedicate resources to technology and innovation;
- j.** Promote the mutual relationship between universities and business in technology and innovation;
- k.** Promote research and development of science and technology to encourage a better use of regional potential.

The progress made with regard to the Competitiveness Plan is not currently systematized, as the relevant information has not been available and many of the programmed activities lack a budget.

The Regional Government of Cusco, through the Regional Economic Development Bureau and the Office of International Technical Cooperation has developed the Program for the Promotion of Science, Technology and Innovation for 2014, approval of which is expected before the end of 2013.

V.3.2 Regional Council of Science and Technology (CORCYTEC) in the Region of Cusco.

Pursuant to Regional Executive Resolution no. 1177, CORCYTEC was created, and chaired by the Regional Government through the Regional Economic Development Bureau and was backed by Caritas Cusco with the RAMP Peru Project, the San Antonio Abad National University of Cusco and the Andean University of Cusco.

CORCYTEC's mandate is to promote, encourage and coordinate plans and projects in science, technology and innovation in the area around the Region of Cusco in accordance with national plans formulated by the CONCYTEC, the National Competitiveness Plan formulated by the National Competitiveness Council and the Regional Coordinated Development Plans 2021 and the Regional Competitiveness Plan within the framework of the fundamental principles of the Science, Technology and Innovation Act no. 28303.

Cusco's CORCYTEC comprises the following representatives:

- 1.** Regional Economic Development Manager of the Regional Government of Cusco, who presides;
- 2.** Regional Social Development Manager, Regional Government of Cusco;
- 3.** Regional Production Director – DIREPRO;
- 4.** Regional Education Director of Cusco;
- 5.** International Technical Cooperation Director, Regional Government of Cusco;
- 6.** National Institute of Agrarian Innovation Director – INIA;
- 7.** Vice-Chancellor of Research of the UNSAAC;
- 8.** Director of Research at the Andean University of Cusco;
- 9.** Director of the Chamber of Commerce of Cusco;
- 10.** Director of the Technological Institute Tupac Amaru;
- 11.** Director of the National Service for Industrial Training SENATI;
- 12.** Regional Association of Innovators Cusco (ARIC);
- 13.** Secretary General of Caritas Cusco;
- 14.** Global University Cusco;
- 15.** Program for Adaptation to Climate Change (PACC);
- 16.** District Municipality of Wanchaq.

Other agencies and/or public and private institutions which abide by the statutes can apply to join CORCYTEC of the Region of Cusco.

Article Six of the aforementioned Regional Ordinance grants the Regional Management responsibility over planning, budget and territorial development of the Regional Government of Cusco; the responsibility for managing the economic resources allowing for the proper functioning of CORCYTEC, and preparation of the

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Regional Plan and Program for Science, Technology and Innovation, in compliance with the Framework Science, Technology and Innovation Act.

The following are among CORCYTEC's main activities:

- a)** Establishment of the Diploma in "National Public Investment System" (SNIP) for technological innovation projects;
- b)** Development of two technological innovation studies, the first on supply and demand for micro and small enterprise, and the second, in the industrial sector, analysis of supply and demand for technological innovation;
- c)** Creation of the Regional Association of Innovators Cusco (ARIC), in 2011, outcome of regional technology trade fairs, with the participation of a group of innovators and inventors in the Region of Cusco;
- d)** Organization of 1st Forum of Integration with Local Governments, with the objective of integrating local governments in the development and promotion of Science, Technology and Innovation through CORCYTEC;
- e)** One of the activities institutionalized by CORCYTEC during these last five years has been the organization of Innovation and Technology Transfer trade fairs, aimed at contributing to the improvement of regional competitiveness by matching academic programs with the technological demands in the business sectors that invigorate the regional economy. The fair is held with funding from public and private institutions—members of CORCYTEC—who contribute through this action but in many cases are not able to cover the budgeted amounts.

The investment made in the six STI fairs is S/. 634,210.00 in which 241 innovative projects participated, of which 74 were awarded with S/. 192,000.00. 10% of the winning participants were able to start their ventures thanks to their exposure at the trade fairs, where they were able to sell their products and prototypes.

Some of the main limitations of CORCYTEC Cusco as indicated by its members are:

- a.** CORCYTEC lacks connection with the National Council for Science and Technology (CONCYTEC), the national governing body for STI, although this national agency does provide a minimal degree of support. The only coordination is CORCYTEC's participation in National Councils Sessions, where almost no implementation specifics are discussed. CONCYTEC provides with scant economic funds for the organization of the technological innovation weeks.
- b.** There is no regional strategic plan for STI.
- c.** Disjunction and disinterest on the part of businesses regarding aspects of STI.

V.3.3. Regional government of Tacna and Regional Development Plans.

In recent years, the background for identifying the focus for development and the role of R&D&I in the Region can be found in the official documents of the Regional Government of Tacna:

- Comprehensive Development Plan for Tacna (2005-2012)
- Policy Guidelines (2011-2014)

The Comprehensive Plan highlights the promotion of scientific and technological research as its vision and development objectives for R&D&I. This is in order to promote and support projects for research and technological transfer incorporating the participation of universities—especially those projects designed along the lines of the region’s productive outlook.

Later, in the Regional Government’s Policy Guidelines (2011-2014), there are minimal references to the development of science and technology within the “educational mandate,” promoting and strengthening productive chains with the “production mandate”. In the “foreign trade and tourism mandate” it mentions competition, productivity and the formalization of economic activity.

We were unable to monitor indicators of the Comprehensive Plan or of any of the Guidelines, not to mention the results of the projects implemented in the field of R&D&I.

In the last two years, regional authorities and social and economic agents in the Region have been working on the development of “Plan Basadre.” This plan addresses regional challenges, strategies and development focus for the 2013-2023 period.

This vision considers Tacna to be a sustainable region, with a regional identity that is attractive for investment both in terms of production and services, balanced management of water resources and human development. As part of this vision, the competitive development of investment in products and services is established as one of the objectives—seeking to encourage scientific research and technological innovation.

In this context, some possible strategic projects should be mentioned: a business technology park, the re-launch of Tacna Free Zone (ZOFRATACNA), the creation of Productive Technological Institute of Research Services and Farming and Livestock Innovation, etc.

Tacna, unlike Cusco, does not have a Coordinated Plan for Regional Competitiveness, which greatly limits the possibilities for creating a Regional Innovation System.

Within GORE, the current vice president has been our interlocutor for the purposes of this study. The Economic Development Bureau is the entity responsible for

establishing a competitiveness plan that we believe should be designed and implemented as soon as possible, granting high priority to R&D&I.

V.3.4 CORCYTEC Tacna.

As a part of its public policy responsibilities in science, technology and technological innovation (D.S. No 032-2007-ED), the government of Tacna was appointed by CONCYTEC to organize and structure the Tacna CORCYTEC. The Regional Bureau for Social Development of the Regional Government of Tacna received the mandate to organize the Tacna Regional CORCYTEC through the Executive Resolution No. 075-2009 P.R/G.R. TACNA, March 13 2009.

It was established that the primary members would be the regional government, Jorge Basadre Grohmann University, the Private University of Tacna and the Chamber of Commerce and Industry of Tacna.

CORCYTEC of Tacna has no systematic operation or effective leadership, as perceived by the different regional stakeholders. Nor is there a regional R&D&I statistics system, nor a coordinated plan for competitiveness—and still no plans to promote R&D&I in partnership with other regional or national entities. Therefore, this lack of institutional leadership coordination by the regional government in turn limits the possibilities for developing a shared innovation strategy with those involved in innovation in Tacna, and hence the importance of activating and institutionally strengthening CORCYTEC so that, similar to the Cusco region, it can play a fundamental role in the development of R&D&I.

There is currently an emerging joint initiative—through competitiveness forums led by Jorge Basadre Grohmann National University and supported by the Regional Government through the Economic Development Bureau and the Chamber of Commerce of Tacna—that can reinforce the urgent institutionalization of CORCYTEC in Tacna.

VI. DEMAND FOR BUSINESS INNOVATION IN THE CUSCO AND TACNA REGIONS.

In this chapter we present the main findings and recommendations from analyses performed on the demand for business innovation in the Cusco and Tacna regions. These analyses are based on the following elements obtained from both primary sources such as interviews and surveys, and secondary sources—studies, statistics, indicators, etc.:

1. Characterization of business and productive sectors in the Cusco and Tacna regions;
2. Productive and development vision and priority sectors;
3. Main features of regional companies;
4. Technologies used, competitive advantages, innovation profiles, key demands, obstacles and factors facilitating the innovation process.

A detailed analysis of various elements listed above can be found in Appendix I.

Consequently, we present the main findings and recommendations gleaned from the study, in regards to the demand for business innovation in Cusco and Tacna:

- 1) Both regions are characterized by a wealth of informal business, bordering on—and even surpassing—50% in the region. It is worth noting that, while informal business is not necessarily incompatible with innovation and entrepreneurship, it is when it comes to the implementation and development of an RIS in which companies, R&D&I suppliers and public entities exchange “formally” (via contracts, agreements or other means), systematically, and habitually, skills, capacities and technical and financial resources in order to achieve individual and collective objectives of competitiveness and development.

Therefore, the transition from business informality to formality is a requirement so that the design and development of a Regional System of Innovation effectively permeates the entire business community in the region; this is a requirement that, given the level of informality characterizing the Tacna and Cusco regions and the lack of information existing on the subject, constitutes a tremendous challenge for public policy.

- 2) Also, both regions are characterized by a business sector consisting of mainly micro and small enterprises. It is recognized that the size of a company is as determining a factor for the development of innovation, as it is in larger companies where innovation management is incorporated as a strategic area.

Moreover, when micro and small enterprises do engage in innovation, it is mainly applied to products and processes as responses to either active or reactive client and market demand. Innovation is not integrated into management as a systematic process and so is not a key factor for business growth and expansion. In fact, in practically all of the companies we interviewed, the sole person directly responsible for innovation is the business manager, who, in turn, is usually the owner.

In the case of these micro and small enterprises, according to the interviews conducted—with some exceptions—almost all the production is destined for local consumption and, in smaller measure, for the domestic Arequipa and Lima markets. There are few export companies or companies operating with international market standards. According to the interviews, Cusco and Tacna entrepreneurs feel that in their areas, the State grants very little support for internationalization, activities such as participation in events abroad or creating and implementing strategies for entering export markets.

Regarding possibilities for entering into the international market, the scale factor arises and looms as an adversary: *"It is very tough for an individual SME to fill orders from foreign countries"*, however the opinion of these entrepreneurs is that partnership *"isn't viable, since the other companies produce a different quality that is quite below my standard."* Business collaboration was a topic addressed in the interviews, with emphasis on the scarcity of cooperation between companies to compete abroad and export. According to the interviewees, this possibility means confronting the difficulty of standardizing quality, and especially, the issue of technology and productive processes being copied by companies in the same trade.

There is, however, a sector of micro-enterprise entrepreneurs who have experience working in cooperatives, such as in the case of the wooden furniture and fur industries of Cusco.

The size of the business determines certain cultural and management issues that must be considered when configuring strategies and designing action plans for promoting regional STI development.

Moreover, it must be noted that this configuration of the productive sector—very few big companies situated in specific sectors (largely mining and tourism), and a large number of small companies—makes it difficult to establish and consolidate productive, mutually-supportive business chains and clusters in order to promote and consolidate technological development in the innovation field. There are no driving-force companies, a factor that must be taken into account when designing policies and programs for promoting regional science, technological and regional innovation.

- 3)** Both regions prove to have high concentrations of formal productive activity in a few provinces. A regional innovation strategy must be configured in order to invert the existing situation of territorial inequality. It is also recommended that local governments participate actively in this, enabling the inclusion of each region's particular circumstances and needs in the policies, programs and projects aimed at promoting and furthering science, technology and regional innovation. At the same time, building and strengthening the local-level capacities and skills required for the application, follow-up and evaluation of RIS will lead to the improvement of regional competitiveness rooted in enhanced knowledge and innovation that will span the entire territory.

- 4) Currently, 92% of the business sector of Cusco and 93% of that of Tacna are devoted to the service sector; in both cases, in the areas of sales, hotels and restaurants, in varying degrees. This means that a large portion of enterprise is devoted to serving the tourism industry. We must highlight that the type of tourism that operates in these two regions is very different, and the current weight that tourism has in both regions explains the priority given to this sector.

Regarding manufacturing businesses (7% of the corporate makeup in Tacna and 8% in Cusco), 40% of them are in the food and beverage sector, followed by furniture manufacturing.

- 5) Cusco is twice as business-intense as Tacna. In recent years, Cusco has enjoyed more activity in terms of number of start-ups than Tacna. Another noteworthy aspect is that, in the case of Cusco, the annual start-up rate for 2007-2010 was relatively similar for both the manufacturing and non-manufacturing sectors. By contrast, in Tacna, the number of businesses in the manufacturing sector grew less than those in the service sector between 2007-2010. A greater number of businesses and more activity can be an advantage, but they are not necessarily conditioning factors for STI development in a region. These are, however, variables that can be considered in a regional development strategy.
- 6) Regarding priority focus and regional perspective, it is firstly important to note that both regions must agree upon and carry out participatory activities to define the regional approach to STI development and that of the key sectors with most potential. These sectors will spearhead technological progress and knowledge, but they will require support early on to improve management.

In both regions, there exist basic elements that must be considered. In Tacna, the vice president expressed his view of the region: *"Tacna has the potential to become the South American Services Platform with an agro-industrial platform operating at international standards...we must throw our weight behind the intelligence of our people with support for education and the understanding that innovation is not only technology, it is a phenomenon that permeates all aspects of life...we must launch the Southern Peruvian Macro Region"*

Moreover, we can also infer which sectors are currently considered priorities based on the existing plans and the interviews conducted. It is interesting to note that both regions coincide in the majority of sectors, where certain categories distinguish themselves from others.

