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Agricultural Innovation in Latin America and the Caribbean: Institutional Scenarios and Mechanisms

Eduardo Trigo
Nicolas Mateo
Cesar Falconi

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Acronyms

AAPRESID	Asociación Argentina de Productores y Siembra Directa
DNA	Deoxyribonucleic Acid
LAC	Latin America and the Caribbean
BID	Banco Interamericano de Desarrollo [IDB – Inter-American Development Bank]
CAFTA-DR	Dominican Republic-Central America-United States Free Trade Agreement
CARDI	Caribbean Agricultural Research and Development Institute
CATIE	Centro Agronómico Tropical de Investigacíón y Enseñanza
CEPAL	Comisión Económica para América Latina y el Caribe
CGIAR	Grupo Consultivo para la Investigacíon Agrícola Internacional
CIAT	Centro Internacional de Agricultura Tropical
CIMMYT	Centro Internacional para el Mejoramiento de Maíz y Trigo
CIP	Centro Internacional de la Papa
COFUPRO	Coordinadora Nacional de las Fundaciones Produce
CONICYT	Consejo Nacional de Investigacíon Científica y Tecnológica
CORFO	Corporacíon de Fomento de Produccíon
CSIRO	*Commonwealth Scientific and Industrial Research Organization*
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
FTE	Full Time Equivalent
FAO	United Nations Food and Agriculture Organization
FIA	Fundacíon para la Innovacíon Agraria
FIDA	Fondo Internacional de Desarrollo Agrícola
FLAR	Fondo Latinoamericano para Arroz de Riego
FONTAR	Fondo Tecnológico Argentino
R&D	Research and Development
IICA	Instituto Interamericano de Cooperacíon para la Agricultura
INBIO	Instituto Nacional de Biodiversidad
INIA	Instituto Nacional de Investigacíón Agraria
INIFAP	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias
RedINNOVAGRO	Red de Gestión de Innovacíon en el Sector Agroalimentario
INTA	Instituto Nacional de Tecnología Agropecuaria
INTEA S.A.	Innovaciones Tecnológicas Agropecuarias
MERCOSUR	Mercado Común del Sur
OECD	Organization for Economic Cooperation and Development
NGO	Non-Governmental Organization
PBBC	Plant Breeding and Related Biotechnology Capacity Assessments
IP	Innovation Platforms
PROCISUR	Programa Cooperacional para el Desarrollo Tecnológico Agroalimentario y Agroindustrial del Cono Sur
TP	Technology Platforms

ETP	Plataformas de Tecnología Europeas [European Technology Platforms]
SNIA	Sistemas Nacionales de Innovacíon Agropecuaria
SNITT	Sistema Nacional de Investigacíon y Transferencia Tecnológica
UNEP	United Nations Environment Programme

Executive Summary[1]

Agriculture and food supply face a repositioning in the context of challenges associated with the Millennium Development Goals. From a development perspective it is of central importance to identify the role that the sector should perform in the fight against poverty and in a world that is increasingly urbanized. In this context, the general objective of the document is to contribute to the discussion of the current situation of the National Institutes of Agricultural Research (INIA's - *Institutos Nacionales de Investigación Agropecuaria*) in Latin America in the framework of the National Innovation Systems and the international scenario. Specifically, the objectives are: i) to characterize the challenges they face and the scientific basis on which the INIA's work and function (sections I.2 and I.3); ii) to analyze the evolution and role of the INIA's in the Region (section I.4); iii) to propose changes that could be put in place to take advantage of opportunities, deal with challenges and be part of the new processes of innovation that are developing (sections I.5 and I.6); iv) to identify specific interventions required to put into practice the required transformations (sections I.7 and I.8); v) to contribute to a better understanding, design and management of innovation platforms for the regional agricultural sector (section II).

JEL Codes: O13; O33; O38; O54

Key Words: Agriculture, Agricultural Innovation, Technology, Institutional Framework, National Institutes of Agricultural Research (INIA's - *Institutos Nacionales de Investigación Agropecuaria*), Innovation Platforms.

[1] The authors are Eduardo Trigo, Director of the CEO Group and a Consultant, Nicolás Mateo, Consultant, and César Falconi, Chief Economist of the Division of Environment, Rural Development and Management of Natural Disasters of the Department of Infrastructure and Environment of the IBD. The authors wish to express their most sincere gratitude to the Korean Fund for Technology and Innovation for the support received for the preparation of this document on the Bank's Technical Regional Cooperation, "Nueva Agenda para la Innovación Agricultural de América Latina y el Caribe" (ATN/KK-12739-RG). They also wish to express their special acknowledgement of Luis Macagno (INE/RND), Willem Janssen (World Bank), Gonzalo Rivas (Chile) and Hugo Li Pum (FONTAGRO) for their important suggestions and comments, as well as Lisa Restrepo (INE/RND) for her technical assistance. Furthermore, thanks are owed for comments made by participants at the Worshop for the presentation of the results of the study in October 2012 at the IBD, Washington DC.

Prologue

Innovation in agriculture has played a decisive role in economic and social development throughout modern history. It was innovation in agriculture that made possible the labor liberalization for industrial development in the second half of the 19th century, as well as the consolidation of markets for new products in emerging sectors. Furthermore, technology and innovation have been crucial factors in balancing the supply and demand for food throughout the 20th century and a central element in dispersing the Malthusian threat despite the fact that world population went from some 1.65 billion people in the last century to nearly 7 billion at present. Milestones such as the introduction of Mendelian genetics to crop improvement in the mid-19th century, corn hybrids in the 1930's, the high yield varieties of the Green revolution and, more recently, genetically modified crops in agriculture, and the improvement of pastures and advances in livestock health, are clear and evident examples of the transformative potential of innovation and the immense social and economic benefits associated with these processes.

Throughout this period, Latin America and the Caribbean (LAC) countries have been active participants in these processes. The region began to construct its national systems of agricultural research in the first decades of the 20th century, and for the post-WWII period, most countries already had structures to take advantage of the advances that were occurring in the agricultural sciences to support their efforts at agricultural development. Subsequently, beginning in the 1950's, there was a strong drive towards transformation with the creation in almost all countries of public agencies specializing in agricultural research, following a more or less common pattern of decentralization – in some cases accompanied by administrative autonomy and/or financial independence - and ample territorial coverage, which is known as the model for the national institutes of agricultural research, considered one of the most important resources the region is endowed with, in order to drive its agricultural development.

These initiatives bore fruit and today there is a consensus that their creation has been positive, and that many of the success stories involving innovation and technological development in the region's agriculture have been and are associated, directly or indirectly, with the operation of these institutions. Their contributions have not been solely in the form of knowledge and new technologies, but also in training human resources and the development of information databases – on soils, weather, etc. – indispensable for the most effective management of agricultural processes. Recently, however, these institutions appear to be losing momentum, and their role - while still recognized – is open to debate, in a process which does not differ much from what is happening in other parts of the world, where the role of the public sector in the domain of promoting innovation and technological agricultural development has been subjected to review. This is driven by various forces, notably the changes taking place in the world of sciences that serve as a foundation for the process of agriculture technology development, the diversification of knowledge and technology sources, the transformation of value chains and the growing role the private sector is playing in this entire process. Therefore in various parts of the world, without abandoning the focus points that have proven effective in the past, new mechanisms are being explored to better mobilize actors in the world of science and technology aiming at greater effectiveness in technological development and innovation.

In this context, the IBD has begun a process of debate to analyze how the aforementioned processes are reflected in the region's institutions, and also to identify alternatives for responding to them. This was accomplished by commissioning two studies looking at how changes are occurring in the various countries, as well as what might be the alternatives for responding, drawing on existing experience and aiming at a rapid and effective transition

towards systems and new focal points which fully reflect the new reality, without failing to recognize what has worked in the past and the idiosyncratic characteristics of our farmers and institutional systems.

These studies, prepared by individual consultants, were inserted into a process of dialogue and consultation with various specialists and actors in national systems or agricultural research and innovation. Two workshops were organized, the first to revise focal points for the studies, and the second to review the results of the studies and the different response alternatives to be followed in the modernization of existing arrangements. The documents presented here compile the discussion and suggestions made on those two occasions.

The first part of the document sets forth the way that systems for research and innovation are evolving, their strengths and weaknesses in the new context, and proposes certain focal points regarding how to better articulate them so as to ensure a more efficient and effective use of resources available in each country. The second is more specific and concentrates on an analysis of the concept of "platform" that has been used in various parts of the world and in diverse contexts to mobilize science and technology resources for the sake of specific objectives in technological development and/or innovation. Along these lines, some of the existing experiences are analyzed, seeking to highlight their value in the context of our region, and specific actions are proposed for consideration in the immediate future. The different parts of the document, while they do have their own identity, must be seen as a common thread that offers – from different perspectives- concrete alternatives to decision makers to ensure greater effectiveness of investments through which technological development and agricultural innovation can be promoted in the region.

