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## A Roadmap for the Commercial Development of Medicinal Plants of the Andean Region of South America

Foresight Brief No. 155

**Authors:** Carlos Aguirre-Bastos , [carlos.aguirre@arcs.ac.at](mailto:carlos.aguirre@arcs.ac.at)  
**Sponsors:** United Nations Industrial Development Organization and Government of Spain  
**Type:** Multi national foresight exercise  
**Organizer:** UNIDO, official in charge: Ricardo Seidl da Fonseca, [r.seidl-da-fonseca@unido.org](mailto:r.seidl-da-fonseca@unido.org)  
**Duration:** 2006/2008      **Budget:** N/A      **Time Horizon:** 2020      **Date of Brief:** Oct. 2008

### Purpose

The main objective of the project was to establish a future vision (2020) and define the best means for the production, commercialization and innovation of products on the basis of medicinal plants of the Andean region of South America that would contribute to its social and economic development.

### The Andean Highlands: Rich Biodiversity but Extended Poverty

The Andean highland regions of Bolivia, Ecuador and Peru are rich in biodiversity, containing unique natural resources, but at the same time face severe poverty. In this region, there is a recognized potential for improving income through the development of region-specific products, but knowledge on what products to develop, what technologies to employ for improving production and how to approach markets is lacking.

To raise production levels, increase productivity and competitiveness of products originating in this region, it is mandatory that the related industrial sectors be organized as productive chains incorporating the necessary institutional framework for modern industry, financial services, wholesale markets, price information, quality standards, transport facilities and a series of other appropriate conditions for their operation. To capture this complex reorganization process, future studies and trend analyses are in demand so as to cover structural and functional change scenarios as well as technology development. Against this background, a foresight study was conducted that could contribute to raising awareness and building consensus and agreements among key stakeholders to pursue such reorgani-

zation. The project set the goal to assist the participating communities in making decisions on future directions in the production of local products that might increase economic and social wealth in the region. It aimed to help identify strategic technology areas for selected products and industrial sectors, to raise their competitive advantage and to enable the national products to better access regional and global markets.

In the particular case of global markets, the world trade of medicinal plants already exceeds 14 billion dollars per year. The yearly growth rate from 1994 to 2006 was between 10% and 20% while the preferred markets were in Europe, US, Japan and China. In Europe alone, nearly 2000 species were commercialized. Such figures pose an important incentive for enhancing the production of the Andean medicinal plants and their products.

In this international context, the project considered it a priority to support the consolidation of the presence of Andean natural products in these growing markets.



## The Project's Specific Objectives

The project had the following specific objectives (UNIDO, 2008):

- a) Facilitate the economic development of the region by enhancing and modernizing the production of medicinal plants.
- b) Establish a database that collects information on all the initiatives, programmes and activities in the region, providing an information and knowledge pool and serving as the centre for the exchange of experience.
- c) Increase the cooperation and communication among stakeholders responsible for the production, commercialization and innovation of products based on medicinal plants.

## A Roadmap as Methodological Tool

The project elected to draw up a roadmap as the key foresight tool. It was built in four phases:

- a) An analysis of the present situation.
- b) The establishment of future visions.
- c) The identification of barriers.
- d) The definition of measures and solutions to overcome such barriers.

For the first phase, a detailed study of the situation (production, collection, marketing, transport, technologies) in each individual country was conducted and the results integrated into a single regional strength, weaknesses, opportunities and threats (SWOT) analysis.

The next three phases were developed in a participatory exercise that consisted of one workshop at the country level and two workshops at regional levels for each country. All stakeholders participated in the workshops at both levels.

For establishing the future visions, two additional studies were made available dealing with the norms existing in the USA and Europe, respectively, for the commercialization of medicinal plants-based products.

## The Regional SWOT

The regional SWOT analysis was built around four areas:

- a) Factors that condition production: land, labour, technology and transport.
- b) Factors that condition demand: behaviour and functioning of national and international markets.
- c) Strategies, structures and competence: promotion and support policies, legislation, forms and associative mechanisms of primary and secondary producers, traders and exporters, and degree of sector institutionalization.

- d) Related industries and services: sector of primary transformation and production of pharmaceuticals and foods, services to industry and to primary producers.

## Visions and Barriers

Based on the SWOT, four visions (2020) and the respective barriers for achieving them were identified as shown in Table 1.