However, it is important to analyze further and appreciate the importance of the sectoral specificities that are fundamental for regional STI development. Very informative claims were recorded in this sense during the field work conducted:

"Cusco has a differentiating factor with respect to other Peruvian regions: a significant proportion of the community speaks three languages: English, Spanish and Quechua. This is positive for boosting the tourist trade. Tourism must become the driving force for the development of Cusco that pulls along with it other sectors and productive activities: the development of ICT applied to the tourist trade, gastronomy, logistics and transport, solid and liquid waste management, and efficient energy, among others."

"The region's wealth should not be based on quantity or volume of agro-industrial production, but on variety, and therefore, on the existing wealth of biodiversity...this makes for enormous potential in the field of applied sciences."

"Information technology is a sector that should be given priority and is emerging right now in the region. Its applications in tourism and public administration are highly significant."

In addition to what has been stated previously, it is interesting to note that the mining sector is not one of those considered a particular priority to the region of Cusco, except when included as one of the export sectors. In fact, the region's public agents involved in economic development refer to it as *"a sector comprising large firms that connect directly with Lima and small and mid-sized producers who mainly operate in an informal context"*. From what can be observed, mining is a sector that operates *"on the margins"* of the region, which, when managing a regional STI promotional strategy, should be analyzed in greater depth.

A very important sector for innovation that does not appear in the existing regional planning instruments, and that was scarcely mentioned in either Cusco or Tacna, is the ICT sector. This is partly because in both regions entrepreneurs are unaware of the advantages of using technology in business, and partly because society—the State, universities and the business sector—does not realize that it is paramount to acknowledge the quality work that can be done locally; the prevailing idea is that quality software and technology can only be produced in Lima or in large cities.

The ICT sector must most definitely be incorporated, since, in the case of both regions, there exist ICT business incubators, and also because it is a cross-cutting sector for promoting competitiveness.

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Table 7: Priority sectors and fields, by region.

CUSCO		TACNA	
SECTOR	SECTOR/PRODUCT	SECTOR	SECTOR/PRODUCT
AGRO-INDUSTRY	Annatto, beans, coffee, tea, cacao, hominy, tara, coca and derivatives, beer, potato, lupin	AGRO-INDUSTRY	Olives, olive oil, oregano
MANUFACTURING IN WOOD	All-purpose furniture and accessories	MANUFACTURING IN WOOD	Manufacture of wooden furniture
TEXTILE	Knit, Alpaca and wool clothing flat weave	TEXTILE	Sportswear and uniforms
METAL AND MECHANICS	Steel and metalworking machinery	METAL AND MECHANICS	Manufacture of wooden furniture
HANDICRAFT	Ceramics, handcrafted items in Alpaca, wool, fur and leather; hand carved wood, wall pieces, jewelry, costume jewelry, skins	HANDICRAFT	Silver jewelry, Alpaca fiber textiles
TOURISM / GASTRONOMY	Adventure travel, culture tourism, traditional experience tourism	TOURISM	Health tourism, shopping and gastronomic tourism
MINING	Gold, copper and derivatives	MINING	Gold, copper and derivatives
ENERGY	Hydraulic energy/ natural gas	ENERGY	Solar, geothermal and wind energy
LIVESTOCK	South American camelid raising, industrialization of animal-derived products and alpaca fiber		
AQUICULTURE	Organic farm-raised fish and eel products (frozen)		

- 7)** Regarding the technology used by businesses, it is surprising that 50% of entrepreneurs interviewed claim that the technology they use is cutting-edge. It seems that these claims are based on the information that these business persons have about technological advances, which, given other comments recorded, such as the need for better information regarding state-of-the-art technologies, does not seem to be very updated. A great many of these businesses acquire technology on the national market, namely in Lima.
- 8)** All of the companies claimed to have developed the technology they use with their own resources. A very small proportion has done so with the collaboration of third parties, mainly with supply companies and in one case with a government body, but never in collaboration with research organizations.

- 9)** The main areas in which technologies are applied are in training personnel and in collaborations with specialized suppliers.

Firms in the regions of Cusco and Tacna mentioned that the aspects that give them a market edge are quality, price, corporate flexibility, response and customer service. Only two of the eighteen companies interviewed mentioned R&D as a competitive advantage.

The main threats to companies are the scarcity of skilled human capital, followed at a great distance by a substitute product being introduced on the market, the presence of transnational companies and the lack of available talent in the local labor force. Only one entrepreneur mentioned the threat of technology and innovation stagnation.

- 10)** Regarding skilled labor, business owners occasionally claimed to have workers from the three levels—university, technical school and secondary school—depending on the different functions required, with a favorable proportion of technicians in the pool. Nevertheless, several entrepreneurs, particularly in Cusco, remarked that technical training is neither very complete nor precise, and therefore, an on-site training period was necessary and that this made labor turn-around costly. In accordance with this, these individuals stated that it would be very good to have a space where they could dialogue with training centers to make these centers aware of the specific needs a company has and design study programs accordingly, or other ways of matching the demand and the supply of trades.
- 11)** The main opportunities envisaged by the entrepreneurs interviewed were related to the forecasted increase in domestic demand, development of technology and knowledge, followed at a great distance by the collaboration with large corporations and the growth of international demand.
- 12)** The Cusco and Tacna companies interviewed have interesting innovation profiles.

Practically all of them claim to have made innovations in products in the last three years and to a lesser degree, in processes and in marketing. The reasons they gave for undergoing these innovation processes were mainly to improve the quality of the services and or products, increase process flexibility and reduce cost.

The innovation was carried out firstly within the company, secondly, in collaboration with public entities on national and regional levels, and thirdly, through the purchase of technology.

The main obstacles to innovating encountered by the interviewees were the lack of information on R&D&I, financial resources, skilled labor, specialized suppliers, and lastly, the lack of aid from public administrations.

The majority of the entrepreneurs claimed to be in favor of partnering with other businesses to further innovations, especially when the adaptation of these innovations require specialized suppliers. Nevertheless, off the record

several of them doubted they would be able to trust other companies enough to partner with them because not all companies share the same quality standards or because their technology could be copied.

Regarding future innovation, that applied to products and processes was the first option chosen by the entrepreneurs interviewed. The aims of these innovations were to broaden their markets; to diversify products and differentiate themselves from the competition; to reduce cost; and finally, to improve quality and lastly, to reduce environmental impact.

The technology most in demand by these entrepreneurs was production equipment and machinery.

- 13)** The obstacles mentioned by the entrepreneurs for developing innovation processes on site were, starting with the most frequent: inadequate formal education to meet the needs of the company, difficulty in finding skilled technical personnel capable of generating innovative ideas, the high price of investment in R&D&I, the lack of information about sources of capital for innovation and inadequate credit lines to meet the companies' needs.

On the other hand, factors that would facilitate the innovation process in the companies involved in the interview, beginning with the most frequent, were: the current level of access to specialized know-how in the region, the current degree of support from public institutions for competitiveness and innovation in business, the degree of access available currently for programs that support innovation, the level of culture regarding innovation in the company, the current degree of know-how of the technological environment applied to business, and the company's current level of financial capability.

- 14)** Regarding Cusco and Tacna's potential capacity to partner with others for R&D&I development processes, most of the business owners claimed to participate in trade associations such as the Chamber of Commerce, the Regional Tourist Trade Association, or others.

It is important to note that most of the entrepreneurs surveyed were not aware that universities could possibly help support them in the innovation they were interested in, in fact, they were only aware of the training role the universities play. Likewise, they did not know the difference between a university and a research institute. Nevertheless, the vast majority were in favor of working with universities, specifying the topics they would be interested in furthering which were directly related to science, technology and innovation (STI) and issues regarding improvement of management.

A Tacna ICT business stated that *"We collaborate with both the private university UPT and the public university UNJBG and technical institutes such as Technological Institute "Francisco de Paula González Vigil"(State-owned) and Instituto Sistema del Sur (privately owned), through different conferences we have held on more than one occasion and continue to hold. With these conferences we seek to, on the one hand, improve the situation for young people by inviting them to better their skills and on the other, to encourage them to be enterprising."*

- 15)** Regarding the projects or initiatives that could help them cover their needs and priorities in innovation related matters, the entrepreneurs mentioned a broad spectrum, ranging from consulting on sales technology, market information, participation in domestic and international trade fairs in their sector, financing to implement new technology, support from governments and or trade associations to support strategic alliances with suppliers and companies that render complementary services for innovative activities. These are the areas included in a Regional Action Plan aimed at promoting and strengthening innovation in companies in Cusco and Tacna.

VII. RESEARCH, DEVELOPMENT AND TRAINING SUPPLY IN THE REGIONS OF CUSCO AND TACNA.

This chapter is based on the analysis of the following fundamental aspects related to the R&D supply in the regions of Cusco and Tacna:

- Characteristics of the main institutions and bodies that offer R&D
- Main sectors of emerging regional opportunity in R&D supply.

These items are analyzed in detail in Appendix II.

The following is a synthesis of the main results regarding R&D supply in Cusco and Tacna:

1. The R&D available in Cusco is more developed and organized than that of Tacna, although innovation is still far from being one of the priority concerns of the regional lawmakers and academia.
2. In Cusco R&D supply does exist and there is capacity for developing a range of knowledge and technologies transferrable from academia to productive and business sectors. This R&D supply falls in the categories of traditional sectors, such as agriculture and food, tourism and related activities, and emerging opportunity sectors such as health and efficient energy.
3. In Tacna there is an incipient capacity for R&D development, with some limited potential in emerging fields of fruit and vegetable and animal biotechnology, tourism service and health services in the border regions and ICT logistics, metallurgy, environmental sciences and emerging sectors such as geothermal and biothermal energy.
4. In both regions, institutional leadership is scarce and the authorities responsible for public policy and budgets for research and innovation are not well informed.
5. Knowledge transfer of R&D is neither a requisite nor a demand in the calls for proposals issued by universities in their public tenders aimed at supporting research, financed by the Canon Act resources.
6. In both regions, more efficient management is needed to use the Canon resources and promote the coordination of R&D between the academic and business worlds.
7. There proves to be a lack of trust and of formal spaces for dialogue for creating collaborations among universities, productive sectors and regional authorities.
8. University research centers have had research teams for several years, with budgets of their own too small to function adequately.

- 9.** Some of the research institutes in Cusco and Tacna work at improving the quality and variety of agricultural food products, and transfer certain knowledge to producers and poor subsistence farmers of said regions, albeit with considerable limitations.
- 10.** There is no support structure for technology transfer. Research teaching and training facilities and infrastructure, where there are laboratories, need to be refurbished and updated. This leads to the urgent need to update existing technology and equipment for the certification of the laboratory of the future, the lynchpin for knowledge production and diffusion.
- 11.** Lack of a business-minded culture; inability to retain skilled talent trained at university; and inability to incorporate more researchers and professionals who can manage to connect the knowledge produced and extend those services to applied research.
- 12.** Absence of sufficient incentives to promote innovative business projects based on the results of R&D.

**VIII. CONNECTING THE SUPPLY AND DEMAND OF R&D&I: PRINCIPLE
CONCLUSIONS, GUIDELINES AND ACTION PLAN.**

VIII.1 Regional Innovation Systems and mechanisms for connecting supply and demand.

On the basis of the elements discussed in chapters V, VI and VII, we may say that adequately structured Regional Innovation Systems do not yet exist in either Cusco or Tacna. Both the agents and the potentialities exist, and activities are taking place at political-institutional, scientific, entrepreneurial and public financing levels. However the interrelations between the agents are virtually non-existent. These are required to carry out production processes, to transfer new knowledge, and to coordinate with productive and entrepreneurial sectors in both regions.

The analysis carried out in the Cusco region shows greater possibilities for the development of a more structured and participatory Regional Innovation System given regional stakeholders' organization and their experience with coordinating amongst themselves. The Tacna region, on its part, is very much behind, functioning in a limited and fragmented manner.

Among the principal factors contributing to this lack of connection in RIS, as identified by the participants, are:

- 1)** A lack of trust between the agents for effective inter-university cooperation;
- 2)** A business community principally made up of micro and small businesses, with nearly a 50% rate of informality and lagging technology, supplying the local market or, at most, the national market;
- 3)** Little or no linkage between entrepreneurs, universities and technological institutes for carrying out joint projects or actions, and the non-existence of formal mechanisms for knowledge or technology transfer;
- 4)** Inefficiency in the national budget for the design, distribution, allocation and use of Canon resources;
- 5)** Inadequacy of public universities' institutional structures for the efficient management of R&D funding, for collaborative work on innovation, or for transferring the knowledge generated;
- 6)** Scarcity of training in R&D&I at a regional level needed to respond to the demands placed by business and society;
- 7)** Lack of multilevel and transversal funding and mechanisms for attracting and retaining qualified talent in the business and science sectors, which would accelerate innovation;

- 8)** Lack of leadership by regional governments and comprehension by both university authorities and business representatives needed to offset failures in the system or the markets, compounded by a still incomplete decentralization process.

VIII.2 Principle conclusions and policy guidelines.