Part I. New Scenarios for the Institutional Framework for Agricultural Research in Latin America and the Caribbean

I. 1. Introduction

In the last fifty years, the agroalimentary sector has grown significantly and modernized both technologically and in organizational respects (Reca et al., 2010). A few examples of the magnitude and diversity of this, includes what has happened with Brazilian "agribusiness," cereals and oil crops in Argentina, livestock and rice in Uruguay, Chilean fruticulture, fruits and produce for export in Peru. At the same time, alongside these successful examples there are situations of stagnation where conditions of poverty, far from abating, have tended to become more acute, indicating that inclusion is still a pending issue on the regional agenda (IICA, 2011). Crops with productivity gaps of approximately 50% in different countries, and also among regions and production systems situations within the same country, are not infrequent. The available information on the productivity of factors shows, furthermore, a wide diversity. These conditions are the result of various causes but are indicative of important opportunities not being exploited, particularly in the context of what is going on in international agroalimentary markets, and trends reflected in food security in countries of the region.

At present, all indicators, including political ones, point to an "era of change" with respect to the role of agriculture in society, where it would appear to be reaching the end of a long period of low incentives and a clear repositioning of its role in development strategies. Agriculture sees itself increasingly as one of the dynamic transformation sectors in the national economies and a new bioeconomy is in the making, by means of which agriculture no longer plays its traditional functions of producing food and fiber, but also a strategic role in the construction of a society that is less dependent on fossil fuel resources, through production of energy inputs and industrial raw materials that are more environmentally friendly (UNEP, 2011a; UNEP, 2011b). Changes also raise the prospect of a sector offering new job opportunities and wellbeing, as well as a major shift in terms of opportunities for innovation and research needs. Indeed, new knowledge and innovation are the decisive elements in emerging scenarios, and success in taking advantage of new opportunities will depend on how effective are the systems for creating new knowledge and innovation to drive the needed changes. This has begun to be recognized in various fora, and increasingly, innovation is a prominent component in strategic discussions on agriculture and food production. One example of this trend is the recently released strategy, "Chile, an Agroalimentary Power" (http://www.chilepotencealimentaria.cl/ and the World Bank, 2011), where it is proposed to implement policies for innovation, in which incentives to connect with TIC's, capacity building, development of value chains and an adequate distribution of the food system are incorporated into agroalimentary development, as a strategy for improving market opportunities. Furthermore, the growing political importance ascribed to innovation was apparent in the selection of the theme for the 2011 meeting of the Ministers of Agriculture of the Americas, entitled "Sowing Innovation to Harvest Prosperity." At this gathering, the theme of innovation was the central topic, and the ways in which it could serve as an engine for agroalimentary development and, ultimately, development of national economies, was discussed. At the meeting, the Inter-American Institute for Cooperation in Agriculture (IICA *Instituto Interamericano de Cooperación para la Agricultura*), the United Nations Food and Agriculture Organization (FAO) and the Economic Commission for Latin America and the Caribbean (CEPAL – *Comisión Económica para América Latina y el Caribe*) submitted a joint report on the situation and prospects for agriculture, in which the urgency of closing

technological gaps to increase food production and exploiting the advantages with which the region is endowed were emphasized (CEPAL/FAO/IICA, 2011).

In parallel, and in spite of this interest, investments in agroalimentary research have been stagnant, and the institutions in charge of these matters do not seem to command the necessary level of political support. In most cases, agroalimentary research takes place in a funding scenario that bears little relation to the level of opportunities identified above.

The general objective of the document is to contribute to the discussion of the current situation of the National Institutes of Agricultural Research (INIA's - *Institutos Nacionales de Investigación Agropecuaria*) in Latin America in the framework of the National Innovation Systems and the international scenario. Specifically, the objectives are: i) to characterize the challenges they face and the scientific basis on which the INIA's work and function (sections 2 and 3); ii) to analyze the evolution and role of the INIA's in the Region (section 4); iii) to propose changes that could be put in place to take advantage of opportunities, deal with challenges and be part of the new processes of innovation that are developing (sections 5 and 6); and iv) to identify specific interventions required to put into practice the required transformations (sections 7 and 8).

I.2. Challenges to be faced in agriculture and food production

Since its beginnings more than 10,000 years ago, agriculture has been a key sector in the development of society, constantly increasing in complexity due both to the incorporation of knowledge, as well as to the nature of its interactions with the rest of society. Following this trend, and as a result of the new demands put forward at the global level, there is a renewed interest in agriculture's role in accomplishing development objectives. This section reviews some of the processes at play.

I.2.1. The repositioning of agriculture in the context of the challenges of development

After a long period of discriminatory policies directed at agriculture and agroalimentary development, and consequently, of few incentives for research, there appears to be a new interest to reassess them as sources of economic growth and for their contribution to address the economic, social and environmental problems of development. Towards the end of the 1990's, the Millennium Goals made it plain that agriculture has a critical and irreplaceable role in ensuring poverty reduction, food security and environmental sustainability. Since then, the food crisis of 2007/2008, made clearly and brutally obvious the global dangers implicit in a stagnant agriculture and the costs of neglecting research and innovation in this area. This pushed agriculture and agroalimentary research to be included on the agendas of the G8 and G20, something that had never happened before.[2]

The above concerns, far from subsiding in coming decades, will be exacerbated by other situations that are beginning to emerge on the international agenda. In the near future, the

[2] In July of 2009, the G8, together with other countries made a declaration emphasizing that "there is an urgent need for decisive actions to free mankind from hunger and poverty... and in consequence we have agreed to undertake actions on the scale and with the urgency required to achieve global food security. With this purpose, we shall work with vulnerable countries and regions to help them to develop and implement their own strategies for food security, and together, to increase in a substantial and sustained manner the commitments of financial and technical assistance to implement these strategies." This declaration was subsequently adopted by the countries of the G20 and signed by 36 countries and agencies of the United Nations.
(http://www.g8italia2009.it/static/G8_Allegato/G8_Report_Global_Food_Security%2c2.pdf)

world must face the challenge of a "change of era," which, when analyzed in depth, reveals that agriculture – in broad terms– is one of its critical components. Three major trends are converging towards this situation. On the one hand, it will be necessary to meet the demands of a population expected to reach some nine billion inhabitants, before stabilizing around 2050, which means a 70% increase of current demand levels, and even more if it is sought to significantly reduce the nearly 1.1 billion people today who must subsist with less than US$1.25 per day (Word Bank, poverty database, 2011). On the other hand, the natural resource base shows clear signs of deterioration and projections of climate change underscore the need for adjustments in production patterns to mitigate the negative effects of today's actions and adapt to new climate parameters. Finally, the era of cheap energy that began with the discovery of the first oil wells in the second half of the 19th century has reached its end, and in the future, high-energy prices will be an unavoidable reality. Regardless of how these trends play off each other, it is undeniable that the scenario of "business as usual" with respect to energy relations within society is finished, and a search for a society that is less dependent on fossil fuels has become an overriding necessity.

Agriculture is at once part of the problem and part of the solution.

In the framework of a complex network of interactions, agriculture is both one of the principal sources of greenhouse gas emissions – and, consequently, one of the principal drivers of climate change – while also a central component in the fight against poverty and the guarantee of food security (Beddington, 2011). Beyond this, new ways of using biomass, as comprehensive alternatives for replacing fossil fuel resources not only with biofuels, but also with the production of industrial inputs and products that today are obtained from hydrocarbons, are also being discussed as part of a process that, in practice, substantially redefines the relationship between agriculture and the rest of society. Agriculture is not seen solely as a source of labor and food, but as strongly integrated with industrial processes of what has been called renewable raw materials, including all plant, animal and microbial biomass, derived from photosynthetic processes, used as raw materials and energy inputs, apart from their uses as food and fiber. Consequently, a wide array of opportunities for economic and social development is opening up (BECOTEPS, 2011).

In the new millennium, and based on the three major trends mentioned earlier, agriculture has been positioned as one of the axes around which development policy is to be elaborated. This is supported by two contextual challenges. On one hand, a change is becoming apparent in development objectives, which are moving from growth through industrialization to a multidimensional agenda that, in addition to growth, includes reduction of poverty and inequality, food security and environmental sustainability. On the other hand, a structural change is becoming apparent by means of which the growth of agriculture occurs in a globalized food system, with the emergence of integrated value chains pushing major institutional and technological changes (de Janvry, 2009).

Latin America and the Caribbean are well positioned to insert themselves into these new scenarios. The region has an immense wealth of land, water and biodiversity resources, which are of great strategic value. The processes of rural transformation, under way in many countries, and the way in which the region has evolved to become a world leader in biofuels markets and in the incorporation of new and more environmentally friendly technologies, are indicators of this potential. Any prospective analysis of future conditions of supply and demand underscores that the region is to perform a critical role in the construction of new global balances, in food, energy and the environment. For this reason, technological strategies

referred to as sustainable intensification or eco-efficient agriculture, as well as better exploitation of biodiversity, genetic transformation to optimize the plant and animal potential based on industrial uses, and post-harvest improvement, among others, are issues that take on a renewed priority (Jones 2010).