**Table 1: Visions and Barriers**

<b>Vision 1: Andean Medicine and its products are recognized internationally</b>
<ul style="list-style-type: none"> <li>• Lack of a joint vision</li> <li>• Limited use of traditional knowledge</li> <li>• Lack of confidence in traditional medicine</li> <li>• Restrictive legislation</li> <li>• No diffusion of benefits from traditional medicine</li> <li>• Lack of international support for diffusion</li> <li>• Weak socio-cultural integration among the countries</li> <li>• Social prejudices</li> <li>• Dispersed information (no systematization)</li> <li>• Lack of leadership for the development of the Andean pharmacopoeia</li> </ul>
<b>Vision 2: The products derived from Andean biodiversity have their own trademark in all markets</b>
<ul style="list-style-type: none"> <li>• Lack of characterization and uniform requirements for certification of an Andean trademark</li> <li>• Lack of standardization of primary vegetal materials and by-products</li> <li>• Lack of confidence in the products' results</li> <li>• Lack of validation of properties to promote medicinal (and nutraceuticals) products</li> <li>• Lack of clinical essays to determine counter-uses</li> <li>• Lack of studies of efficacy and clinical security (lack of pre-clinical security and non-compliance with WHO norms)</li> <li>• Lack of scientific publications in international journals to avoid bio-piracy</li> </ul>
<b>Vision 3: The multinational sector research and innovation system is consolidated</b>
<ul style="list-style-type: none"> <li>• Lack of financing for R&amp;D</li> <li>• Lack of information on research and innovation capacities of the region's institutions</li> <li>• Limited supply of trained personnel</li> <li>• Lack of state policies for promoting and favouring research and innovation</li> </ul>
<b>Vision 4: A sustainable production cluster exists</b>
<ul style="list-style-type: none"> <li>• Lack of sustained water management</li> <li>• Lack of articulation and integration among the agents of the cluster</li> <li>• Dominance of conventional agriculture threatens biodiversity</li> <li>• Bio-piracy</li> <li>• Lack of technologies appropriate to the region's conditions</li> <li>• Lack of documentation and appreciation of ancestral knowledge and technologies</li> </ul>

## A Multinational Roadmap

A multi-national roadmap was developed and the technologies and tools were identified for each vision as shown in Tables 2-9 for the short (5 years), mid (10 years) and long-term (15 years). The illustrations of the roadmap show only the main actions of the many discussed.

**Table 2: Roadmap for Vision 1**

<b>Andean medicine and its products are recognized internationally</b>	
<b>Short-term</b>	<ul style="list-style-type: none"> <li>➤ Create an information system</li> <li>➤ Launch diffusion campaigns</li> <li>➤ Establish a regional forum</li> <li>➤ Identify R&amp;D centres</li> <li>➤ Create a coordinating centre to group stakeholders</li> </ul>
<b>Mid-term</b>	<ul style="list-style-type: none"> <li>➤ Conduct market studies</li> <li>➤ Develop financial mechanisms for the transfer of technology</li> <li>➤ Create a holding of regional R&amp;D centres for a regional programme</li> </ul>
<b>Long-term</b>	<ul style="list-style-type: none"> <li>➤ Establish regional and international cooperation networks</li> </ul>

**Table 3: Technologies and Tools for Vision 1**

<ul style="list-style-type: none"> <li>• ICT for the management of networks and diffusion of information</li> <li>• Field technologies for managing specific crops</li> <li>• Entrepreneurial management tools</li> <li>• Tools for promoting association</li> <li>• Culture of cell lines for specific tests</li> </ul>
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**Table 4: Roadmap for Vision 2**

<b>The products derived from Andean biodiversity have their own trademark in all markets</b>	
<b>Short-term</b>	<ul style="list-style-type: none"> <li>➤ Promote the creation of an Andean Council</li> <li>➤ Create an institution for certifying the denomination of origin</li> <li>➤ Develop a technical standard for medicinal products</li> <li>➤ Search for financing</li> </ul>
<b>Mid-term</b>	<ul style="list-style-type: none"> <li>➤ Develop external markets and eliminate obstacles to international trade</li> <li>➤ Develop and harmonize sanitary norms</li> </ul>
<b>Long-term</b>	<ul style="list-style-type: none"> <li>➤ Develop new products</li> <li>➤ Diversify</li> </ul>

**Table 5: Technologies and Tools for Vision 2**

<ul style="list-style-type: none"> <li>• Standardization of laboratory analysis methods</li> <li>• Creation of specialized laboratories to determine Andean ingredients</li> <li>• Create pilot plants to develop new products</li> <li>• Scale-up technologies for innovation</li> </ul>
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**Table 6: Roadmap for Vision 3**