- 1.** The Peruvian economy has significantly increased its GDP in recent years, and is one of the Latin American economies which has grown the most in the first decade of the 21st century. However, this growth has not been accompanied by an improvement in productivity as a whole or the diversification of economic activities with an emphasis on products and exports of greater added value in order to guarantee the sustainability of the country's growth and development in the medium and long term. A greater investment in human resources and knowledge assets to broaden capacity for innovation could contribute to maintaining present growth. This is an urgent public policy task, as it takes time for this kind of investment to bear fruit and this will determine the competitive edge of the business sector in the future.
- 2.** We observe a lack of mutual awareness on the part of the principle stakeholders in innovation in both regions, as well as a certain distrust between them. However in Cusco an entity has been formed to promote dialogue in the field of R&D&I, and in Tacna small paths for inter-institutional communication are being forged.
- 3.** In both regions there is interest in working on strengthening the institutions of a nascent regional R&D&I governance. For some years Cusco has had a Regional Science and Technology Council (CORCYTEC) led by the regional government (GORE), made up of representatives of the GORE as well as the principle academic and research institutions and business organizations, forming a "triple helix". This Council enjoys a certain degree of enthusiasm and some initial experiences in carrying out joint projects, but few permanent resources to guarantee its institutional sustainability.
- 4.** Tacna has not yet established CORCYTEC, and is recommended that it do so as soon as possible. To date there has been no coordinated work as there has been in Cusco, except the offer from the Jorge Basadre Grohmann National University to develop an incipient collaboration through the creation of a joint Forum on R&D&I matters, with the participation of the Chamber of Commerce and the regional government.
- 5.** Cusco has a Regional Competitiveness Plan (*Plan Concertado*) for 2011-2021 in which its vision of development is defined and its objectives, policies and activities in various fields—specifically R&D&I— are established. However there is no system for follow-up or evaluation of the Plan. Tacna does not have a Competitiveness Plan to date, although this is crucial. It is presently developing the Basadre Plan in which innovation and research issues play a secondary role. It is of utmost importance in both regions to conduct a concentrated participatory exercise with the key R&D&I stakeholders in order to define a shared vision of regional development and a pragmatic, strategic approach to

identifying the sectors with the greatest relative potential in order to carry out joint R&D&I initiatives and projects.

- 6.** It is important to reinforce the points of collaboration between regional actors and the institutions and entities responsible for R&D&I policies and instruments at a national level in order to better adapt and apply certain existing policies and instruments to benefit the regions. In general, many of the problems present at a national level—such as the nearly non-existent collaboration between universities and the business sector, the limitations in carrying out research, the lack of mechanisms for technology transfer, the existence of legal restrictions in the use of financial instruments (the mining canon), and others—are difficulties which also exist at a regional level. In this regard we recommend that a dialogue be established between the Multisectoral Group led by the Ministry of Foreign Affairs and representatives of CORCYTEC in Cusco and the Forum in Tacna in order to share the results of the study and identify policies and instruments to support collaboration.
- 7.** Cusco's regional government has an organized institutional structure in which the Economic Development Bureau plays an important role in supporting CORCYTEC, but it is limited by its multiple responsibilities as well as by its lack of human and financial resources. Tacna's GORE has a fragile structure in which the only relevant political role is played by the vice president, and it lacks human or financial resources and follow-up of its proposals.
- 8.** Both regions are characterized by a high level of informality in their business sectors, exceeding 50-60% (no reliable statistics). It should be noted that while informality is not necessarily a condition that is incompatible with innovation and entrepreneurship, it is incompatible with the implementation and development of a regional system of innovation in which businesses, suppliers of R&D, and public entities formally exchange (via contracts, accords, grants, and other mechanisms) responsibilities, capacities, technical and financial resources in order to achieve individual and collective competitiveness and development goals. This structural element is present in both regions and constitutes a fundamental challenge for public R&D&I policies.
- 9.** Another important aspect of the business community in both regions is that it basically consists of micro-enterprise and, to a lesser extent, of SMEs. It is well known that the size of a business is a conditioning factor in its ability to push innovation forward as large and medium-sized businesses often incorporate the development and management of innovation as a strategic area. In the course of our study we have found that in micro and small enterprises, innovation is not integrated into management as a systemic process, and therefore as a key growth and company-expansion factor.
- 10.** In both regions, formal production is highly concentrated in very few provinces. A regional strategy of innovation should be formulated so as to reverse the territorial inequality that currently exists. Therefore it is recommended that it actively include local governance.
- 11.** The companies interviewed in Cusco and Tacna have interesting profiles in terms of innovation. Virtually all entrepreneurs state that during the last three

years they made innovations in products and, to a lesser extent, in processes and marketing. The reasons they gave for making these innovations were mainly to improve the quality of the products and/or services, increase the flexibility of processes, and reduce costs. The largest number of respondents said the innovations were firstly developed within the company, secondly, in collaboration with national and regional public entities, and thirdly, through the purchase of technology.

- 12.** The main problems faced by the entrepreneurs interviewed in developing innovations are the lack of information about the R&D&I available, financial capacity, the lack of qualified human resources, the lack of specialized suppliers, and, finally, the lack of public aid. Thus the majority of entrepreneurs support entrepreneurial partnership in order to develop innovations, especially in those cases in which the adaptation of technologies requires specialized providers.
- 13.** It is important to note that the majority of the interviewed entrepreneurs did not know that universities could potentially support them in the development of possible innovations. In fact, they only were aware of universities' educational role. Moreover, they were not familiar with the distinction between universities and research centers. However the vast majority of entrepreneurs would agree to work with universities, and specified the fields they would be interested in developing were they to do so. Nearly all of these were related to science, technology and innovation or the improvement of management.
- 14.** The sector of Information and Communications Technologies (ICTs) should be incorporated as a transversal fundamental pillar of promoting competitiveness and innovation in the regions. We have found that employers are unaware of the benefits of the use of ICT in their businesses.
- 15.** Public universities, San Antonio Abad of Cusco and Tacna's Jorge Basadre Grohmann, play an important role in academic education, providing an important supply of human resource development in the respective regions.
- 16.** However, the research being carried out by both universities is still minimal given the financial resources they have received from the Canon Act. Legal provisions enormously limit the normal use of these funds. This is compounded by the need to improve universities' management tools.
- 17.** Cusco and Tacna have university departments and public research centers that undertake important research projects in areas of food, agriculture and human health. They participate to a certain degree in knowledge transfer to small farmers and peasant organizations. However there is no link between research and the business sector working in these fields. This is due to both parties' lack of knowledge as well as the absence of interface mechanisms for connecting and adapting the research process to the demands of the business sector.
- 18.** There are specific possibilities for developing some pilot experiences linking research institutions, promoting the development of medium-range technologies and business activities that can contribute to key innovative processes for the regions. Examples include the improvement of alpaca fiber

for the textile industry in Cusco and the production of oregano for export to European markets in Tacna. Both regions could also boost development of the tourism sector.

19. We recommend:

- A.** Working intensively to strengthen institutions and to build management and innovation capacities in order to ensure sustainability in the construction of the fledgling Regional Innovation Systems of Cusco and Tacna;
- B.** Developing the regional capacities of government, academia and the business sector to produce and promote regional innovation agendas and policies in the medium and long term that are not at the mercy of political change;
- C.** Investing in the training and development of qualified human capital that can nourish the regional and local private sector's skills in technology, organization, management and promotion of innovation, etc.;
- D.** Building capacity of the regional and local agencies charged with managing resources—either their own or decentralized—applied to R&D&I programs;
- E.** Strongly encouraging linkages between academia and business, with emphasis on applied research to contribute to resolving local businesses' short and medium term problems. Public policies can serve as catalyst for collaborative projects of innovation, as well as being a tool for identifying and expressing businesses' demands;
- F.** Increasing public incentives for the private financing of investments in R&D&I at a national and regional level;
- G.** Strengthening EU cooperation in innovation, as—given the best practices and experiences in European regions—it can contribute to the development of regional innovation strategies, support the design of public policies, and open channels of cooperation between European and Peruvian regions, as well as between the main regional stakeholders (universities, research centers and companies).

VIII.3 Action Plan.

VIII.3.1 Short term proposals.

Cusco Region:

- 1.** The institution of CORCYTEC should be strengthened, reinforcing its established competencies, endowing it with human resources (establishing a permanent technical secretariat) and financial resources (derived from the national CONCYTEC funds or from membership dues), and establishing a short and medium term working plan.
- 2.** The regional government should take a greater leadership role in the implementation of the 2011-2021 Competitiveness Plan by putting into place the specific actions this plan describes in the field of technology and innovation, and the financial support agreed in the Incentive Program for Science, Technology and Innovation for 2014.
- 3.** The participatory process of the study and the conclusions and action guidelines which it proposes must be taken on by the regional actors, with leadership from the institutional representatives comprising CORCYTEC. To this end it is indispensable that dialogue and exchange activities be organized to reach a certain degree of consensus on priorities, means available and pilot actions to be undertaken in the coming months.
- 4.** A capacity-building program should be developed to be coordinated by CORCYTEC in order to train agents to support innovation management and networking. This program should be oriented to regional government employees and representatives of universities, research centers, and the business sector.
- 5.** One to two R&D&I projects should be identified and designed. These should require collaboration between universities and business in the fields of agriculture and food, shopping or cultural tourism. These projects should be supported by CORCYTEC.

Tacna Region:

- 1.** It is crucial that the Tacna regional government firmly place support for competitiveness and innovation among its regional development priorities. To this end it is important that it foster the creation of a Competitiveness Plan with the active participation of regional economic and social stakeholders. In this Plan shared vision should be defined and priorities, specific actions and human and financial resources for its implementation should be clearly laid out.
- 2.** As soon as possible, CORCYTEC should be established as an operational institution in the Tacna region, based on the still very incipient collaboration between the Jorge Basadre Grohmann University (Graduate School), the chamber of commerce and the regional government (department of economic

development). The institution should be endowed with financial and human resources according to a working plan adopted by its members.

- 3.** The primary results of this study, as in Cusco, should be taken up by regional actors, determining the priorities and pilot actions to be undertaken in the coming months and identifying possible university-business collaborations.
- 4.** A capacity-building program should be developed, to be coordinated by the Graduate School of the Jorge Basadre Grohmann University with the participation of the regional government, research centers, the Chamber of Commerce and other business sectors in order to train agents to support innovation management and networking.
- 5.** With the support of the regional government, one to two R&D&I projects should be identified and designed. These should require collaboration between universities and business in the fields of agriculture and food (oregano) and shopping or cultural tourism.

Cusco and Tacna Regions:

- 1.** A multilevel pilot round-table should be established, to be made up of the Multisectoral Group (coordinated by the Ministry of Foreign Affairs) and representatives of CORCYTEC in Cusco and the Forum in Tacna in order to exchange the results of the strategic assessment conducted in each region, the principle conclusions and proposals of the study, the coordination of R&D&I policies and instruments at national/regional/local levels, and the launch of specific actions.
- 2.** Annual forum on competitiveness and innovation should be organized, based upon the organizational experience and contents of the Lima International Seminar held in December of 2013. These should become places for meeting, dialogue, coordination and exchange of experiences between States, regions and local governments, with both national and international participants.

VIII.3.2 Medium term proposals.

Cusco and Tacna Regions:

- 1.** Create innovation strategies for each region based on the RIS methodology and European best practices, defining—on the basis of the assessments which have already been carried out—the principle R&D&I priorities in each region, the transversal and sector-specific actions to be undertaken, the role and commitment of regional stakeholders, the financial resources available and the projects which should take priority.
- 2.** Restructure and strengthen the supply of innovation to those sectors identified in the study as representing competitive opportunities.

- 3.** Strengthen entrepreneurial groups and trade associations which promote business partnership in order to provide them access to information about public resources and instruments which support innovation
- 4.** Build the capacities and responsibilities of public authorities at a local level to work with businesses and productive units in improving competitiveness.
- 5.** Foster a culture of innovation in each region in order to raise awareness about the importance of entrepreneurship and innovation for regional development through campaigns targeting a broad audience (youth, business representatives, public employees, media, etc).
- 6.** Design a program to promote development and the use of Information and Communication Technologies (ICTs) in each region, facilitating contact between suppliers and potential users.

VIII.3.3 Proposals for cooperation in the framework of the European Union-Peru dialogue on regional policies and innovation.

The interview conducted in Lima between the Prime Minister of the Peruvian Government and the European Commission's Directorate-General for Regional and Urban Policy (DG REGIO) in December of 2013 confirmed that the Peruvian government is giving priority to promoting and improving the competitiveness and productivity of the Peruvian economy through public policies and instruments supporting R&D&I both at a national and regional level. To that end, the Prime Minister affirmed the importance of cooperation with the European Union in regional policies and innovation in the framework of the EU-Peru Dialogue.

This priority was also clear throughout the interview with the Minister of Production, as well as in the remarks of public authorities, university representatives, business organizations and international organizations at the International Seminar on Innovation and Territorial Development organized by the Ministry of Foreign Affairs and the European Commission between December 11 and 13, 2013.

The positive experiences and best practices of European regional policies were cited and their potential contribution to the economic development of Peru were hailed both in official interviews and in the video-message from Johannes Hahn, Commissioner of Regional and Urban Policy at the European Commission at the inaugural event of the Seminar.

In order to reinforce the EU-Peru Dialogue and carry out shared activities in the field of regional policies and innovation, we propose that the following actions be undertaken in the short and medium term:

- 1.** Seek to involve representatives of the Presidency of the Council of Ministers, the Ministry of Production, and the Ministry of Economy and Finance of Peru in this dialogue, in light of its content.
- 2.** Request support from the European Union through the Directorate – General for Regional and Urban Policy (DG REGIO) and Directorate – General for

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Development and Cooperation (DG DEVCO) for the creation of Regional Innovation Strategies in the various Peruvian regions, based upon the RIS3 methodology and drawing upon European and Latin American experiences and best practices. Contribute to the implementation of pilot projects involving collaboration with European regions identified in the course of the Dialogue.

- 3.** Carry out actions in which European civil servants and experts provide technical assistance to personnel from Peruvian institutions and entities through the following activities:
 - a. Institution building and multilevel governance of innovation;
 - b. Capacity building for regional innovation managers;
 - c. Collaboration in establishing university-business alliances;
 - d. Use of European financing instruments for projects between European and Latin American countries.

- 4.** Facilitate cooperation with Peru through the exchange of experiences and the development of collaborative projects with European regions, universities and business sectors.