I.2.2. The geography of poverty and its consequences for the demands of research

The importance of technological change and of agroalimentary research as an instrument for poverty reduction is unquestionable (CGIAR, 2011). Research and technological development can help reduce poverty both directly, through an increase in the welfare of farmers (improvement in subsistence farming conditions and nutrition, increases in income through sale of surpluses, lower production costs, conservation of natural resources, etc.) as well as indirectly, through positive linkages between the growth of agricultural productivity and production, and the other variables and sectors of the economy (availability and prices for food and raw materials, employment, consumption, generation of savings and investment surpluses, positive contributions to the balance of payments, etc.). The relative importance of the direct or indirect impacts will depend, in the final analysis, on the distribution of the population and the magnitude of rural and urban poverty and agrarian structure in each particular case.

In this framework, the fight against poverty as such, or associated with the need to foster more equitable conditions within rural settings, has always been one of the strategic objectives of national and international agricultural research, and constitutes one of the most important influences both in terms of priority setting and the design of methodological focal points. This has led towards granting high priority to the development of technological alternatives aimed at increasing productivity in small-scale agriculture and, in many cases, constitutes a central axis for interactions between national and international institutions working in the region. There is no doubt that this kind of strategy has been successful in many cases, although its validity should be reviewed in light of the evolution that the dynamics of poverty has undergone in the region in recent decades.

Latin America and the Caribbean is now a predominantly urban continent. Whereas in 1950, approximately 60% of the population lived in the countryside, in 1990 this percentage had fallen to 30%, and it is expected that it will not exceed 15-20% by 2020 (United Nations, 2009). Together with this transformation, the geography of poverty is also changing, because while total population below the poverty line is growing, it is also becoming "urbanized." (Table I.1).

Table I.1: Evolution of poverty (in millions of people) and of urban population in Latin America, 1980-2010

	Poverty			% Urban Population
	Total	Urban	Rural	
1980	144	69	74	64
1990	210	127	83	70
2000	225	144	79	75
2010	193	129	63	80

Source: CEPALSTAT (2011) and United Nations Population Division: Overview of World Urbanization. 2009 Revision.

Notes: The Poverty line is defined in relation to insufficient income for acquiring daily nutritional requirements and other basic necessities (hygiene, clothing, education and transportation). Poverty indicators include population in a situation of indigence. The analysis includes the following countries; Argentina, (the Plurinational State of) Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, the Dominican Republic, Uruguay, and the Bolivarian Republic of Venezuela.

A predominantly "rural" social phenomenon until 1980, when rural poverty accounted for nearly 55% of the total population, in this century it is increasingly becoming an urban phenomenon, whereby the increase of the population in conditions of poverty takes place in the city and the urban poor have come to represent 68% of the total population with income below the poverty line. In this sense, the situation is markedly different from what is occurring in other regions in the developing world, particularly in Africa south of the Sahara and southern Asia, where rural poverty continues to be the prevailing phenomenon. Even though, its magnitude is significant, both in absolute terms, (according to the FIDA, it affects 24 million people on the continent), as well as in relative terms, considering that in many countries, the rural population below the poverty line continues to grow as a proportion of the total population of rural areas. On the other hand, it is also true that poverty is more acute in rural than in urban areas, inasmuch as in rural areas the percentage of the poor population is more significant. (FIDA, 2011; Berdegué et al, 2002).

From the point of view that concerns us in this discussion, the key point is not so much the poverty in the region, but rather the role that technology and ultimately agroalimentary research can play and what are the strategies that ought to be prioritized in terms of objectives linked to poverty and equity. This is influenced by the type of poverty and also by the production scenarios associated with it. The reality is that a high proportion –for example, nearly two thirds of poor rural families in Chile towards the end of the last decade – did not have access to land under any form of tenure (Berdegue, et al., 2001). For those who qualify as (small) family producers, a recent analysis estimates that out of a total of 15 million, with some 400 million hectares; i) some 10 million, who control roughly 100 million hectares, obtain the greater part of their income from non-agroalimentary work, remittances and/or social subsidies; ii) some 4 million, who control roughly 200 million hectares, are integrated into markets, but face heavy restrictions arising from the poor quality of their natural resources, or a lack of infrastructure and/or services; and iii) only the remaining one million, with roughly 100 million hectares, are able to sustain themselves and hire some labor not connected to the family. In all cases the study found that performance and opportunities in all of these situations are strongly conditioned by the characteristics– such as infrastructure, services, etc. – of the surrounding setting, which in most cases is very unfavorable (Berdegue and Fueltealba, 2011).

In scenarios with these characteristics, any strategy based on productive development will inevitably be of low impact, unless access to resources, and other factors like sufficient income are resolved in order to make it possible to overcome the conditions of poverty in which farmers subsist.

In this context, the potential of agroalimentary research as an instrument in strategies to fight poverty is limited and, in many cases, has only a secondary role. The discussion is not the importance of poverty, which is beyond any doubt, but rather on the efficacy of agroalimentary research as an instrument to solve such problems. Research and technological development are powerful instruments to promote economic and social development, but their potential impacts depend on the setting in which they are applied. The social benefits of investments in agroalimentary research are determined, in the final analysis, by the scale and type of productive reality where they take place. Farmers without land, and small farmers cornered in settings of reduced productive potential, lack the basis to gain access to a share of the benefits afforded by the application of modern science to agricultural production. In the conditions of access to resources in which the region's rural poor live, not even the best technological

advances could have a significant impact on their income, beyond, of course, improvements in their direct situation of food security and nutrition.

The insistence on focusing the efforts of research institutions on these kinds of socio-productive realities may have been one of the reasons why they came to be perceived as of low impact and, consequently, regarded as "ineffectual" for fulfilling their mandates. This in turn may be one of the explanatory hypotheses for the persistent under-investment that has affected public research institutions in most countries. The perception of low impact leads to under-investment, which weakens existing capacities and has a negative effect on expected results and accomplishments.

In terms of demand, changes in poverty scenarios also have a significant importance in the guidance of agroalimentary research activities. In terms of policy, priorities regarding food security are displaced in favor of provision of food for urban populations, which are quantitatively more substantial and reflect a tendency that, far from being reversed or moderated, will become more pronounced in the immediate future. The opening up of economies and their growing share in international trade, as well as the processes of economic and political integration (MERCOSUR, CAFTA, DR-CAFTA, bilateral free trade agreements with the United States and the European Union), whereby agriculture and the food industry are a strategic axis of negotiation, establish the theme of competitiveness quite bluntly, and consequently, the need to expand the quest for productive alternatives that better reflect the characteristics of resources and the manner of entry into markets for small-scale agriculture. Both aspects converge to emphasize that addressing issues of food security will be increasingly oriented towards strategies "centering on urban concerns," instead of "centering on rural concerns" which have prevailed until now. From an urban perspective, the important thing is to ensure an adequate supply of good quality food at accessible prices, therefore efficient agroalimentary systems are required that are capable of offering their products at the lowest possible prices, as well as -ideally- competing as well on international markets. In brief and in terms of policy and "market signals," the quest for efficiency in the use of resources and greater competitiveness are transformed into key components in the struggle against poverty.

In the framework of the region's macroeconomic and institutional reality, the traditional focal points connecting agroalimentary research with small-scale agriculture geared towards food production offer limited opportunities, and only in very specific situations. In this context, it appears that the moment has arrived to adjust strategies for "producing food with the poor" (emphasis on direct impacts), and embrace the objective of "producing food for the poor" (emphasis on indirect impacts), seeking production alternatives based on the type and availability of resources to which they have access, and not necessarily to strengthen their role in food production.

These perspectives are increasingly reflected in new rural development strategies addressed at solving problems of access to resources (for example by promoting farmers' associations), the creation of non-agroalimentary income alternatives in rural areas, and building farmers capacities (FIDA, 2011; RIMISP, 2009). From this point of view it is important to underscore that, except for a few specific situations, the small producer in Latin America and the Caribbean is not an isolated economic actor in a situation of subsistence, but is rather generally integrated into the market. In fact, a major portion of basic foodstuffs consumed in the region, plus significant ammounts of export crops such as coffee, cotton and tobacco, are grown by small producers. Questions arise regarding to what end should productive efforts be directed, and how to optimize the competitive advantages of small growers. This is an area in which

agroalimentary research can make a strategic contribution by developing new products and strategies to facilitate market entries with greater added value, such as tropical fruit and off-season production that make it possible – through higher prices – to offset restrictions of the scale of production.