<b>The multinational sector research and innovation system is consolidated</b>	
<b>Short-term</b>	<ul style="list-style-type: none"> <li>➤ Prepare a regional directory of research groups</li> <li>➤ Create an interactive network of research and innovation centres</li> <li>➤ Create a regional R&amp;D institute</li> <li>➤ Generate a regional fund for R&amp;D</li> </ul>
<b>Mid-term</b>	<ul style="list-style-type: none"> <li>➤ Strengthen the research lines of the regional institute</li> <li>➤ Consolidate the regional research and innovation system</li> <li>➤ Establish training programmes</li> </ul>
<b>Long-term</b>	<ul style="list-style-type: none"> <li>➤ Create permanent foresight mechanisms</li> </ul>

**Table 7: Technologies and Tools for Vision 3**

<ul style="list-style-type: none"> <li>• Domestication techniques for local species and post-harvest production</li> <li>• Agricultural management tools</li> <li>• Transformation technologies (collection, drying and powdering, extraction etc.)</li> <li>• Biological validation technologies</li> <li>• Technologies to identify bioactive composites</li> <li>• Technologies for the extraction of active principles</li> <li>• Chromatography equipment</li> <li>• Germplasm bank and sequencer</li> <li>• Pilot plant for the elaboration of phytopharmaceuticals and nutraceuticals</li> <li>• Micro-array technology for the study of gene expression</li> </ul>
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**Table 8: Roadmap for Vision 4**

<b>A sustainable production cluster exists</b>	
<b>Short-term</b>	<ul style="list-style-type: none"> <li>➤ Prepare a best practice manual for each product</li> <li>➤ Prepare an equipment infrastructure plan for the value chain</li> <li>➤ Develop an information system for producers to integrate their activities and negotiate</li> <li>➤ Train producers in management and cooperative culture</li> </ul>
<b>Mid-term</b>	<ul style="list-style-type: none"> <li>➤ Produce a regional agreement on commercialization systems</li> <li>➤ Define market strategies</li> <li>➤ Promote the creation of regional clusters</li> </ul>
<b>Long-term</b>	<ul style="list-style-type: none"> <li>➤ Develop a collaborative innovation culture</li> <li>➤ Develop technology management capacities</li> </ul>

**Table 9: Technologies and Tools Relative to Vision 4**

<ul style="list-style-type: none"> <li>• Management tools for implementing best practices</li> <li>• Tracking tools</li> <li>• ICT for training</li> <li>• Tools to develop capacities for association</li> </ul>
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## A Regional System of Innovation

The highlands and central valley regions of the three Andean countries Bolivia, Ecuador and Peru are characterized by a rich biodiversity but also by extreme poverty. The roadmap aims at supporting the countries' policies and strategies to face the challenges of poverty by creating improved conditions for primary production, industrial transformation and exports of value-added products into a growing world market. The project is geared toward attaining the first Millennium Development Goal of poverty reduction.

The project has been able to identify the whole set of problems that affect this key social and economic sector where more than ten million people depend on the production and commercialization of both medicinal and nutraceuticals plants and make extensive use of traditional medicine. The roadmap is a key guideline for policy makers and has made an important inroad into the study of research policy in the three countries involved.

The process followed in preparing the roadmap permitted a most inclusive participation of stakeholders in the course of which the roadmap recommendations were fully validated. Of particular value to policy-making is the fact that the regional roadmap provides ample room for the adoption of multinational norms, thus complementing those already existing in the Andean integration process.

Further, the results of the project provide an excellent example of how a regional system of sectoral innovation can function, thus providing guidelines to policy makers for the configuration of such a system, in particular in terms of measures to be adopted for creating and strengthening new research and innovation capacities.

## Restructuring Clusters and Value-chains

The results of the project show the need and importance of restructuring the national and regional clusters and value-chains, starting from the collection of primary products, to the modernization of industry and the improvement of marketing channels. For this purpose, all three countries will require access to international cooperation to obtain both financing as well as technical and human resources.

### Short-term Priority

The highest priority is given to the creation of a Regional Observatory for Medicinal Plants as a permanent network structure whose main tasks will be to generate, coordinate and distribute information and knowledge on medicinal plants of the Andean highlands and central valleys. It is to provide specialized advice and training to all agents involved in the medicinal value chain (or cluster), conduct policy analyses and help establishing contacts inside and outside the Andean region.

### Critical Factors

A critical factor in shaping the future is the creation of a technology and market-oriented culture among primary producers of medicinal plants in the region and the active participation of research and innovation centres in support of a better knowledge and understanding of the clinical effects of medicinal plants for promoting the acceptance of Andean traditional medicine and its products at the international level, much as is already done today with some Oriental medical practices. The growing world demand for natural, biological products is a very strong incentive to move in this direction.

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## Sources and References

UNIDO, 2008 Final Report "The Future of the Products of the Highlands and Central Valleys of the Andes: Medicinal Plants", in Spanish, UNIDO, Vienna. The report is available at [www.unido.org/foresight/andean-study](http://www.unido.org/foresight/andean-study).

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