With the goal of building a broader framework for cooperation between the EU and Peru, we propose the following actions for 2014 on the basis of the studies and projects already approved by DG REGIO. These actions should be coherent and complementary:

- A.** Taking into account the results of the study "Regional Innovation Systems: Policy Lessons" mentioned above:
 - a. Promote and support the activities recommended in the conclusions and the implementation of the present action plan proposed and led by the principle innovation stakeholders in the Cusco and Tacna regions;
 - b. Collaborate with similar projects requested by other Peruvian regions;
 - c. Promote awareness-raising actions in order to foster the emergence of an entrepreneurial and innovative culture in the regions.

- B.** Continue the collaboration and dialogue in the field of innovation with the Multisectoral Group coordinated by the Ministry of Foreign Affairs, broadening participation in this group to include representatives of the principle business organizations.

- C.** Peru – Chile – EU cooperation in innovation: this project, funded by the DG REGIO, will be carried out throughout 2014. Its principle elements of interest include:
 - a. It provides a political opportunity to reinforce Peru – Chile – EU cooperation at a moment which coincides with the final decision of the International Court of Justice; of The Hague;

- b. It will allow for Peruvian, Chilean and European regions to cooperate in innovation, involving representatives of regional government, universities, research centers and business sectors;
 - c. It will complete and reinforce cooperative cross-border activities and initiatives between the regions of Tacna and Arica on the basis of the RIS study carried out in Tacna and work on Innovation Strategies in the region of Arica and Parinacota (Chile), carried out with the support of DG DEVCO and the best practices of some participating European regions;
 - d. It will involve the regions of Lima and Santiago, where the majority of national R&D&I institutions are concentrated, in supporting that cooperation;
 - e. It will contribute to facilitate the transfer to Peruvian regions of experiences from European regions and Chilean regions involved in the Proyecto RED on Regional Innovation Strategies in Chile. This will help to make such a project possible in Peru with the support of DG DEVCO and REGIO.
- D.** Cooperation in innovation between border regions in Peru and Brazil, with the collaboration of European regions. This second project to be carried out in 2014 is also funded through the DG REGIO. Among its principle points of interest are:
- a. It takes advantage of the experiences of cross-border cooperation between Peru and Brazil already at work;
 - b. It opens up possibilities of cooperation in innovation throughout the Amazon corridor, involving economic agents in important sectors for Peruvian and Brazilian regions;
 - c. It encourages contact and cooperation with European regions with similar characteristics and/or best practices in sectors of shared interest.
- E.** The organization of decentralized seminars and capacity-building workshops in some important cities (Piura, Arequipa, Lima) on regional innovation strategies, urban development and rural-urban partnerships, with the participation of European experts.
- F.** In the context of the European "Open Days" (October 2014), invite experts from Peru, Chile, Brazil and other Latin American countries to share with representatives of the European regions the innovation experiences which have been undertaken with the support of the DG REGIO.

APPENDIX I: ANALYSIS OF THE DEMAND FOR BUSINESS INNOVATION
(Support document to chapter VI)

1. Characteristics of the business and productive sector.

1.1 Level of formal activity within the business sector.

Neither Cusco nor Tacna have official data on how much of the region's economy is made up of formal activity. Nevertheless, according to surveys taken, Cusco is estimated to be a region with a high incidence of informal production: between 40% - 50% of the total productive units that are engaged in some form of economic activity in the region. It is estimated that this informal production is concentrated in micro-enterprise and principally in the sectors of handcrafted goods, mining and agricultural production.

In Tacna, the level of informal economic activity is also estimated to be high. According to the information collected by the Economic Development Bureau of GORE, in Tacna, the ratio is three informal business structures to every one formal structure. As in Cusco, most of the informal structures are concentrated in micro enterprise, mainly in commerce and mining sectors.

Informal economic activity is not necessarily incompatible with innovation nor entrepreneurship, but it is incompatible with the implementation and development of a Regional Innovation System in which businesses, R&D providers and public entities "formally" and systematically exchange (via contracts, agreements or other means) know-how, capacity-building and technical and financial resources, on a regular basis, seeking to reach individual and collective objectives in terms of competitiveness and development.

The transition from informal to formal entrepreneurial activity is necessary for the Regional Innovation System to effectively permeate the makeup of a business community; a prerequisite which, given the levels of informal activity existing in Tacna and Cusco, present an enormous public policy challenge.

1.2. Distribution of enterprises by size.

In Cusco there are 227,556 "active" tax-payers (registered under the Single Contributor Registry, RUC) formally in operation, of which 44,857 are considered "Natural or legal persons with business activity". These pay taxes as third category contributors, meaning they count as businesses. In Tacna, there are a total of 93,994 active tax-payers registered in the RUC and operating formally. Of these, 22,594 are situated in the third tax category, as businesses.

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Number of businesses by size – Regions of Cusco and Tacna.

Size bracket	CUSCO		TACNA	
	N° Business	%	N° Business	%
Micro enterprises	43.694	97,4 %	21.817	96,6%
Small enterprises	1.068	2,4 %	707	3,1%
Medium - large companies	95	0,2 %	70	0,3%
Total	44.857	100%	22.594	100 %

Source: Table compiled by the authors of this study, based on the report "Regional Analysis of Industrial Business, 2011" of the Region of Cusco; Directorate-General for Industry (DGI), Ministry of Production (PRODUCE) based on the Manufacturing Census 2007 - SUNAT REGISTRO RUC, 2011.

Note on business size: Micro (0 - 150 tax units), Small (151 - 1700 tax units), Medium and large (1701 or more tax units)

Even though Cusco has twice as many businesses as Tacna, the distribution by size is similar in both regions; there is a higher concentration of enterprise in the micro and small categories, accounting for 97% of the regional business makeup.

It is well known that the size of a company is a conditioning factor in innovation, as it is the larger companies which incorporate innovation as a strategic pillar. *Many SMEs innovate mainly in products and processes*, both actively and in reaction to the demands of clients and the market. Innovation, however, is not integrated into management as a systematic process and therefore, is not included as a key to company growth and expansion. This was perceptible in the individual interviews conducted in both regions: innovation in design, product and, to a lesser degree, in processes, is carried out in practically all of the businesses. Innovation is not established as an internal feature of the productive unit, but rather, is a responsibility taken on exclusively and directly by the business manager who, in most cases, is also the owner of the business.

Additionally, it is noteworthy that this configuration of the productive sector—very few large companies mainly situated in specific sectors, like mining and tourism, and a large number of small companies—makes it very difficult to establish and consolidate productive chains and mutually supportive business clusters which seek to promote, boost and consolidate their capacities for innovation through technological development. The lack of driving-force companies is a factor to consider when designing regional science, technology and innovation-fostering policies and programs.

1.3. Territorial distribution of enterprise.

The territorial distribution of enterprise in both Cusco and Tacna evidences a dense concentration of formal productive activity in few provinces, a territorial imbalance characteristic of many regions in Latin America. To some extent, this facilitates State promotional actions through the implementation of public policy in support of productive development and innovation. These policies should go hand-in-hand with an action plan arising from a territory-wide strategy, as a formula for reversing this tendency of geographic concentration. Such a strategy should extend throughout the

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entire region the logic of innovation and competitiveness rooted in activities of greater added value and in knowledge-based economies.

Total businesses by province, Region of Cusco (2011).

Province	Number	%
CUSCO	28.756	64,1%
LA CONVENCIÓN	4.560	10,2%
CANCHIS	2.459	5,5 %
URUBAMBA	1.923	4,3%
ESPINAR	1.720	3,8%
QUISPICANCHI	1.431	3,2%
CALCA	1.214	2,7%
ANTA	896	2,0%
CHUMBIVILCAS	725	1,6%
PAUCARTAMBO	508	1,1%
CANAS	280	0,6%
PARURO	236	0,5%
ACOMAYO	149	0,3%
TOTAL	44.857	100%

Source: Table compiled by the authors of this study, based on the report "Regional Analysis of Industrial Business, 2011" of the Region of Cusco; Directorate-General for Industry (DGI), Ministry of Production (PRODUCE) based on the Manufacturing Census 2007 - SUNAT REGISTRO RUC, 2011.

Total businesses by province, Region of Tacna (2011)

Province	Number	%
TACNA	22.024	97 %
JORGE BASADRE	287	1 %
TARATA	167	1 %
CANDARAVE	116	1 %
TOTAL	22.594	100%

Source: Table compiled by the authors of this study, based on the report "Regional Analysis of Industrial Business, 2011" of the Region of Cusco; Directorate-General for Industry (DGI), Ministry of Production (PRODUCE) based on the Manufacturing Census 2007, SUNAT REGISTRO RUC, 2011.

The basic idea is to configure a Regional Innovation Strategy that includes the active participation of local governments and seeks to, on the one hand, draw upon the specific requirements and needs of each territory from the very get-go, in terms of policy, programs and projects aimed at promoting and developing regional STI and, on the other hand, anchor and strengthen local-level capacity and skills required to implement, follow up and evaluate RIS. These actions will improve regional competitiveness rooted in enhanced knowledge and innovation spanning the entire territory.

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1.4. Sectoral distribution of enterprise.

Total number of businesses by sector and field of economic activity, Region of Cusco (2011)

Double digit economic activities	TOTAL	44.857	100%	
	Non – manufacturing sector	41.154	92 %	100%
52	Retail sales except automobile; appliance repairs	16 623		40.4%
55	Hotel and restaurant	5.679		13,8%
60	Land transport and pipelines	2.848		6,9%
51	Wholesale and sales on commission, except automobile	2.786		6,8%
93	Other service activities	2.318		5,6%
	Other business activities	2.190		5,3%
50	Sales, maintenance of automobile and motorcycle; retail fuel sales	1.459		3,5%
71	Machinery and equipment rental	1.207		2,9%
63	Complementary transport activities, travel agencies	1.152		2,8%
	Other (10 categories)	4.932		12%
	Manufacturing sector	3.703	8 %	100%
15	Food and beverage	803		21,7 %
36	Furniture manufacturing and other industries	626		16,9 %
28	Metal products	551		14,9 %
22	Publishing and printing	443		12,0 %
20	Woodworking and manufacture of wood products	410		11,1 %
17	Textile	275		7,4 %
18	Clothing; leather tanning	242		6,5 %
26	Other, non-metallic minerals	148		4,0 %
19	Hide tanning and preparation	43		1,2 %
29	Machinery and equipment	38		1,0 %
	Others (10 categories)	124		3,3 %

Source: Table compiled by the authors of this study, based on the report "Regional Analysis of Industrial Business, 2011" of the Region of Cusco; Directorate-General for Industry (DGI), Ministry of Production (PRODUCE) based on the Manufacturing Census 2007 - SUNAT REGISTRO RUC, 2011.

According to previous analysis available on the variable "number of businesses," of the total formal businesses in Cusco, 92% pertain to the non-manufacturing sector. At the double-digit economic activity level (CIU Division) the companies in Cusco are dedicated principally to retail sales (40.4%); followed by Hotel and Restaurant (13.8%); land transport and pipeline (6.9%); wholesale (6.8%); and other service activities (5.6%).

The remaining 8% pertain to the manufacturing sector, listed from greater to lesser importance: food and beverage, furniture manufacture, manufacture of metal products, publishing and printing, manufacture in wood, textile and clothing manufacture, among the most important.

In the Region of Tacna, just as in Cusco, 93% pertain to the non-manufacturing sector. At a double-digit economic activity level (CIU Division), the principle categories for these businesses are: retail sales (47%); followed by wholesale

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(8.8%); other service activities (8.5%); hotel and restaurant (8.4%); land transport and pipeline (5.2%); and other business activities (3.8%).

The remaining 7% of Tacna businesses pertain to the manufacturing sector and are distributed as follows, from greater to lesser importance: food and beverage preparation (greatest number of businesses, 347), followed by furniture manufacturing companies (239), clothing manufacturers (219), publishers and printers (172), manufacturers of metal products (170).

The sectoral distribution of the businesses in Tacna can be seen in the following table:

Total of businesses according to sector and product in the Region of Tacna (2011)

Double-digit economic activity	TOTAL	22.594	100%
	Non – manufacturing sector	21.172	93 %
			100%
52	Retail sales, except automobile; appliance repair	9.954	47%
51	Wholesale and sales on commission, except automobile	1.872	8,8%
93	Other service activities	1.807	8,5%
55	Hotel and restaurant	1.768	8,4%
60	Land transport and pipelines	1.109	5,2%
74	Other business activities	815	3,8%
	Others (13 categories)	3.707	17,6%
	Manufacturing Sector	1.422	7 %
15	Food and beverage	347	24,4%
36	Furniture manufacturing and other industries	239	16,8%
18	Clothing; leather tanning	219	15,4%
22	Publishing and printing	172	12,1%
28	Metal products	170	12,0%
17	Textile	75	5,3%
26	Other, non metallic minerals	35	2,5%
34	Motor vehicles	19	1,3%
	Others (10 categories)	146	10,3%

Source: Table compiled by the authors of this study, based on the report "Regional Analysis of Industrial Business, 2011" of the Region of Cusco; Directorate-General for Industry (DGI), Ministry of Production (PRODUCE) based on the Manufacturing Census 2007 - SUNAT REGISTRO RUC, 2011.

This is to say that the regions of Cusco and Tacna have business communities dedicated 92% and 93% respectively to the service sector. In both cases, sales for domestic consumption ranks high, as well as consumption related to tourist demand. We must note that the type of tourism that takes place is different in one region than the other: Cusco has a culture and nature-based tourist trade, whereas that of Tacna is more focused on shopping, with a significant and growing influx of tourists from Chile. This is a difference that is further underscored when we see that the second most important non-manufacturing sector in Tacna is wholesale commerce, followed by other services and then the hotel and restaurant sector. In Cusco, retail sales is followed by the hotel and restaurant sector and transport, in order of importance.