I.2.3. International markets and agroindustrialization

In the framework of the processes of globalization that have dominated the international economy in recent decades, growing economic interdependence and greater insertion of economies in the international market have led towards deregulation and the opening up of economies in the region, as a basic instrument for driving productive transformations and increasing the volume of foreign trade. From protected economies, they have moved into a growing degree of openness and prioritization of agricultural exports. All of this has made it possible to reposition primary production, both within national economies and international markets.

Nevertheless, the opening of economies have also brought the region's agroalimentary systems into more direct contact with international forces of demand and supply, characterized by a swift evolution towards differentiated production and greater added value, even in commodity markets where demand is growing for raw materials with specific characteristics and qualities (such as different varieties of rice, saturated fat content in vegetable oils - particularly for grapeseed and soybeans - and omega 3 content). In general, areas and products that were already integrated into international trade have benefited and strengthened, while traditional sectors of small-scale agriculture are facing a growing loss of competitiveness and productive disarticulation.

These new trends have significantly altered scenarios in which profitability and sustainability of agricultural operations have been based on the extensive use of land with low levels of input use, low yield per hectare and low production costs.[3] At present, generally speaking, all incentives point towards development of high productivity strategies in which the incorporation of technology constitutes an indispensable component.

The new scenarios also indicate new kinds of relationships between the agroalimentary sector: producer of foodstuffs as raw materials, and consumers. As demand for differentiated products of greater added value increases, the importance of agroindustrial value chains also grows – upstream towards providers of inputs, and downstream with transformation and commercialization - as strategic components of food-producing systems. One consequence is that agriculture as such tends to lose specificity, and its development comes to be governed by group logic. The importance of these processes is clearly indicated by the weight of the links in the generation of added value for the sector. In 2007, primary production in Brazil –including production used as an input – accounted for roughly 30% of the added value of agribusiness, while raw materials, the processing industry and the various components of the distribution system shared the remaining 70% (IICA 2007, Brazil, 2010).

The degree of agroindustrial integration is a critical element for better exploitation of these new trends. In Latin America the level of integration - measured as a proportion of

[3]These strategies find their elucidation and support in the logic of an agricultural export model based on the wealth of the region's resources but restricted by a macroeconomic environment of high instability and discriminatory policies towards agriculture, including low domestic food prices and high prices for inputs that discourage investment and technological development (Piñeiro and Trigo, 1983).

agroindustrial products in the consumption of food – does not amount to 30%, compared to levels of between 80% and 90% in developed countries. This gap is indicative of the potential that agroindustrial development may afford.[4] Indeed, according to de Ferranti, et al. (2005), the multiplier and spillover effects of the agroalimentary sector on the rest of the economy – substantially greater for the countries of Latin American and the Caribbean than in other regions of the developing world – increase significantly when the agroindustrial chains are added to the primary sector.[5]

At the same time, these transformations are giving rise to new social actors who need to be recognized and incorporated into decision-making processes. The traditional heterogeneity of producers of a given product and the location and size of the undertakings, take on greater complexity as a consequence of a multitude of differentiating factors: entrepreneurial and managerial aptitudes, technological behaviors, financing strategies, ways of entry into the value chain, etc. In parallel, other economic agents such as providers of technical services and inputs, contractors, and processing and marketing companies are becoming more important.

Another key element is the growing participation in agroindustrial development of transnational companies of considerable size. The FAO estimated in 2005 that in the ensuing ten years, between 40% and 60% of agroalimentary products from "emerging countries" would be sold in large commercial outlets controlled by transnational distribution chains. Data on direct foreign investment show that during the first half of the decade, there was a continuous increase in investment flows, together with intense activity of mergers and acquisitions on the part of American manufacturers of foodstuffs, which has intensified in recent years to include internationalization not only of large-sized firms, but also of many medium-sized companies (Deloitte and Touche, 2004, Mercado and Córdova, 2011). One indicator of the importance of this trend is that in 2007, twelve of the one hundred largest companies in the region (nine from Mexico and Brazil and one from Argentina), were engaged in agroalimentary activities, nine of them multinational in character (Mercado and Córdova, 2011).

What are the technological consequences and what are the effects on research and technology transfer of these processes? First, there is a change in the process of innovation. The increased diversification and differentiation of products as competitive instruments means that in many cases the search for greater yields and the increase in productivity and cost reduction cease to be the sole reason for demand for improved technologies, giving way to issues relating to quality, harvest opportunities, or product conservation or processing.

Secondly, there is the need for integrating primary production with the processing and market phases as a point of departure for defining technological strategies as well as research and development priorities. The transition from mass production for direct consumption or export, to product differentiation and competitiveness, implies, from a technological point of view, going from a vision of "supply" -productivity, cost efficiency, etc. – to one of "demand"- producing the required technological developments to occupy, maintain and expand particular market segments. It is necessary to incorporate into the institutional, organizational and managerial considerations the reality that the agricultural sector produces raw materials, while the consumer consumes food.

[4] Given that export of *commodities* without any kind of processing accounts for a relatively large amoung of regional production, this comparison under estimates the existing potential for agroindustrial development.

[5] Emphasizing this point, for Brazil, Chile, Guatemala and Mexico, Schejman (1994) estimated income and employment multipliers in the agroalimentary and agroindustrial sector at 8.7%, el 16.7%, 10.2% and 15.5%, respectively, and as higher than those for any other sector of the economy, excluding oil and services.

In this context, agriculture as such loses its identity. From a technological perspective, this requires visualizing the entire value chain, and not just its individual components. Isolating primary production from agroindustry -inputs and processing- and final distribution, hinders the generation of innovation and improvements in competitiveness.

I.3. The new scientific and institutional basis for technological agricultural agroalimentary development

Two new trends have begun to consolidate as a central part of the scenario linked to innovation and technological development: biotechnology –and to a lesser extent, computer science – and the participation of the private sector. Although the origin of both dates back several decades, in addition to being closely connected, in recent years they have taken on greater importance.

I.3.1. Biotechnology and software: a new framework of opportunity for agroalimentary technological development

Advances in the field of biotechnology and computer technology constitute the basis for a new techno-economic paradigm, with profound impacts on social organization and the productive processes of present day society. These developments are reflected both in the organizational processes of agriculture and its linkages with other economic sectors, as well as in the nature of the associated technological processes and the actual manner of “doing science" within the sector.

Advances in molecular biology and biochemistry achieved in the past twenty years and which have led to what is known as the "new" biotechnology have made research and development processes more precise and reliable, and are applicable to practically all fields of human activity. In agroalimentary development, their applications range from plant cultivation to forestry activities, animal health and production, and agroindustrial processes. These traits are of unquestionable value since they allow for a more fluid linkage of agricultural research with the remaining sectors and –in technological development- open up a broad array of opportunities for facilitating vertical articulation of primary production with post-harvest, processing and marketing.

In organizational and institutional development, the principal impacts can be gleaned from the fact that the disciplines involved –and the sources of information used and the human resources required- are very different from the scientific disciplinary foundation of traditional agroalimentary research. On the other hand, with the advent of new biotechnologies, the traditional distinction between pure and applied science tends to become blurred, and often commercial applications emerge directly from “basic” research, calling for a redefinition of emphasis between work in the laboratory and the field, and the development of precise arrangements for monitoring research processes, in order not to lose sight of commercial considerations.

In this new "climate," changes are required in the development of human resources and in the nature of scientific and informational links on which research institutes depend, including closer cooperation with disciplinary centers and centers of biotechnological research in universities, and between public research institutes and industry. In practice, the relative isolation that existed among institutions of the scientific-technological community is breaking down. To take advantage of the potential of biotechnology in the agroalimentary-agroindustrial

fields, there is a need – in many cases – for generic capacities that have no reason to be located within the actual research institutes; it is necessary to have in place -in the national domain- institutional mechanisms to allow for efficient and effective articulation between capacities and needs.

Furthermore, a large proportion of the new biotechnologies and their applications can be appropriated, which has also brought about a redefinition of the public-private character of many areas of research and laid the foundation for an active participation of the private sector in financing and development.[6] These relationships are a crucial element for harnessing the potential of new technologies, which in the final analysis depends on the existing capacities for production on a commercial scale of the processes of research and development (R&D). The key limiting factor is the availability of financing. The fine tuning of new technologies and bringing them up to industrial scale – processes that in most cases are subject to complex biosafety regulations and long approval processes on the part of public regulatory agencies – require investments of certain magnitude and risk. The absence of venture capital is a factor to be resolved if the potential of these new technologies is to be further exploited (Kuramoto and Torero, 2009).

The impacts of computer technology, including microelectronics and advances in the fields of communications and teledetection, are perhaps less apparent, but not of lesser importance for agricultural, and agroindustrial, research and technology transfer. In procedural terms, the application of microelectronics to the processing and transmission of data reduces research costs by facilitating the search and access to information, preventing duplication and facilitating the sharing of the results of research within and beyond the institutions. These elements imply major reductions in the operating costs of research projects and facilitate institutional decentralization. Furthermore, advances in teledetection and simulation techniques would permit a reduction in the number of experimental replications, as well as the projection of results to other related agro-ecological areas.