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Companies that are placed in the manufacturing sector—in the case of Cusco—account for 8% and in the case of Tacna, 7%; in both, 40% of these are dedicated to food and beverage, followed by furniture manufacturing. Regarding the remaining 60% of the companies in this sector, we observe greater diversity of economic activity categories in both regions.

1.5. Growth levels in the business makeup.

In recent years, Cusco has a greater business growth rate than Tacna. In the following tables it is clear that, on the one hand, before 2007 Tacna already had an entrepreneurial base equivalent to 50% of its total number of businesses in July 2011. This is higher than the 44% in Cusco. This means that from 2007 to July 2011, the rate of business creation was greater in Cusco than in Tacna.

Number of active businesses by year of start-up, listed by economic activity, Region of Cusco

SECTORS	BUSINESSES	BEFORE 2007	2007	2008	2009	2010	2011
Manufacturing	3.703	1.701	312	387	428	512	363
Non-manufacturing	41.154	17.900	3.419	4.359	4.588	5.883	5.005
Total	44.857	19.601	3.731	4.746	5.016	6.395	5.368

Source: Table compiled by the authors of this study based on the report "Análisis Regional de Empresas Industriales, 2011" of the Region of Tacna; Directorate-General for Industry (DGI), Ministry of Production (PRODUCE) based on the Manufacturing Census 2007 - SUNAT REGISTRO RUC, 2011.

Number of active businesses by year of start-up, listed by economic activity, in the Region of Tacna

SECTORS	BUSINESSES	BEFORE 2007	2007	2008	2009	2010	2011
Manufacturing	1.422	708	155	142	152	165	100
Non-manufacturing	21.172	10.588	1.820	2.031	2.133	2.736	1.864
Total	22.594	11.296	1.975	2.173	2.285	2.901	1.964

Source: Table compiled by the authors of this study, based on the report "Regional Analysis of Industrial Business, 2011" of the Region of Cusco; Directorate-General for Industry (DGI), Ministry of Production (PRODUCE) based on the Manufacturing Census 2007 - SUNAT REGISTRO RUC, 2011.

A second interesting aspect to note is that in the case of Cusco, the annual start-up rate for businesses from 2007-2010¹⁰ was relatively similar for both the manufacturing and non-manufacturing sectors. This means that in Cusco, even though the manufacturing sector is smaller than the non-manufacturing one, the growth rate of manufacturing enterprises is similar and even higher than those of the service sector, as is the case for the 2008-2009 period.

¹⁰ To analyze the annual variation in company start-up, the year 2011 was not taken into account and the data for number of businesses created correspond exclusively to the first half of that year.

On the contrary, in Tacna, the number of businesses in the manufacturing sector for the 2007-2010 period grew at a slower rate than that of the service sector.

2. Productive capacity, vision of development and priority sectors in Cusco and Tacna.

In Cusco a strategic economic growth and development plan exists, called the "Regional Competitiveness Plan 2011 – 2021".

When this data was analyzed at the thematic seminar in Cusco, the following came to light:

- Not all the participants were aware of the existence of the Regional Competitiveness Plan. Neither the entrepreneurs nor the representatives from PROMPERU knew of it;
- It was mentioned that water basins (water sources) are situated in the upper-Andean area. Water is a permanent source of conflict between the mining industry and the population;
- Cusco is different than other Peruvian regions because a significant proportion of the population speaks three languages: English, Spanish and Quechua. This is an asset that can boost the tourism industry. Tourism should become the driving force for development in Cusco, exercising pull on a set of productive sectors and activities, developing STI and applying it to tourism, gastronomy, logistics, transport, solid and liquid waste management, efficient energy, etc.

Regarding the prioritizing of sectors, it is interesting to note the following observations made by participants in the seminar:

- *"Cusco's wealth is not based on the quantity or volume of agro-industrial production but rather in the variety of products, therefore in the region's genetic wealth... This constitutes an enormous potential in the field of applied science."*
- *"Information technology is a sector which should be prioritized, and which in Cusco is just emerging. Its application to tourism and public management is very important."*

Reviewing various documents, among them the above-mentioned Plan and the PROMPERU 2010 document, as well as the information gathered in the thematic seminar "Productive Enterprise and Entrepreneurialism" held on September 18 in the city of Cusco and the interviews conducted with the various public agents promoting

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regional productive development, the following critical sectors/fields were identified in the Cusco Region:

List of Priority Sectors/Fields in the Cusco Region:

Sector	Product
AGRO-INDUSTRY	Annatto, fava beans, coffee, tea, cacao, white maize, tara, coca and derivatives, beer, potato, lupin.
LIVESTOCK	Raising of South American camelids, industrialization of livestock derivatives, alpaca fiber
AQUACULTURE	Organic farm-raised fish and eel (frozen)
WOOD INDUSTRIES	Furniture building, accessories
TEXTILE INDUSTRY	Knit weaving, textile products in alpaca, wool and flat weave.
METALLURGICAL INDUSTRY	Metal structures and machinery
HANDICRAFTS	Ceramic, handicrafts made with alpaca, wool, fur and leather, woodcarving, wall pieces, jewellery, costume jewellery, Furs.
TOURISM/GASTRONOMY	Adventure, cultural and experiential Tourism
MINING	Gold, copper and derivatives
ENERGY	Hydraulic and natural gas

Source: Table compiled by authors of this study on the basis of Report from the 1st Regional Innovation Week in Cusco, 2011; Report from the 2nd Regional Innovation Week in Cusco, 2012; Cusco Regional Competitiveness Plan 2011-2021; PROMPERU Cusco 2010 document; opinions expressed by participants in the thematic seminar "Productive Enterprise and Entrepreneurialism" held in Cusco.

In addition to what has been discussed above, it should be mentioned that the mining sector is included because it is one of the Cusco industrial sectors that engages in export activity, but is not one which has been identified as a priority. In fact, public agents promoting economic development in the region refer to this sector as one which *"is constituted by big businesses linked directly to Lima and then small and medium-scale producers which generally operate informally."* In any strategy for promoting regional STI, this sector should be analyzed in greater depth.

Lastly, it is important to note that the Cusco Region needs to conduct an exercise of prioritizing sectors and fields, identifying in a participatory and consensual manner those sectors which have the greatest relative potential and which could spearhead technological and knowledge-based development, those sectors which have potential

but which require support to improve management in order to spearhead technological and knowledge-based development, and those sectors and fields which serve principally as a strategy to generate employment.

In Tacna, the Head of Economic Development of the regional government informed us that a Development Plan 2021 had been prepared, and was in the process of incorporating comments from the Peruvian National Center for Strategic Planning (CEPLAN) in order to better coordinate this plan with the Bicentennial Plan 2021 being designed at a national level. Once the Development Plan is concluded a Competitiveness Plan for the Tacna Region will be undertaken.

The lack of these instruments of regional planning demonstrates that the region does not presently have a shared and consensual outlook. In fact, at the thematic seminar "Productive Enterprise and Entrepreneurialism" held on Wednesday, September 25, 2013 in the city of Tacna, participants indicated specifically that the region lacks a shared outlook and, therefore, a development strategy. The plans established to date do not emphasize the need to agree upon a regional outlook in order to strategically direct both public and private resources. The Vice-president of the region shared his perspective: *"Tacna has the potential for positioning itself as the South American Service Platform, with a world-class Agro-industrial Platform... we have to throw our weight behind the intelligence of our people through education, and understand that innovation is not just a matter of technology but rather an activity which cuts across all aspects of life... We should project a Southern Peruvian Macro-region..."*

Equally, there exists no document which identifies the sectors prioritized by regional stakeholders. Nevertheless, on the basis of interviews conducted with the Vice-president of the region, the Head of Economic Development, the PRODUCE team, the DIRCETUR staff and the Chamber of Commerce, the following lists have been drawn up indicating sectors and fields presently considered priorities in the allocation of public funds for promoting regional productive development. According to the observations of the Regional Head of Economic Development, the key criteria for selecting sectors are their contribution to the GDP and to regional employment.

In order to design programs for reinforcing the textile, wood and metal furniture building sectors, PRODUCE is carrying out a survey to create a baseline for micro and small enterprises in these sectors. The survey will be finished soon, thereafter programs will be designed to solicit resources from the 2014 regional budget.

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List of priority sectors/products in the Tacna region:

Sector	Product
AGRO-INDUSTRY	Olives, olive oil, oregano
WOOD INDUSTRIES	Furniture building
TEXTILE INDUSTRY	Sportswear and work uniforms
METALLURGICAL INDUSTRIES	Furniture building
HANDICRAFTS	Silver jewelry, alpaca fiber textiles
TOURISM	Medical, shopping and gastronomy tourism
MINING	Gold, copper and derivatives

Source: Table compiled by the authors of this study on the basis of meetings with the Vice-president of the region, the Head of Economic Development, the PRODUCE team, the DIRCETUR staff, and the Chamber of Commerce.

Lastly, the Tacna Free Zone, which provides tax advantages to those businesses established there, has not brought about the desired effects. According to government officials this is due to a lack of adequate promotion, but given the complexity of the matter it would be important to analyze it in greater depth within the framework of STI promotion in the region.

It is interesting to point out that the stakeholders in Tacna did not mention commerce (wholesale or retail) among the priority sectors, despite its current importance in the regional economy. When asked about this, the response was that commerce is included in tourism, specifically as shopping tourism.

3. Principle characteristics of regional business.

As mentioned above, the businesses interviewed belong to the strata of micro and small enterprise, with the sole exception of the Tacna business which provides medical services and which classifies itself as a "medium-sized enterprise".

As corresponds to their small size, nearly 50% of the interviewed businesses in both regions are family businesses. With respect to the market, in Tacna two of the eleven businesses interviewed dedicate nearly the entirety of their production to the international market, whereas the other eight businesses work within the regional and national markets.

¹¹

Collected in the course of interviews with entrepreneurs and representatives of trade associations

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In Cusco only one of the seven businesses interviewed—the handicraft enterprise making silver jewelry—exports part of its production. The rest produce for internal consumption or for national markets in Lima and Arequipa.

Regarding opening up to international markets, the entrepreneurs interested in undertaking this challenge claim that there is very little assistance from the public sector: there is no support for attending events abroad or for designing and implementing strategies to enter export markets. Likewise, the economy of scale is a factor working against their internationalization: *“It is very difficult for a SME working alone to fulfil the orders from foreign countries”* and the possibility of forming associations does not seem viable because, *“the other companies produce a different quality product, much inferior to mine.”*

Collaboration between enterprises was discussed in the interviews, highlighting the scant cooperation existing between enterprises in order to compete abroad for exports. According to the interviewees, collaboration would require confronting the difficulty of standardizing quality and, above all, overcoming the problem of companies in the same field copying technologies and productive processes.

With regard to who manages the business administration, in most cases it is the owners themselves or the principle partners, with the sole exception of the wood furniture building company in Cusco which belongs to an NGO.

Most of the owners and/or administrators have a university education (ten out of the eighteen interviewees in the two regions), then vocational degrees (seven). The only entrepreneur with only a secondary education produces machinery for the local market on the basis of many years of experience, and at present he is assisted by his children who do have university educations.

Regarding the level of qualification of the work force, the entrepreneurs claimed to have employees from all three educational levels, depending upon the functions required of them, though the most prominent group were those with vocational degrees. However various entrepreneurs, particularly those in Cusco, indicated that vocational training is not very complete nor precise, and that employees require a period of on-the-job training. This makes employee turnover more costly. They stated that it would be useful to have a space for coordination with the training centers in which these might learn the specific requirements of businesses and design their programs of study accordingly, or in some other way link the supply of workers with the demand in specific trades.

In Tacna the entrepreneurs’ opinions regarding the qualifications of the work force varied by sector and field. In the case of the business producing wooden furniture, the entrepreneur indicated that in the region there are no specialists in designing and finishing pieces. This was confirmed by the jewelry entrepreneur who also indicated that the available work force did not include persons specialized in design.

The vast majority of the entrepreneurs indicated that they managed their companies in an integrated manner, at most distinguishing between production and administration, as corresponds to small-scale businesses. At the same time, nearly

all the entrepreneurs claimed that they themselves took direct and exclusive responsibility for innovation in their businesses.

4. Analysis of regional and business innovation.

4.1. Technologies and means used to develop innovation.

Of the eighteen companies surveyed, half of them stated that they had adapted their machinery, meaning that they have adequate but dated technology. In contrast, the other half of them believe that the technology they use is cutting-edge according to the information they have in this regard.

A large proportion of the businesses (12/18) acquire their technology on the domestic market, primarily in Lima; the rest of the companies import it. They mainly go to trade fairs, congresses, exhibits, magazines and catalogs to find information on these technologies. Only two interviewees mentioned receiving information from the service providers themselves.

All of the companies claim to develop the technology that they use with their own resources. Only three of them also collaborate with a third party in this process, with entities that help them to adapt the technology, in one case with a government entity (FIDECOM – FINCYT). It is important to note that no entrepreneur claimed to have sought out a research institute to develop his technology.

Lastly, we note that the principle activities for implementing these technologies are capacity-building for personnel that will be using them and collaboration with specialized providers.

4.2. Competitive advantages: threats and opportunities.

As listed by the entrepreneurs, those features that best position companies on the market are: quality, price, flexibility, customer care and service.

Only two businesses mentioned R&D as a competitive advantage, one being a gourmet coffee producer from Cusco which is applying cutting-edge technology, but is just now emerging on the market.

Among the threats that business owners mentioned, the scarcity of human capital was the most frequently cited. Far behind this was the emergence of a substitute product on the market, and the presence of multinational corporations. Only one business owner pointed to stagnation of technology and innovation as a threat.

Regarding the opportunities identified by these entrepreneurs were an upward trend in domestic demand and the development of technology and know-how, followed at a great distance by possible collaborations with large firms and the increase in demand from abroad.