The organization of private computer networks that include technological information in their services opens a new and efficient mechanism for information transfer to producers, but at the same time it is also making possible the appropriation of a broad spectrum of agronomic research that up until now has been considered the archetype of public goods. Indeed, by charging for the services they provide, network operators actually appropriate part of the benefits generated by research conducted by public institutes. These processes, though as yet incipient, are going to undergo increasing development and open up both opportunities with respect to establishing new relationships for research financing, as well as new ways of organizing technology transfer.

I.3.2. The growing role of the private sector in research and technological development

The participation of the private sector in agroalimentary research is a phenomenon of growing importance all over the world. In the countries of the Organization for Economic Cooperation and Development (OECD), private investment in R&D accounts for approximately 60% of total investment (HighQuest, 2010), although there is no precise data on the magnitude of private participation in Latin America and the Caribbean, apparently is also growing significantly and in very diverse sectors and institutional arrangements.

[6] In 2009 investments of the private sector in biotechnology in Latin America rose to 20% of the total (Falck Zepeda, et al, 2009).

To a great extent, the development of private participation in R&D is a response to greater possibilities for those conducting and/or financing the consolidation of agricultural markets or the improvement of infrastructure and communications, to appropriate the benefits by responding to the greater availability of basic information and skilled human resources that the public sector has developed over the past decades. All of these factors have enhanced the interest and actual possibilities for the private sector to become involved - directly or indirectly - in R&D activities in agricultural and agroindustrial areas (see Box I.1). In addition to the traditional forms of private participation in the production and commercialization of technological inputs, other developments are being put in place through producers' organizations, on a territorial or value chains basis, that represent key institutional innovations, not only because of the kinds of resources that they contribute, but also because of what they mean in terms of actual possibilities for interaction among productive sectors and existing capacities in research and development (see Box I.2). In parallel, from 1980 onwards a series of foundations to support research have been created, essentially generic organizations not oriented towards any productive sector in particular, but rather towards fostering technological development by financing research and related activities. Their greatest appeal lies in their acting as bridges or "banks" between the private and public sector to manage projects aimed at harnessing the existing capacities of the public sector, at the same time resolving one of the traditional constraints on private sector support for public institutions: arrangements that

Box I.1: Relations between companies and public institutions: the case of Innovaciones Tecnológicas Agropecuarias-INTEA S.A.

The relationship between public institutions and private companies for the development and commercialization of certain technologies, has become increasingly important in pace with the growth of local markets for technological inputs for agriculture, and range from the provision of simple services and field tests for generating information for the commercialization of technology, to "venture" R&D contracts with shared intellectual property, royalties, etc., as appropriate. These arrangements are similar to those existing between universities and companies in the United States and Europe, and have great importance. On the one hand, they link the innovative capacities existing in the public sector to the capacities for production and commercialization that are needed for research results to reach users and produce the impacts expected of them. On the other hand, and this is, perhaps, most important, they enable national companies to have access to R&D capacities that they would have difficulty internalizing within their own structures due to problems of scale and market size. This kind of contract is quite common, and in some cases, such as the National Institute of Agricultural Technology (INTA - *Instituto Nacional de Tecnología Agropecuaria*) in Argentina, represents a key component of the institution's strategy, to the point that it has created a private company – INTEA S.A. (http://www.inta.gov.ar/ins/intea/index.htm) – in order to manage the technological "business" that has arisen from this kind of relationship.

Source: Prepared by authors, based on information from www.inta.gov.ar

ensure a high degree of transparency on the part of the latter. In this light, foundations offer this service to private sector investors and operate as public sector "agents" to generate additional revenues.[7] In most cases initial financing has come from development assistance agencies that felt national institutions did not offer sufficient guarantees of efficiency and effectiveness with regard to the use of their funding, or particular political situations as was the case of the Fundación Chile. Except for the latter, most of these initiatives did not survive their

Box I.2: Different types of private sector participation

In addition to commonly known strategic participations by the private sector with public institutions (Box I.1), at least two types are recognized in Latin America that make it posible to provide examples of these mechanisms.

The first of these is associated with a territorial base and is exemplifed by the National Coordinator of Produce Foundations, A.C. (COFUPRO - *Coordinadora Nacional de las Fundaciones Produce, A.C.*). This is a coordinating agency that represents *Fundaciones Produce* (these are non-profit associations of producers with their own juridical personality and assets, the purpose of which is to ensure a bigger and better generation of agricultural and forestry technology in Mexico) before public and private institutions at the national and international level, as a response to their common needs and individual limitations, to support technological innovation. To this end, they apply various strategies, notably i) strategies for direction (centered on alliances with similar institutions; the procurement and diversification of funds; the development de Technological Innovation Units in the country's primary agroindustrial chains); ii) Operating strategies, centered on aspects of management and integration and the systematization of information); and iii) strategies for management.

The second is associated with financing research and has the example of National Centers for Coffee Research (CENI – *Centros Nacionales de Investigaciones de Café*). In particular, it is based on recognition by various agricultural production guilds in Colombia of the need to invest in research to improve productivity and ensure competitiveness, and to do this they have created their own research centers. Financed primarily by the private sector, the CENI's (as they are commonly called), have been an important tool in the country's economic development.

Source: Prepared by authors based on data of COFUPRO web page (www.cofupro.org.mx) and CENI (http://www.cenicafe.org/)

"baptism of fire," that is to say, survive beyond the initial project that created them and be capable of generating a space of their own to attract other donors and private sector agents interested in supporting additional R&D. Once the initial period has elapsed, these organizations have either been reduced drastically or have been adjusting within a space of

[7] The following are some of the foundations – or legal-institutional arrangements of a similar nature – that have been created under the model in question. The main sponsors are indicated in square brackets: Fundación para el Desarrollo Agropecuario (FUNDAGRO) Ecuador,1987,[USAID and Gov. of Ecuador]; Fundación Salvadoreña de Desarrollo (FUSADES) El Salvador, 1983, [USAID]; Fundación Hondureña de Investigación Agrícola (FHIA), Honduras, 1984, [United Brands Co., USAID, Gov. of Honduras]; Fundación Servicio para Agricultor (FUSAGRI), Venezuela, 1972, [Compañía Shell de Venezuela and 45 national firms]; Proyecto de Apoyo Tecnológico para las Industrias de Exportación (PROEXAG), Guatemala, 1986, [ROCA/USAID]; Fundación para el Desarrollo de Agro (FUNDEAGRO), Peru, 1988, [USAID, INIA, Organización Nacional Agraria (ONA)]; Fundación Chile, Chile, 1976, [ITT (USA) and Government of Chile]; Coalición Costarricense de Iniciative de Desarrollo (CINDE), Costa Rica, 1982, [USAID]; *Jamaican Agricultural Development Foundation* (JADF) Jamaica, 1986, [USAID]; Fundación para el Desarrollo Agropecuario (now Center para el Desarrollo Agropecuario y Forestal CEDAF), Dominican Republic, 1987, [CNHE (private), USAID and the Government of the Dominican Republic].

development cooperation, undertaking to manage resources in other areas associated with rural development.

In brief, the private sector has been transforming itself into a key actor in agricultural and agroalimentary R&D, in a trend that will become more extensive and consolidated. To the extent that the issue of competitiveness is gaining space in strategies for the sector, the issues of technology and research are also gaining importance, likewise it is to be expected that the productive sectors will influence the direction of investments and accelerate processes for the incorporation of new knowledge and technology. The growing importance of biotechnology and the agroindustrial steps in the innovation process reinforce these trends, and drive the search for flexible arrangements with firms active in specific areas, where competitive technologies and innovations that can be appropriate tend to be more important than primary production. It should be underscored, that until now, not much progress has been made in relating the existing capacities in agroindustrial activities. The incorporation of specific work in processing, handling and post-harvest in general, whether in the form of research on products or specific processes, or else as information for markets and assistance to interested companies, is a pending matter. Where it has occurred, it has been as part of programs and projects connected to generic instruments for the promotion of science, technology and innovation, within the domain of the Ministries of Science and Technology, with a very limited participation of agroalimentary research institutions (see Box I.3).

Box I.3: Innovation funds and promotion of consortium efforts

In Latin America, two kinds of incentive and support for innovation activities have been used: funds to promote innovation and financing of Productive Consortia. THe latter, although they have sought to achieve similar results propose a working metodology that is substantially different.

Funds – Brazil and Argentina are perhaps the most relevant cases – essentially emphasize financing as an instrument to promote innovation. In Brazil, where sectorial funds have existed since the end of the 1990's, the aim is to finance research projects, development and innovation. They promote a deconcentration of science and technology activities and the consequent dissemination of their benefits. There are 14 funds in strategic or priority sectors of the economy, and 2 horizontal funds in important areas for R+D (infrastructure and university-business cooperation). These funds are financed with *ad-valorem* mechanisms specific to each sector that are managed jointly by representatives of the private sector, the respective ministeries and the academic world. In Argentina, the Argentine Technological Fund (FONTAR - *Fondo Tecnológico Argentino*) has similar objectives, but it is financed by funding from the national treasury that, in both cases, supports diferent kinds of projects (R+D, subsidies to companies, clusters, etc.), and they are implemented through public bidding processes and permanent loan offices, as appropriate.

The productive consortia, used in Chile, aim to integrate the efforts of scientific and technological institutions with the private sector under a partnership structure focused on solving problems identified as strategic to the development of the productive sector in question. They are administered by the National Council for Scientific and Technological Research (CONICYT – *Consejo Nacional de Investigación Científica y Tecnológica*) Bicentennial Program, and are funded by a World Bank loan to the Chilean Economic Development Agency *(*CORFO – *Corporación de Fomento de Producción*), of the Ministry of Economy – executed through its INNOVA Program and the Foundation for Agrarian Innovation (FIA – *Fundación para la Innovación*) of the Ministry of Agriculture. The organization of the productive consortia is derived from the technological institutions identifying their lines of work in research based on the current state of their abilities and their own evaluation of the scientific and technological challenges to be addressed, and do not necessarily aim to solve problems with productive applications. To reverse this situation, the development of consortia is conceived as coming from productive sectors and results in the creation of an enterprise, which is what will carry forward the research process –usually of excellence, but with direct applications in the productive sector; the fine tuning of the technology, including its scaling, as appropriate, its transfer, commercialization and dissemination, as well as the training and insertion of highly skilled human capital into key areas for industry and the regions of the country. The goal that is sought is to combine cutting-edge research with the patenting and commercialization of the new products created.

Source: prepared by authors based on web pages of the institutions and programs mentioned.

I.4. The institutional agroalimentary research system in LAC: structure and evolution since the creation of the first national institutes

When one thinks of agroalimentary research in Latin America and the Caribbean (LAC), one thinks immediately of the model of the national institutes of agricultural research (INIA's) as the region's typical and predominant institutional form. This idea is correct, in the sense that all, or nearly all countries in the region have a public institution within the domain of the Ministry of Agriculture, and this institution accounts for the bulk of the country's agricultural research capacity. This basic "model," however, has been changing significantly, both in terms of its orientation as well as in stature in the countries. In the following paragraphs, a summary of how the model has evolved is presented, as a point of departure for analyzing the best possible options in the framework of the challenges confronting the region.

1.4.1. National Institutes of Agricultural Research (INIA's), the principal component of the present system

The national institutions for research and technology transfer were created at the end of the 1950's in a context of predominantly agrarian societies, with a mostly rural population, and where there were farmers had scarce linkages to the market, producing mostly for their own consumption. The production of items or "commodities" for export was in most cases the axis for the insertion of economies into international markets and their main source of foreign exchange. In this framework, research and technology transfer institutions were designed aiming at modernization of agriculture via technology transfer, which it was assumed would be available in the developed countries (Schultz, 1964). The goal was to integrate agriculture into the emerging market economies, increasing agroalimentary outputs, foreign exchange and savings, and to facilitate the transfer of labor to urban industrial sectors, on whose growth the strategy for an industrialization of import substitution was based (Reynolds, 1975).

This conception, identified as the " productivity paradigm," was founded on the idea that in the developed countries there was sufficient technology available to drive the agroalimentary modernization of the countries in the region, and what was lacking were effective mechanisms to adapt it to local conditions and disseminate it among farmers. Based on this idea, most countries undertook to create semi-autonomous public research institutes, some of which were also made responsible for extension (Trigo, Piñeiro and Sábato, 1983). These organizations, conceived as less bureaucratic and, at least on paper, more independent from political pressures, assumed responsibility for research that, up until that time, had been research units of the Ministries of Agriculture, and proceeded to form the basis of national research and technology transfer systems, structures that in the ensuing decades would receive strong support from the international development assistance community. For the most part, they were structured with a high degree of centralization, governed "from the top down," and with a fragmented and "supply-side" conception of the technological process. Their objectives have been to solve technological problems of primary production and promote the adoption of new available technologies; the post-harvest and agroindustrialization stages were not perceived as high priority and, in cases where they received some consideration, it was within separate organizational structures. The first of these initiatives, back in 1956, was the National Institute of Agricultural Technology (INTA – *Instituto Nacional de Tecnología Agropecuaria*), of Argentina and it was followed by similar structures in practically all the countries of the region, in a process that has persisted practically into today, even as contextual conditions –

including sectoral policies – have changed significantly.[8]

The prevailing sectoral policies are aimed at improving production and to induce the adoption of technological packages -essentially the use of improved seeds and other inputs – as a means of increasing the supply of foodstuffs and keeping prices low for urban consumers. The State has performed a key role in technological change, as a result of the conception of what its role should be in promoting economic development, and also owing to the public goods nature of the technologies created. In tandem, the State also took action to shore up the incipient level of participation of the the private sector; which in most cases was limited to providing seeds and agrochemicals, while the food processing industry was still in its first stages of development and was strongly dependent on public sector support (Trigo, 1981). The overvaluation of exchange rates, the subsidizing of credit and other inputs and state intervention in the commercialization of agroalimentary products were some of the instruments of economic policy used to ensure the economic viability of the proposed technologies. This state intervention was justified on the grounds that the enhancement of the agroalimentary sector was a strategic requirement to reduce inflation and develop the economy.

This institutional arrangement was complemented by the creation, from 1960 onwards, of the International Centers for Agricultural Research (*Centross Internacionales de Investigación Agrícola*) sponsored by the Consultative Group on International Agricultural Research (CGIAR). The Centers were oriented towards facilitating the linkages between national institutions and centers of excellence in more advanced countries, focusing on the collection, improvement, evaluation and distribution of germplasm, and in training national scientists. Following the same logic of the national institutes, the international centers were designed to create a critical mass of highly qualified scientists with access to sufficient resources in a non-bureaucratic environment and shielded from political pressures. Within this framework, between 1966 and 1972, the International Center for the Improvement of Maize and Wheat (CIMMYT – *Centro Internacional para el Mejoramiento del Maíz y el Trigo*), in Mexico, the International Center for Tropical Agriculture (CIAT – *Centro Internacional de Agricultura Tropical*), in Colombia, and the International Potato Center (CIP –*Centro Internacional de la Papa*), in Peru, were founded. In the last 20 years these three centers have established themselves as key actors in the regional system of research and technology transfer; furthermore, also active in the region are some of the centers of the CGIAR system located in other parts of the world, although their impact on research capacities and activities is much less.

[8] The INIA's by country and year of creation in Latin America are:

- ✓ Instituto Nacional de Investigaciónes Agropecuarias (INIAP) of Ecuador (1959)
- ✓ Fondo Nacional de Investigaciónes Agropecuarias (FONAIAP) in Venezuela (1959/61); in 2000 it came to be called the Instituto Nacional de Investigaciones Agrícolas (INIA)
- ✓ Instituto Nacional de Investigaciónes Forestales, Agrícolas y Pecuarias (INIFAP) in Mexico (1960)
- ✓ Instituto Colombiano Agropecuario (ICA) in Colombia (1963)
- ✓ Instituto Nacional de Investigaciónes Agropecuarias (INIA) in Chile (1964)
- ✓ Instituto de Ciencia y Tecnología Agrícola (ICTA) in Guatemala (1972)
- ✓ Empresa Brasileira de Pesquisa Agropecuária (Embrapa) in Brazil (1972)
- ✓ Instituto Boliviano de Tecnología Agropecuaria (IBTA) in Bolivia (1975)
- ✓ Instituto de Desarrollo y Investigaciónes Agropecuarias (IDIAP) in Panama (1975)
- ✓ Instituto Nacional de Investigación Agropecuaria (INIA) in Uruguay (1989)
- ✓ Direction de Investigaciónes Agrícolas (DIA) in Paraguay (1992)
- ✓ Center Nacional de Tecnología Agropecuaria y Forestal (CENTA) in El Salvador (1993)
- ✓ Instituto Nicaragüense de Tecnología Agropecuaria (INTA) in Nicaragua (1993)
- ✓ Instituto Nacional de Innovación y Transferencia de Tecnología Agropecuaria (INTA) in Costa Rica (2001).