4.3. Company innovation profile.

Regarding the innovation applied, practically all the entrepreneurs claimed to have innovated in products in the last three years and to a lesser degree, in processes and in marketing.

Regarding products, they referred mainly to new designs, except in certain cases, such as one olive oil producer, who had been conducting research with palm oil through FINCYT funding. Regarding innovation in processes, several entrepreneurs mentioned applying the Japanese "5S" program with the support of PROMPERU; and regarding innovation in marketing, they mentioned brand design and website development.

The interviewees stated as reasons for innovating in these areas, firstly, to improve product/service quality, increase their flexibility in processes, reduce costs, and develop better quality products to satisfy demands of new markets.

These innovations were, in most cases, developed within the company, then in second place, with the aid of public entities on a national level (Research and Development for Competitiveness Fund of the Ministry of Production, other support instruments from the Ministry of Production – PRODUCE, Fund for Innovation, Science and Technology-FINCYT, Promotion of Peruvian Export Commission – PROMPERU, among others) and at a regional level (Regional Directorate for Production Cusco/Tacna-DIREPRO); and in third place, through the purchase of technologies.

Among the main obstacles to developing innovative processes mentioned by the business owners, the main issues were:

- lack of information about available R&D;
- financial capabilities;
- lack of skilled human resources;
- lack of specialized suppliers;
- non-existence of public funding.

The majority of entrepreneurs claimed to be in favor of business partnerships to develop innovation, especially in cases where the adaptation of technology requires specialized suppliers.

4.4. Innovation in the future: regional demand.

Innovation in products and processes head the list of options selected by the interviewees. The range of alternatives in processes, for companies in Cusco, are the development of quality certification labelling for products and services in order to improve quality and standardize the supply provided by micro and small enterprise.

There were a couple of entrepreneurs both in Cusco and Tacna, from the cacao producing agro-industry as well as from the metallurgical industry who pointed out

the need to improve their production infrastructures and maximize processes and procedures for taking inventory, manufacturing and administrating.

Only two companies stated the need to innovate in the future in product design and in organizational management, and only the Cusco leather company stated the need to acquire infrastructure and modify processes to reduce the negative environmental impact of leather tanning processes.

The objectives targeted with these innovations are: market expansion; product diversification and competitive edge; cost reduction; quality enhancement; and reduction of environmental impact.

The technologies required by entrepreneurs were production equipment and machinery.

4.5. Factors that hinder or help the innovation process.

Obstacles to developing innovation processes in their companies, as stated by the owners, are the following, in order of most frequent responses:

- 1)** Formal education which is not adequate to the needs of the company;
- 2)** Difficulty of finding skilled technical labor to generate innovative ideas;
- 3)** The high cost of R&D&I investment;
- 4)** Lack of information on available financing for innovation;
- 5)** Inadequate funding to cover the needs of the company.

On the contrary, factors that facilitate innovation processes in the company, as stated by their owners, in order of most frequent response, are:

- 1)** Current degree of access to specialized know-how in the region;
- 2)** Current level of support by public entities for competitiveness and innovation in the company;
- 3)** Current level of access to innovation-supporting programs;
- 4)** Level of companies' innovation culture;
- 5)** Current degree of knowledge of the technology environment in the company;
- 6)** Current financial capacity of the company.

The majority of the firms participate in trade associations such as the Chamber of Commerce, the Regional Tourism Trade Association, etc.

With regard to the universities, the majority of the companies were not aware that universities could potentially support specialized innovation, in fact, they were only aware of the educational role these play. Additionally, they did not distinguish between university and research institution.

Nevertheless, when asked if they would work in collaboration with universities, the vast majority responded positively and specified the special interest areas they would work in:

- Equipment to monitor fat content in olive oil;
- Development of winemaking varieties;
- Productivity increase;
- Systems management for inventory and administration;
- Participation in international technology fairs, technology exhibits, market studies, marketing plans, best practices in technical management for bulk food preparation;
- Creation of strategic plans for the business, conduct in-depth innovation studies in search of opportunities for furthering the sector.

As we can observe, the entrepreneurs mention issues directly related to STI and management improvement. These are issues prevalent throughout the entire interview.

4.6. Business proposals linked to specific innovation requirements.

The entrepreneurs suggested the following initiatives or proposals to meet their needs and priorities regarding innovation:

- Consulting in Smart Commerce, market research;
- Technical assistance and use of software for textile and clothing manufacture;
- Design and technique skills for furniture finishing;
- Specialization in methods for olive oil and gourmet coffee tasting;
- Participation in national and international trade fairs in the tourism sector;
- Financing to incorporate new technologies;
- Transfer of best practices in food preparation technical management;
- Use of new machinery and hiring more personnel;
- Knowledge of how companies in their sector in other countries with high standards acquire and manage innovation;
- Government and trade associations' promotion of strategic alliances between suppliers and businesses offering complementary services.

APPENDIX 2. DETAILED ANALYSIS OF R&D SUPPLY
(Support document to chapter VII)

1. Regional performance indicators for R&D&I activity.

In the regions surveyed, there exists no standardized, reliable statistical data base for analyzing the effective performance of the different players involved in R&D&I.

According to the data available, there is very little R&D&I being developed in either region, especially in Tacna. The following are some indicators gathered in both regions:

R&D&I activity.

R&D&I activity	Cusco	Tacna
Number of industrial property right applications, D.P.I, 2007-13	29	2
Total number of industrial property rights granted, D.P.I	8	0
Number of university-based scientists, 2013	12	N A
Average number of researchers, 2010-13	186	159
Number of accredited universities	0	0
Number of accredited research laboratories	0	0
Number of accredited research or technology centers	0	0
Number of projects funded through the Canon Act, 2011-12	105	N A
Regional R&D&I funding, 2004-13 (Peruvian M. S.)	120.809	N A
Private Regional R&D&I funding, 2004-13 (Peruvian M. S.)	N A	N A
Number projects presented to tech trade fairs CORCYTEC, 2008-2013	313	N A
Number of projects financed by CORCYTEC, 2008-13	74	N A
Number of R&D&I Graduate programs	1	2

Source: Table compiled by authors of this study based on information from the Regional Government of Cusco, 2013. Directorate for Innovation and New Technology; San Antonio Abad National University; CORCYTEC; Information contributed by the Region of Tacna, gathered from institutional websites and by the Graduate School of Jorge Basadre Grohmann National University.

Note: N A – No available or reliable data.

2. Features of regional supply and identification of stakeholders.

The existing supply of R&D is made up of those who participate in scientific, technology and finance environments in the regions of Cusco and Tacna. Participants in this supply are universities, innovation institutes of the Ministry of Agriculture, engineering firms and or consultancies who involve their clients in technology matters and offer specific services.

As a part of the innovation ecosystem, we will also discuss those agents who are most representative in providing vocational technical training and or specialized higher education, although their task is not focused on producing new knowledge since they do not carry out systematic research activities. These agents, however, play a role in the dissemination and transfer of knowledge that can have an impact on regional economies' competitiveness.

2.1 Regional R&D providers.

The regional supply of scientific and technological knowledge, although concentrated in very few institutions, these being generally public, is better structured in different environments where research and development skills are consolidated and specifically aimed at regional and national interests.

There are few institutions of higher education or public, and to an even lesser extent, private institutions that continuously engage in R&D. For this reason, in order to identify the regional agents involved in R&D, this study focuses on the analysis of those institutions which have research teams or organized networks with greater experience in science, technology and graduate education and which have infrastructures, resources, organizations and professionals devoted to the area. These engage, to some degree, systematically in the effective development of R&D activity in the region. The R&D suppliers which fit into this profile are:

Agents interviewed within Regional Innovation System.

Region	Area	Agents interviewed within RIS
Cusco	Science	<ul style="list-style-type: none"> ▪ San Antonio Abad National University ▪ Andean University of Cusco
	Technology	<ul style="list-style-type: none"> ▪ National Institute of Agrarian Innovation (INIA). Cusco Terraces Agricultural Experiment Station
Tacna	Science	<ul style="list-style-type: none"> ▪ Jorge Basadre Grohmann National University

Source: Table compiled by authors of this study based on the interviews conducted and on institutional annual reports, 2013.

Note: In Tacna, during the analysis conducted, no agent was found that either participated in a technological area, rendered advanced technology services to businesses or engineering companies, technology institutes or centers nor to R&D&I business associations; infrastructures that provided interfacing support to SMEs or R&D&I units of multinational corporations located in the regions.

Cusco Region:

In 2011, *The San Antonio Abad National University (UNSAAC)*, created the Vice-presidency of Research (VIRIN), a Research Council, an operational plan and units to provide support for research and invention, innovation and transfer based on intellectual property protection and entrepreneurialism. VIRIN's mandate is to support essential, strategic and applied research, technology transfer and innovation in management and promotion of scientific programs and projects.

The priority areas targeted in the annual operational research plan are: environmental protection, biodiversity and biotechnology; nanotechnology; public health; ancestral wisdom; agriculture and livestock health; ICTs; human development and democratic governance.

UNSAAC has diverse laboratories and centers that are being renovated in terms of infrastructure and equipment; research teams in which young students and academic researchers participate; and research centers that have been running for over ten years. In these centers, researching professors carry out their work but are not exclusively dedicated to knowledge production. The university currently has sixteen

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graduate programs—doctorate, masters and special certificate—as well as exclusive financing from Canon Act resources which are earmarked for capacity building in scientific and technological research of regional and national relevance.

The Andean University of Cusco, created in 1984. In 2011, the Research Directorate was formally established. It has a Research Council that establishes policy and plans, guides and establishes strategies for the development of scientific research; evaluates and oversees progress of the coordination projects underway with research institutes; incorporates and coordinates research as both process and result of academic activity in order to apply this outcome in both teaching and society; offers consulting services on research projects to professors and for student theses through its research centers; establishes financing agreements and cooperation with university institutions and other bodies that work toward furthering research projects. The Council does not have researchers exclusively dedicated to R&D. It does offer 22 graduate degrees, both doctorate and masters.

The National Agrarian Institute (INIA) and Cusco Terraces Agricultural Experiment Station. Created in 1975, INIA is a public body reporting to the Ministry of Agriculture and Water in charge of designing and executing national agricultural innovation strategy. The institution conducts research activities and has certification authority for the agricultural products produced in the region; it also interfaces with producers and peasant communities to share experimental processes and transfer knowledge to them. INIA has Cusco Terraces Agricultural Experiment Station.

Ingeniería y Mediciones INGENIMED S.A is an entrepreneurial venture created in 2009. It is lead by young professionals and engineers, aimed at generating research, dissemination and application of scientific and technological knowledge in biomedical instrumentation, clinical engineering and industrial robotics.

Tacna Region:

Jorge Basadre Grohmann National University, created in 1971. Fewer than 10% of the academics are PhDs. The University has an important graduate school with fifteen degree programs (both doctorate and masters). It founded a Research Council that establishes policy and has recently created a Research Unit which aids in allocating Canon funds earmarked for research, oversight and follow-up.

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2.2 Providers of specialized professional and technical education.

The main agents in the regions studied, according to RIS sector.

Region	Type of Education	Professional and technical educators interviewed within the RIS
Cusco	Regional area of university training and professional technical training	<ul style="list-style-type: none"> ▪ San Antonio Abad National University ▪ Cusco Global University ▪ Technological Institute “Tupac Amaru” ▪ National Training Service for Industrial Sector Work SENATI
Tacna		<ul style="list-style-type: none"> ▪ Jorge Basadre Grohmann National University ▪ Tacna Private University ▪ Technological Institute “Francisco de Paula González Vigil”

Source: Table compiled by the authors of this study based on the interviews conducted and institutional annual reports, 2013.

Cusco Region:

Cusco Global University, created in 2012 and member of CORCYTEC. It currently conducts its undergraduate degrees in collaboration with the business sector: international business administration; tourism sector administration; ICT engineering. It has graduate degrees and a focus on comprehensive development of the tourist industry in Cusco.

Technological Institute “*Tupac Amaru*” begun in 1975. It trains mainly in the areas of: business accounting; electronics; automobile mechanics; hospitality management services; computer science; etc. It contributes greatly to professional technical training at a regional level. Member of CORCYTEC, its mandate is to foster productive activity.

National Training Service for Industrial Sector Work (SENATI). Area Directorate, Cusco, created in 1961. Institution with legal public status and with technical, educational, administrative and financial independence; privately managed and with its own capital, it seeks to train professionals and endow workers with skills for productive activities, especially in the industrial sector—for example, the installation, repair and maintenance of metal machinery. It plays an important role in professional technical training, providing human resources for the industrial sector, updating its curricula in accordance with the needs of business and providing current technology information. Member of CORCYTEC.

Tacna Region:

Tacna Private University, created in 1993. Private higher education institution with graduate degrees. The graduate school houses the recently created Research Bureau, which promotes educational research and applied student projects, showing some results of combining knowledge with architecture, economics and engineering

and social housing solutions. It offers nine graduate degrees (doctorate, masters and special certification).

The Technological Institute "*Francisco de Paula González Vigil*" is a public institution dedicated principally to training technicians. It has had a Technological Research Bureau for two years. It has no contacts with businesses in terms of R&D. The Bureau promotes educational research, and six of the eighty faculty members of the Institute are involved in specific related projects. The educational areas with greatest research activity are electronics, agriculture and livestock raising and civil engineering.

2.3 Public provisions and financial support instruments for regional R&D.

In Chapter III of this study, we pointed out the main instruments and funds that exist for financing national R&D projects that can be utilized by the regions.

The following is a list of the main support instruments for financing R&D.

R&D financing agents.