For the most part, this institutional system –the first generation of INIA's – met the goals that had been set for it, particularly with respect to increase productivity and keep food prices low for a population in a rapid process of urbanization (FAO, 1996; García Olmedo 2010). The objectives could be stated indiscriminately in terms of hunger, poverty or under development, but the objective was always summed up as increasing the availability of agricultural supply (foodstuffs or *commodities* for export) and the strategy was to increase productivity for a relatively small number of key species of traditional as well as commercial agriculture. Improvement of varieties and solving problems of soil fertility and plant protection through greater use of energy inputs comprised almost universally the scientific-technological strategy followed. Work was done with commodities for undifferentiated clienteles and markets, where the supply side prevailed as a central criterion for selection of priorities.

I.4.2. INIA's and technology transfer: from the extension model to rural development

In recent decades the region has undergone a permanent process of change that, in fact, has modified the insertion of the agroalimentary sector in the economies and, consequently, the demands for technology, and the nature of research and development activities required to meet them. A new set of concerns and perspectives have also appeared in today's society with an impact on demands for research and technological development. These transformations have undermined the apparent "simplicity" outlined above and are introducing a growing complexity of objectives, some of which are even contradictory. Furthermore, they have major consequences in the institutional, organizational and managerial schemes where agricultural research and technology transfer take place.

The macroeconomic adjustment policies promoted by multilateral agencies at the end of the 1980's and early 1990's, as a consequence of the foreign debt crisis of the previous decade, significantly modified the institutional frameworks aimed at the agroalimentary sector and rural population. On the one hand, the dismantling of support infrastructures in terms of services and the provision of inputs – seeds, credit, and commercialization – that had accompanied the creation of the technological research institutes occurred in various places. On the other hand, there was also a change in the conception of policies for rural development, and programs for the productive sectors that had predominated since the 1950's. A more comprehensive vision of poverty and rural development has been put forward, in which technology is only one of the instruments of State intervention, within the framework of more encompassing programs and projects, which may also include infrastructure –roads, health, etc. – access to markets and education, as well as the beneficiaries' participation in project identification, design and execution.

Specifically, extension programs in Latin America and the Caribbean have been focused on small-scale agriculture as a way of improving rural living conditions and bringing technology (knowledge) that serves to increase productivity and act an engine of development. Initially, extension was public in character, and in practice followed the same format throughout Latin America keeping close linkages with the INIA's and technology transfer work. It is worth noting LAC has had the implementation of "a single extension model," which today after the dynamics of change presents a diversity of conditions and objectives.

According to Roseboom, et al. (2006), four great transformations have taken place over the past two decades in extension services:

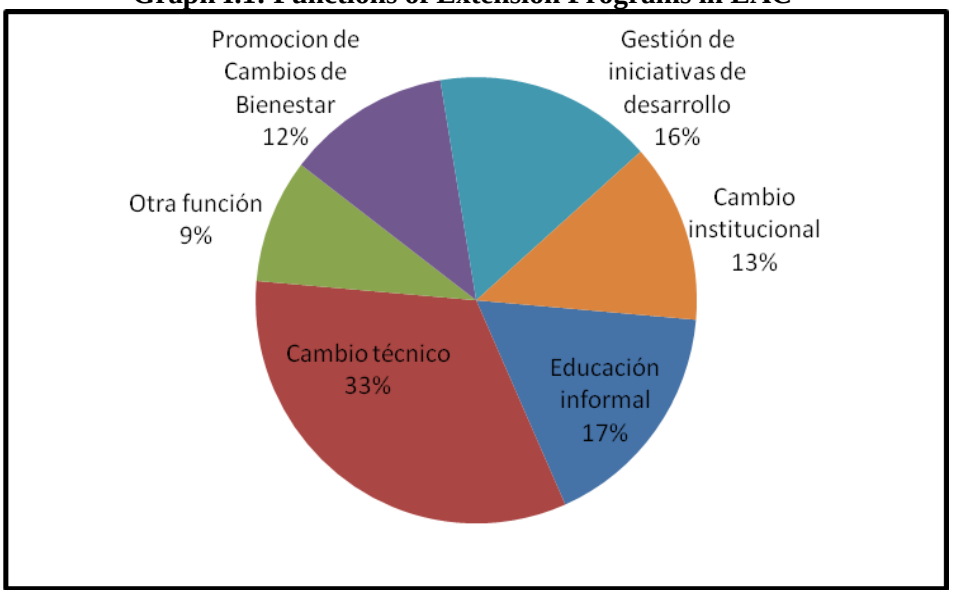
- co-financing of service by direct beneficiaries;
- greater customer orientation, and greater participation of the latter;
- decentralization of service delivery; and
- outsourcing of service delivery.

At the start of the extension programs in the 1950's and 60's, the target populations were generally made up of subsistence production units, with the expectation that the incorporation of technology and knowledge with training could make way for increasing capitalization, productivity and additional food production. It was essentially a public service. Nowadays, numerous rural communities have advanced to higher stages of development, are more connected to the market, and so it is possible to observe transformations in the way these extension services or technical assistance are financed, no longer exclusively dependent on public support, especially when it comes to agricultural communities that generate a significant economic surplus through the modernization of their productive processes. On the other hand, there are programs of incentives to adopt technologies such as the "technology bonus" in Honduras, that take the form more of assistance than of extension, in addition to providing seeds, fertilizers and other inputs.

Definitely, although extension services began to be implemented in the region through INIA's, they have become more complex and have taken different forms. The INIA's have ceased to have a monopoly on these activities, although they continue to contribute substantial resources (both economic and human) to their implementation. In particular, as can be seen in Graph I.1, only 33% of the functions currently performed by extension programs are concerned with technical change, while the rest have to do with social and institutional modifications.

Parallel to the growing complexity and diversification of extension systems, there has been a substantial increase in their budget. Both the magnitude of funding as well as its growth in the past decade, are important indicators of the reactivation of extension programs, not only as a result of investments of the region's governments, but also due to a flow of resources from non-governmental organizations (NGO's), municipalities and producers' organizations. The budget growth observed in the past decade, as of 2002, accounted for some US$ 125 million dollars annually, equivalent to 15% of the total allocated to agricultural research (Ardila, 2010). This situation implies a major under-investment in research, or what amounts to a drag on the circulation of methodologies, knowledge and technology that could be increasing the welfare of farmers with limited resources (Ardila, 2010). In particular, as indicated in the quantitative section of the document, there has been no significant increase in the budget allocated to agricultural research in the region.

Graph I.1: Functions of Extension Programs in LAC



Source: Ardila 2010

Promotion of changes in Welfare (12%)
Management of development initiatives (16%)
Other functions (9%)
Institutional change (13%)
Technical change (33%)
Informal education (17%)

In this context, the majority of INIA's have been progressively pushed to become development agencies, in many cases at the expense of their research and knowledge creation functions.[9] To a great extent, this has been the consequence of their image as successful institutions – especially when compared with the failed attempts of the government to intervene in the domain of providing inputs (seeds, credit) or commercialization– and also because of their considerable territorial presence, an indispensable requirement for the implementation of new rural development policies. This has often transformed them into agencies better suited to carry development programs and implementing public policies, issues that have greater visibility, urgency and political weight than research. These trends have also been reinforced by the fact that, in parallel, the private sector has been acting as a provider of new knowledge and technological services, particularly in commercial agriculture, therefore the redirecting of public efforts in research would not have had clear impacts in the short term.

These changes had a powerful effect on the structure and behavior of INIA's. On the one hand, it was necessary to adjust the structure of research and extension organizations –in some cases- to turn them into intervention agencies, with responsibilities way beyond the technological sphere, they often became responsible for the implementation of rural development programs– or important parts thereof – and, consequently, they had to adjust their structures, human resources and mechanisms for interaction with state agencies to suit new requirements. The generation of knowledge, their original mandates, came to be simply one more component of their "real" mandates, even when this was never formally enunciated and they continued to be considered "research" institutions. On the other hand, the new emphasis on a participatory approach also entailed the need to revise the "linear" and "supply-side" model of technological

[9] In particular, this conversion resulted in the appearance of second generation INIA's characterized by their ceasing to focus activities around agricultural research (Barrera, - http://www.arturobarrera.com/- 2011).

development, in favor of participatory methodologies, to better reflect the new perspectives, as well as the characteristics and limitations of the sectors that were now prioritized. This involvement in fighting poverty and rural development distracted institutional attention and energy, removing them from research and technological development, it also changed the mechanisms for the selection and promotion of personnel and, consequently, the institutional culture of these organizations and -what is perceived by some- as their growing politicization.[10]

I.4.3. National innovation systems as a framework for agricultural research

In recent years,, a new axis of institutional development has been imposed, that of innovation systems, conceived as a network of agents and their interactions that are directly or indirectly related to the introduction and/or dissemination of new products and new technological processes in the economy. This is a consequence of the growing weight of concepts associated with the knowledge economy and the prevailing perception that competitiveness is not related to science and technology *per se*, but rather to innovations, understood as concrete improvements (in productive, economic, social and environmental terms) of present situations. In brief, new knowledge and technologies are introduced and assimilated into specific economic and social processes. In this context, institutional leadership loses weight in favor of concepts associated with learning, complementation, interaction and multiplicity of actors, elements predominant in current policy discussions for science, technology and innovation in the agroalimentary sector.[11]