Region	Field	Innovation system agent
Cusco	Financial, support for R&D and Invention	<ul style="list-style-type: none"> ▪ Central, regional and local governments, Canon Act and sectoral funds ▪ San Antonio Abad National University, private funds and Canon funds ▪ NGO Caritas ▪ Private
Tacna		<ul style="list-style-type: none"> ▪ Central, regional and local governments, Canon and sectoral funds ▪ Jorge Basadre Grohmann National University, private funds and Canon funds ▪ Private

Source: Table compiled by the authors of this study based on the interviews conducted.

As has been previously stated, the major instrument used by the regions to finance R&D is the Canon Act, which is "The share of the total income and proceeds the State receives from the economic exploitation of non-renewable natural resources, which are enjoyed by the local and regional governments," (Peruvian Ministry of Economy and Finance, 2004). These resources are regulated by law and identified as: mining canon, hydro-electric canon, gas canon, fishing canon and forestry canon, with the exception of the oil canon and supra canon, which are regulated under special legislation for each region.

The Canon Act resources are one of the major decentralized public investment sources for promoting R&D&I in Peru on both regional and national levels. From 2004 to 2013, Canon resources have been distributed by the central government among the regional and local governments, pursuant to criteria established by the Ministry of Economy and Finance and with the participation of the National Institute of Statistics and Information Systems (INEI), the Ministry of Energy and Mining (MINEM) and the National Tax Agency (SUNAT), which provide data to facilitate the calculations for territorial allocation of these resources. The proportional allocation of national, regional and local distribution of the Canon resources is the following:

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Criteria and beneficiaries of the Mining Canon.

	%	Beneficiaries	Criteria
Mining Canon (50% Income Tax)	10%	Districts/Townships where resources are exploited	If there are more than one township divided
	25%	Townships in the province where the resources are exploited	According to population and backfit coverage
	40%	Townships in the Department where the natural resources are	According to population and backfit coverage
	25%	regional government	80% regional government 20% university

Source: Ministry of Economy and Finance (2013)

As seen in the table above, 75% of the total Canon resources distributed are allocated to regional governments, district townships, and provincial and local governments from the department or departments in the regions where the natural resources are extracted. The remainder, accounting for 25% of the total Canon resources, are allocated annually to the governments of the regions from which the natural resource is extracted. Regional governments, in turn, must transfer 20% of the Canon resource funds received to the national universities in their jurisdictions. These universities can allocate these funds for certification, scientific and technological research, preparatory investment or investment in infrastructures.

Act 28.562 of 2005 establishes that investment in scientific and technological research must be construed as “*spending on erecting infrastructure and equipment*”. It also establishes that “*proceeds from the Canon Act cannot in any case be used to pay out remunerations or compensations of any type*”. To guarantee excellence in scientific and technological productivity, the research profession must be submitted to rigorous standards and it must be differentiated from teaching in its remuneration, dedication and incentives. The aforementioned allocation was ratified under the tenth final provision of the Budget Act of 2009 and includes financing for physical infrastructures for regional and territorial development. According to regulation, in no case can these resources be invested in for-profit projects (business) or in the private sector.

In the region of Tacna, *Jorge Basadre Grohmann University*¹², recently held its first call for research proposals utilizing Canon resources. These resources, pursuant to the priorities marked by the university authorities, are earmarked for the following: 40% to public investment, renovation and updating of physical facilities and equipment; 40% to R&D and 20% to university accreditation.

¹² At publication of the study, the use of these resources transferred was still underway and did not allow for final figures.

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Resource intake from the Canon Act by the regions of Cusco and Tacna.

Resources/ year	2004	2005	2006	2007	2008
Transferred	1,318,564	13,462,684	14,304,412	33,102,103	49,854,415
Carried out	0	0	6,179,714	11,879,889	990,101

Resources/ year	2009	2010	2011	2012	2013
Transferred	57,288,239	67,801,617	48,651,796	59,173,457	75,350,418
Carried out	14,396,502	21,852,248	16,293,712	0	0

Source: Table compiled by the authors of this study based on information collected from local stakeholders, October 2013.

Regional Program ProCompite: Act 24.337 establishes provisions for supporting productive competitiveness, authorizing regional and local governments to directly intervene in favor of producer associations organized into different production chains (dairy, beekeeping, guinea pig, etc.). In some regions, Pro-Compite seeks the social inclusion of marginalized communities within the local economy. The regional Pro-Compite program falls under the auspices of economic development agencies of the regional governments that are previously coordinated with the Ministry of Economy and Finance. The program finances development, adaptation, improvement and technology transfer initiatives, amongst other activities.

3. Fields of opportunity in the regional supply.

The criteria we have applied in selecting fields of regional opportunity for developing the R&D supply, which might in turn facilitate the creation of R&D activity, are the following:

- The presence of at least minimum capacities of intangible capital for producing R&D. This should be determined on the basis of whether or not core research groups with adequate scientific experience in certain fields of knowledge are present and whether technological researchers and experts are available to transfer knowledge to third parties.
- The availability of funding to foster joint investment in the production, spread and/or use of new knowledge. This should be determined on the basis of whether specific projects funded with private or Canon Act resources exist, whether support infrastructures in the relevant fields of opportunity are present, and the extent to which competitive facilities exist or are being acquired in order to assure that laboratories and centers are adequately equipped to provide future services to third parties.

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3.1 Opportunity sectors for R&D in Cusco and Tacna.

Following the criteria stated above, the fields and/or sectors of competitive opportunity identified in the regions of Cusco and Tacna are the following:

Fields of opportunity by region:

Field of Opportunity	Regions in study and present situation	
	Cusco	Tacna
Human health and applied life sciences, new biology. Andean biomedicine. Medical equipment.	<ul style="list-style-type: none"> • Researchers, laboratories and supporting university infrastructures exist; scientific supply and funding from Canon Act resources to promote R&D are available. • A burgeoning health industry exists, with a present contribution of 0.3% to the regional economy. Technology entrepreneurs with useful patents. 	<ul style="list-style-type: none"> • Cross-border demand for special interest tourism relating to health services exists. There are public Canon Act resources for funding R&D. • Presently there is no R&D or scientists working in this field, nor infrastructure to provide university R&D services.
Agro-industry. Food, biotechnology and food security, preservation of Andean species	<ul style="list-style-type: none"> • Researchers, university centers and public technology institutions with experience do exist. • Scientific supply, systematic research and funding from Canon Act resources and from national funds exist in this field. There is a peasant agrarian economy which requires improved technology. • Businesses are not present. 	<ul style="list-style-type: none"> • Inter-university training is available. Public Canon Act resources and national funds are available for funding R&D. There is scientific activity and a supply of R&D in plant biotechnology. • Advanced technology in biotechnology and food security is not present. There are local businesses and exporters interested in acquiring knowledge and new technologies.
Metallurgical Industry.	<ul style="list-style-type: none"> • An industrial sector does exist in the region's economy, and there is a technological tradition reaching back to ancient times. • There are centers for technical training of human resources and business demand for these. Support from Canon Act resources and private funds exist for investment in this area. 	<ul style="list-style-type: none"> • University undergraduate training exists, as does qualified R&D, research, and university laboratories with the capacity to provide services to business. • There is support from Canon Act resources associated with environmental improvement.
Renewable Energy (RE). Clean technologies and energy efficiency in the context of climate change	<p>There are Canon Act resources and national funds available in this field, related to climate change. It is uncertain whether specific research is available and whether businesses are interested in energy efficiency, or what capacity they might have to take on new technologies.</p>	<ul style="list-style-type: none"> • Geothermal energy reserves exist, transnational businesses are interested, and research facilities interested in non-conventional renewable energy are present.
Tourism and related activities	<p>Professional and technical training in international tourism is available. There is no supply of technology nor specialized R&D, though there is research in the field. There is business demand for regional specialization in this sector. A driving-force sector in tourism and related activities does exist.</p>	<ul style="list-style-type: none"> • There is a demand for cross-border special interest tourism and for related activities. There is private funding available in this field. • No specialized R&D or technology is available. • There is potential for the development of a logistical, touristic and commercial platform in advanced border services.

Sources: Table compiled by the authors of this study on the basis of interviews conducted throughout the study, reports and official documents associated with the Cusco Region Competitiveness Plan and the Peruvian National Competitiveness Plan, and with the Profile of the Program for Promoting Development in Science, Technology and Innovation in the Cusco Region, 2013. Summary report on the "Assessment of the Supply and Demand of Technological Innovation in the Cusco Region Industrial Sector, 2011" commissioned by the RAMP Peru Project and the Cáritas Foundation.

3.2 Analysis of the R&D availability and specialized training in the fields of competitive opportunity.

Strategic sectors

Traditional Sectors with Opportunities for Regional Growth	Emerging sectors or fields of opportunity for competitiveness
<ul style="list-style-type: none"> ▪ Tourism and related activities 	<ul style="list-style-type: none"> ▪ Human health and applied life sciences, new biology. Andean biomedicine and medical diagnostic equipment
<ul style="list-style-type: none"> ▪ Agro-industry, food, biotechnology and food security, preservation of Andean species ▪ Metallurgical industry: Biomining and related productive activities 	<ul style="list-style-type: none"> ▪ Renewable energies. Clean technologies and energy efficiency in the context of climate change.

Source: Table prepared by the authors of this study, 2013.

In what follows we present, by field of opportunity, the principle R&D activities carried out by institutions or relevant entities in science and technology, the degree of institutional support available, and the kind of relations already existing within the innovation system of each region.

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3.2.1 Human health and applied life sciences

In the public universities and some of the private ones which conduct research there is scientific experience in microbiology, epidemiology, pharmacy, Andean medicine and illnesses. This experience is principally oriented towards teaching and clinical practice, with results from systematized research which are transferrable to the network of public health services and/or the industry.

Supply of health science by region.

Region and suppliers of R&D	Supply of R&D	Graduate programs of study
<p>Cusco</p> <ul style="list-style-type: none"> ▪ National University San Antonio Abad (UNSAAC) ▪ Andean University of Cusco (UAC) ▪ Business: INGENIMED and Clinical Human Health Services 	<ul style="list-style-type: none"> ▪ Biology and tropical illnesses, others. ▪ Pharmacy, mental health. ▪ Medicine, nursing, reproductive sciences. ▪ Metrology and prognostic science in human health 	<p>Graduate programs (UNSAAC):</p> <ul style="list-style-type: none"> ▪ Masters in Health Policy and Management ▪ Masters in Public Health, specializations in: Management of Health Services, Epidemiology. <p>Graduate Programs (UAC):</p> <ul style="list-style-type: none"> ▪ Doctorate in Health Sciences ▪ Masters in Industrial Engineering, specializations in: Industrial Safety, Occupational Health; ▪ Masters in Community Health ; ▪ Masters in Stomatological Science; ▪ Masters in Intercultural Health; ▪ Masters in Sexual and Reproductive Health; ▪ Masters in Nursing and Health; ▪ Masters in Intensive Care Nursing;
<p>Tacna</p>	<ul style="list-style-type: none"> ▪ No R&D in human health was identified 	<ul style="list-style-type: none"> ▪ Masters in Health Services Management (Universidad Cesar Vallejo, UCV).

Source: Table compiled by the authors of this study on the basis of institutional information published on university websites, interviews conducted and information provided by interviewees. November, 2013.

Cusco Region:

The National University San Antonio Abad del Cusco (UNSAAC) carries out part of its scholarly activity in collaboration with Peruvian public institutions in the fields of health and environment, as well as with NGOs and European university institutions. Environmental and ecosystemic knowledge is combined with scientific scholarship to study the possible therapeutic effects of Andean species in human health problems: skin injuries, epidemiological testing, applied medical technologies, research into tropical illnesses with impact at a national level, etc. Moreover the university has a network of laboratories for teaching and research, the infrastructures, equipment and technology of which is currently being renovated and modernized. These laboratories are not accredited and lack safety and use protocols, but are in a process of

transformation in order to be able to provide competitive services to natural and legal persons in the fields of biology, chemistry and pharmacy.

The Andean University of Cusco (UAC), promotes research circles in the field of human medicine. In order to achieve accreditation, it has recently improved its organization and increased its interest in managing research using its own funding and/or joint projects. The field of health could help to generate a pole of inter-university development of great public interest in issues of public health, biomedicine and illness prevention.

The existence of some ten university programs for specialized training in health, as well as the existence of capacities and infrastructures, does not mean that there are strong collaborative bonds, according to those interviewed. There are no formal inter-university relations for developing joint projects, nor are the universities aware of each others' R&D supply or specialized training. A certain competitive mistrust prevails in a field of interest to regional and national development in which opportunities for mutual enrichment exist.

During the field work for this study, and in relation to the entrepreneurial supply of advanced technical services, we were able to confirm the existence of a burgeoning activity creating diagnostic equipment and new businesses in the third sector working on issues of human health.

At present, such little entrepreneurial talent as there is is neither adequately promoted nor protected, which could discourage future development in a technological sector of advanced services in medical engineering and production of support equipment for medical diagnosis.

Support for inventors and entrepreneurs in the region is just beginning, and comes principally from the regional government and NGOs.

Tacna Region

The supply of health care is linked to special interest tourism and at present is fairly limited to training; no systematic R&D work has been identified.

The Jorge Basadre Grohmann National University (UNJBG) has greatest potential for developing research activities in the fields of nursing, obstetrics and health sciences, and has a Master's program in Public Health. In the 2003-2006 period the research projects carried out by scholars at the UNJBG in the field of health represented 13% of the total research activity registered internally, with little scientific impact. Tacna is a city frequently visited by tourists from Chile and other neighbouring countries in search of outpatient health care.

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3.2.2 Food and agriculture. Food, biotechnology, food security and preservation.

In the field of food and agriculture the supply of R&D is of a quality competitive at a national and international level, with possibilities for improving its capacity for technology absorption in order to diversify research and link it to chains of production and transfer, as well as improving its relationship with the business community and international research networks.

The R&D activity in agro-industry and food (this includes fishing) is present in both the Cusco and Tacna regions, with a tradition of applied research and transfer to productive peasant communities, especially through NGOs, public university research centers, and the National Institute for Agricultural Innovation in Cusco.

The supply of training and R&D follows, based on interviews with players in the sector of food and agriculture:

Supply in food sciences, by region:

Region and R&D suppliers	Supply of R&D	Graduate Programs of Study
<p>Cusco UNSAAC: Center for Research on Andean Crops (CICA), created in 1976 Center for research on Pastures and Grazing land (CIPRAS) INIA: Cusco Terraces Experimental Station for Andean Agriculture</p>	<ul style="list-style-type: none"> ▪ Security and recuperation of indigenous food heritage ▪ Genetic improvement of Andean species, both plant and animal ▪ Protection, knowledge transfer, production and release of indigenous species to peasant communities 	<ul style="list-style-type: none"> ▪ Master in Food Science and Technology
<p>Tacna UNJBG: Laboratory of plant biotechnology Research projects presented in 2013 for funding by Canon Act resources.</p>	<ul style="list-style-type: none"> ▪ Plant biotechnology related to indigenous crops for export and in high-mountain peasant cultivation ▪ Productive diversification in the use, commercialization and processing of marine products 	<ul style="list-style-type: none"> ▪ Master in Food Science and Technology (UNJBG) ▪ Master in Agricultural Export (Universidad Cesar Vallejo, UCV)

Source: Prepared by this study on the basis of institutional information, interviews conducted, and information supplied by interviewees. November, 2013.

Cusco Region:

In Cusco the regional R&D activity in the field of food brings together knowledge from biological science and genetic engineering associated with the preservation of Andean species, plant biotechnology. It is principally oriented towards conserving productive and technological heritage and generating new species which will be more resistant to climate change in order to guarantee the security of staple foods for future generations. This concern is shared by all the R&D researchers interviewed.

The University Research Center for Andean Crops in Cusco (CICA), which is older than the INIA and has over 40 years of experience in research, training and

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experimentation with native Andean varieties, has the oldest existing seed bank¹³ of quinoa germplasm from the Inter-Andean valleys of Peru. The Agricultural University also houses part of the germoplasm of Inter-Andean crops and quinoa from the high Andean plateau, in coordination with the Ministry of Agriculture.

According to the R&D providers interviewed, the majority of the varieties produced and released by the CICA (amaranth, potato, oca, quinoa, white and yellow grain maize, lupin) permit an improvement in the productivity and productive quality of small farmers in those regions which cultivate these crops. This tacit scientific knowledge, focused on species grown in the high Andean agro-ecological zone, constitutes part of the ancestral food tradition of the region's population. In general it is not protected under any of the forms of intellectual property rights by the University. Much work is not published. However the university does have publishable catalogues on each species.

At present the center has eight researchers on staff (three hold PhDs and five hold MAs). The principle beneficiaries of the transferable results of the research have been: NGOs (they access genetic material of proven quality), municipalities of the region and of other nearby regions, and peasant groups which fund their own short-term training visits.

The CICA perceives that these transferal processes have been effective and that absorption of the contents shared through field demonstrations has been satisfactory. The new varieties improved by agricultural engineering prove adaptable.

On the other hand there is the perception on the part of INIA researchers and authorities regarding the supply of R&D in the sector in the Cusco region: "If research is not conducted nothing can be contributed to the productivity of the 900 peasant communities dedicated to small-scale agriculture, either recognized by the State or in the process of seeking recognition." The INIA reaches one third of these communities with the scarce resources available to it, leaving space for the activities of NGOs, universities and other institutions. This is a sector for public policy attention as it involves bringing small-scale peasant agriculture—where the greatest concentrations of poverty lie—into the processes of agricultural modernization.

Experiences in carrying out R&D projects and/or technology and knowledge transfer projects with the regional government and the university (UNSAAC) have failed and have caused frustration. This may limit the possibilities of future institutional cooperation in R&D&I activities, in which project overlap might increase without encouraging an effort to define complementary capacities.

The advantage of the INIA with respect to other regional institutions providing R&D lies in: its demonstrated competence in registering improved plant varieties,

¹³ A broad collection of genetic resources from Peru, Ecuador, Columbia and part of the north of Argentina. According to the CICA, it holds the following species in these quantities : potato (2000 types), kiwicha amaranth (1600 types), lupin (1500 types), oca or New Zealand yam (840 types), quinoa (570 types), maize (450 types), olluco (294 types), masha (241 types), arracacha (63 types), arrowleaf elephant ear (47 types), yacon (34 types), canna indica (23 types)

certifying the quality of seeds, providing specialized human resources working full-time to carry out systematic experimental activities for development purposes. Its permanent technology and knowledge transfer activities are significant, working under informal arrangements based on mutual agreement with the direct producers, within a process of participatory research which includes the final beneficiary (the producer) and the intermediary institutions (public sector, NGOs, municipalities, agricultural organizations, etc.). Moreover, the INIA has a national system of entry training for the service's professionals.

In the case of CIPRAS, its research contributes to strengthen the ecosystem and habitat of the camelid species of the region. Agricultural associations dedicated to raising camelids collaborate, as do farmers interested in improving the quality of their grazing land. The emphasis of the Center's processes of technology and knowledge transfer is placed on Andean communities which raise camelids, as well as individual livestock operations.

The relationship with the productive sector which the center has achieved in recent years is significant, as it has become a point of reference in the struggle to offset the loss of native grazing land to agricultural activity. The center's greatest contribution is its work on transferring knowledge on the care of native grazing lands to Andean communities and agricultural associations of the region. However it should be pointed out that the center does not have any specific projects with businesses. Its activities are funded directly by the university through Canon Act resources, dedicated to researching methane generation by the livestock which graze on native grasses.

The human capital of the center is nourished by academics working in Animal Science, especially those motivated to study native grazing land. Most of the researchers hold master's degrees in some area of specialization related to the center's work; a smaller number hold doctorate degrees. The teaching professors who wish to conduct research in the university may respond to calls for research funding with Canon Act resources, or may access the university fund of the Special Fund for University Development (FEDU).¹⁴

The researchers interviewed perceived the center's potential and hailed its contribution to productive communities, although some claimed that the university research generated is of very low quality, which may be a direct result of the lack of incentives and funds in place to encourage it. CIPRAS does not charge for its work as it considers it part of the university's relationship to the community. The transfer mechanisms it uses are training and in-field technical assistance.

¹⁴ This fund assigns the researcher a total of S/.260 a month (approximately US\$95) for research throughout two years. This sum is in addition to the payment received for teaching. At the end of the two year period, the research is presented for peer review. This fund does not require that work be published nor that there be mechanisms for transfer of results. It is not possible to use FEDU resources for the purchase of laboratory equipment.

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Tacna Region:

The research in this area is applied and is oriented specifically to respond to the public health demand for nutritional diversification related to the use of marine products in gastronomy, as well as the production of new exotic agricultural products grown using technology. Work is done in the modernization and creation of university laboratories which provide academic services of regional public interest regarding plant biotechnology, food security and cross-border pesticide and herbicide issues. This is funded through Canon Act resources transferred to the university (UNJBG).

The R&D activities in biotechnology are carried out by the Food Science and Food Engineering faculties working in fishing, agriculture, animal science and livestock. The work is done by academic groups which recent graduates may join as research assistants or scholars. Proposals are presented for funding using Canon Act resources and transfer actions.

Regarding biotechnology, the supply of R&D generated through Canon Act projects in 2013 is to be transferred at a regional level to businesses and remote peasant communities, facilitating its impact on the business competitiveness of regional exporters and producers of oregano and alpaca fiber, on the basis of genetic material and technological information which have direct results on their income and the final quality of their products.

R&D activities conducted with Canon Act funds:

Activities	Reach and orientation
Biotechnology	<ul style="list-style-type: none"> ▪ Biotechnology applied to the genetic improvement of the alpaca. The project includes creating laboratories and transfer to small producers through training. ▪ Molecular plant biotechnology in oregano: building a cutting-edge laboratory for the development and execution of protocols which provide guaranteed results, refining the technological bundle which will allow the productive potential of oregano to be identified, and spreading the results achieved throughout the scientific community.
Technological strengthening and diversification of production	<ul style="list-style-type: none"> ▪ Diffusion of new technologies for the processing, sale and human consumption of marine products (cuttlefish and anchovy) with a high nutritional and vitamin content in order to fight malnutrition in children and remote communities. ▪ Ecology and micro-economy in the processing and sale of technologies for marine products (sea cucumber), providing training services to fishing micro-enterprises.

It should be noted that Tacna is the principle producer of oregano in the country, followed by Moquegua, Ancash and Arequipa, with an average national yield of 4,407 kg per hectare. The university's research project seeks to identify the different varieties or species through molecular indicators, then transfer these to producers in different technological bundles. These results would help oregano producers, the local government and liaison workers from the Ministry of Agriculture to be aware of

different qualities of oregano for different markets, and to evaluate more positively the production of organic products.

To carry out this research, the UNJBG has a Plant Biotechnology Laboratory, created in 1995, which has the capacity to assess the development of those native crops which are best adapted to the conditions of local production, taking into account climate change and the scarcity of existing water resources.

Four qualified professionals work in the laboratory, dedicated to the effort to conserve and promote applied research, to recover Andean species, and to define protocols for providing virus-free genetic material. This team transfers its knowledge in a barter system, in exchange for materials and supplies to support research. They do not charge for their services, as they are a public institution and the laboratory is equipped with plant biotechnology equipment which is obsolete, affecting the precision of their results.

At present this laboratory and its research team only carry out teaching activities and occasionally lend support to peasant communities and institutions in analyzing plant health, though the laboratory is not yet certified to do so. They do not have any relationship to the business sector, and only have contact with small-scale producers, NGOs, public institutions, and the International Potato Center.

For the genetic development of the alpaca, the UNJBG has an Animal Reproduction Laboratory which belongs to the School of Veterinary Medicine and Animal Science. They have an experimental campus and research programs in genetic improvement with impact in the field of livestock raising.

The supply of R&D in this field allows researchers to identify early phases of deterioration in the quality of alpaca fiber (fine and extra fine) and to detect reproductive problems. This has a direct impact on productivity and the commercialization of the fiber and meat, to the benefit of the producers in the high-Andean zone of Tacna. Many of the peasant families in the region work raising camelids. One of the principle problems of public concern for producers and traders is the quality of their products, as the lack of a uniform standard of quality contributes to the uncertain incomes of alpaca producers.

3.2.3 Metallurgical industry and the environment.

Cusco Region:

No supply of R&D in metallurgy has been identified in the region, although the technological institutes Tupac Amaru and SENATI provide professional training for technicians in these subjects.

Tacna Region:

In the metallurgy department of the Faculty of Engineering of the UNJBG in Tacna there is some R&D activity, with research professors (fifteen scholars, of whom four

hold doctorates, who dedicate one third of their time to research, with fifteen projects under way). They are specialized in metallurgy and have a laboratory which is not yet certified, with updated equipment and the opportunity to provide future services of experimental and advanced analysis at a regional and national level. In 2013 one of the project proposals presented for Canon Act funding was "The degradation of cyanide residue through microbial activities applied to gold mining processes in the Tacna Region". The research seeks to have impact on the environment and on human health in association with mining activities.

The research takes into consideration the progress shown in previous studies and research on biomining, biodegradation, biotechnology and hydrometallurgy, as well as the viability of transferring knowledge available in the universities of northern Chile and combining it with new knowledge being developed at the UNJBG, and adapting these inputs to the situation in the Tacna region.

The project involves researchers from different fields of knowledge (microbiology, cellular and molecular biology, industrial engineering and metallurgy, biochemistry, environmental science, and others) based at other Peruvian universities (Santa María de Arequipa National University, Tacna Private University) and Chilean universities (University of Antofagasta, University of Tarapacá, Catholic Pontifical University of Valparaíso). The results will be transferred and spread through publications and different materials. These results could be extended to the domestic mining industry in the south of Peru, which is concerned with mitigating the pollution caused by its activity.

However the specific interest on the part of large mining companies and related industries to hire analysis and consulting services from university researchers requires that the universities move towards certifying or accrediting the quality of their laboratories and centers, as well as professionalizing the management of transfer and innovation. In no case have we seen smaller regional companies approach the universities nor have we seen the universities make an explicit effort to encourage smaller business associations to participate in calls for R&D funding in order to confront the transfer of specific technological solutions in a coordinated manner.

3.2.4 Energy.

In the field of energy efficiency and renewable energies no systematic research activities have been identified, although isolated efforts have been scattered over time. However this is a priority field for the universities and the regions in terms of allocation of Canon Act resources, especially in Tacna where the UNJBG has researchers, students and research projects underway. The UNJBG also has a Center for Renewable Energies, although it lacks a working budget and its teaching laboratory's equipment is obsolete. In addition, Tacna has a special opportunity in that it has the greatest reserves of geothermal energy in Peru. Energy efficiency is not a concern within institutional culture, communities or smaller businesses, although saving energy could be an important resource in their productive efforts.

3.2.5 Supply of R&D in tourism and related activities.

In this field there is no quality R&D. According to reports by institutions of higher education and technical institutes, there is undergraduate training in tourism and business in universities in the Cusco region, especially in the Cusco Global University, UNSAAC, and the professional technical institutes. In Tacna, a supply exists related to logistical enterprises at the Cesar Vallejo University. However the development of platforms for trade, financial services and cross-border logistics needs to be strengthened through graduate specialization.

Lastly, these last three sectors (tourism and related activities, logistics, trade, renewable energies) constitute fields of future opportunity for the development of innovation systems, based on the development of policies to attract investment and technological cooperation between businesses. This would endow the regions addressed in this study with a greater capacity to absorb technology, generating a technological and business environment which would demand more research, given the conditions and competitive advantages of these activities in these regions.