The emphasis on innovation is the appropriate emphasis. Society's interest in investing in the generation of new knowledge and technologies –which are, in the final analysis, research products – is not for their own sake, but rather for the greater good that can be achieved through their use, in essence, the innovation process! Given the particularities of innovation in the agroalimentary sector – the small scale of actors, specific biological processes and locations, etc. (see Pardey et al., 2007)- and the importance of context for decisions at the farm level, a more holistic perspective such as that proposed by the concept of systems innovation, ought to entail an improvement in the effectiveness of research efforts. Science and technology are critical factors for improving productivity, however their effectiveness is enhanced when there is greater interaction with research clients in the identification of problems, implementation and evaluation, as well as with infrastructure and the functioning of value chains. In most industrial sectors – including those connected to the food industry – innovation takes place in quite a natural way, since frequently the development of new knowledge and technologies occurs within the companies themselves. The process of trial and error, which gives feedback for research and expedites the "fine tuning" between products and productive processes and/or markets, unfolds almost naturally. The characteristics of the agroalimentary sector and innovation per se should permeate the focus of the National Systems for Agricultural Innovation (SNIA's), in order to make investments more effective and efficient.

[10] See Sain and Ardila (2009).

[11] According to Barrera (2011 - http://www.arturobarrera.com/) these are third generation INIA's. As per the same author, some of their characteristics are: a) they continue to conduct basic and applied research, but from the standpoint of agricultural research for development, intended from the outset to address development goals; b) they constitute a significant part of national systems for agroalimentary innovation. In this light, INIA's's are one of the sources of agricultural innovation, but not necessarily the only one; c) they have solid alliances with the private sector and universities; d) they have more entrepreneurial management models, with a culture of results, of impact evaluation and social control; e) they are connected to international research, developing alliances with leading institutions in the region and the world; f) they give rise to a good coordination of research and extension considering that they are concerned with the impact of their research "products"; and g) they have a solid strategic vision.

The incorporation of SNIA focal points into the management of agroalimentary research and technological development are still in their early stages, and seem to be unfolding through two main axis. One is how to link research and processes of innovation – settings, responsibilities, actors, instruments – the second is the insertion of agroalimentary research institutions into national systems of science, technology and innovation. This second is of particular importance given that historically, agroalimentary research institutions have been somewhat isolated from other scientific and technological institutions, probably as a result of conditions prevailing at the time of their founding. In many cases, scientific research, in particular the one connected to technological development, was quite limited, so that institutes were designed to contain all of their disciplinary needs.[12] In time, this led to the developing of an attitude of self-sufficiency, considering themselves primarily responsible for the sector's technological development. More importantly, little effort was made to link and coordinate their activities with other institutions in the science system. Consequently, neither the institutional architecture adopted nor the available financing mechanisms have privileged inter-institutional coordination and a spirit of belonging to a broader and more complex scientific community that would allow assimilating new perspectives and demands. This did not have a major impact on the effectiveness of the institutes, while the rest of the scientific community remained weak and uninterested in agroalimentary subjects, and while agricultural research was chiefly aimed at developing agronomic practices and varietal selection.

The transformations referred to in the foregoing sections change the scenario, and resorting to focus on SNIA's as a way to dynamize research and innovation processes is in all likelihood a response to these changes, and an attempt to seek the basis for a new working strategy. In recent decades the development of universities and other research institutions has been vigorous, and today there is an entire array of institutions – both public and private - of growing importance. The new technological paradigm rests on the biological and computer sciences, disciplinary fields in which the collaboration of universities and non-agroalimentary research institutions is of crucial importance. This calls for the development of more complex mechanisms for inter-institutional coordination and cooperation explicitly coordinated through public policy, including the structure of financing.

[12] Although the idea that INIA's were modeled after the system of experimental stations and the "Land Grant institutions," the reality is that although there was that influence – chiefly through technical assistance provided by the U.S. academic institutions in the first stages of the process – the "model" for the INIA's was not fully reflecting some of the central characteristics of their U.S. counterparts. The experimental station, as a physical space for applied research, was assimilated almost without modifications, but the same did not happen with the other components of the "model," at least in two aspects of strategic importance. In the first place, they did not replicate the close relationships with the acadmic world that existen in the "Land Grant Institutions".. A second difference was the centralized character with little effective linkage – in terms of policy and financing – between the research institutions and local or state/provinical interest groups. While the institutions of the Land Grant system are directly connected to local "politics" and financing, INIA's, on the other hand, are connected to central governments with little or no connection at the local level when it comes to political orientation and financing. These two diferences have been key elements in the way that these institutions have evolved in the decades since they were founded (Trigo, 1983; Piñeiro, 1983).

Box I.4: The search for good practices for SNIA's

The discussion on the potential role for National Systems of Agricultural Research, and mechanisms for increasing their effectiveness, has been taking on growing importance of late. The recent establishment of the INNOVAGRO network (*Red INNOVAGRO*) is a clear indicator of this process.

With the goal of institutionalizing interchange and linkage among the various actors in the region's innovation processes, the National Coordinator of Produce Foundations (COFUPRO – *Coordinadora Nacional de Fundaciones Produce*) and the Inter-American Institute of Cooperation for Agriculture (IICA – *Instituto Interamericano de Cooperación para la Agricultura*) took the initiative of setting up the Network for the Management of Innovation in the Agroalimentary Sector (Red INNOVAGRO - *Red de Gestión de la Innovación en el Sector Agroalimentario*), which, with the participation of a number of countries, including Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, El Salvador, Guatemala, Mexico, Nicaragua, Peru, and the Dominican Republic, aims to become a platform for the discussion of policy and the exchange of good practices in innovation. In this context, the INNOVAGRO Network held its first meeting in Guadalajara, Mexico, in May of 2011, where a working plan was developed among the participants to maximize innovation management processes in the agroalimentary sector through knowledge exchange, information, technical cooperation and experience, making the most of synergies and the ways that the member countries complement one another.

Source: prepared by authors based on Documento Base of RED INNOVAGRO.

One example of how this evolution is taking place, is the recent creation of the INNOVAGRO Network, an initiative in which most of the region's INIA's are involved to exchange ideas and generate good practices with regard to the role of research institutions in processes of innovation and the management of the SNIA (see Box I.4). From the initial discussions held within the network, some implicit and unresolved problems are emerging that go beyond a simple replacement of the term "research" by "innovation." Another one relates to focal points, strategies and policies, including arrangements for coordination and articulation among institutions and different institutional venues to faccilitate work based on the concept of innovation. From this point of view, the evidence shows that implementation is still at a very early stage, and advances have been limited, in most cases, to the creation of venues for coordination of science and technology policy, generally at the ministerial level, and in some cases (Argentina, Brazil, Chile, Peru, Paraguay, Colombia, Mexico, Uruguay) at the definition of medium term plans and specific instruments to foster developments at the territorial or sectorial level ("clusters" and sectorial programs), as well as greater private sector participation (see http://www.cepal.cl/iyd/). Nevertheless, agricultural research institutions in general are not clearly focus into these arrangements, since they have other administrative affiliations (usually within the domain of the Ministries of Agriculture or the equivalent). The emphasis of these initiatives, even in cases where innovation appears as the goal, focuses on involving science and technology, without taking into consideration the broader framework of innovation processes and the need to coordinate research and technological development with efforts aimed at solving market failures and other restrictions affecting innovative processes. At this level, only Chile and Uruguay, have set up policy venues of an inter-sectorial nature, with responsibility for coordinating national innovation policy, integrating the efforts of all sectors: science and technology, education, infrastructure, small- and medium-sized businesses – '*PYMES'* – foreign trade, industry, etc.[13]

[13] For a summary of the situation in the different countries of the region, see "InnovaLatino: impulsando la innovación en América Latina" (2011) Editorial Ariel, Barcelona, Spain.

I.4.4. A quantitative vision of the status of SNIA's

The institutional structure for agricultural research, in spite of having common roots, is quite heterogeneous, and public institutions – INIA's or their equivalents – have a predominant role, although there is nonetheless a wide range of other institutions involved (see Chart I.2). In this context, the importance of universities tends to be underscored – they represent more than half of the institutions involved in agricultural research in the region – likewise the weight that NGO's have acquired keeps increasing and now account for some 10% of the institutions in question. On the other hand, the private sector does not appear to have much importance, although it is highly probable that the figures indicated in the chart are somewhat underestimated, as a consequence of the difficulties inherent to surveying these actors. The presence of private companies in regional R&D efforts in the region is probably very slight, although in some countries such as Argentina, Brazil and Chile, there are explicit mechanisms to encourage it.

Regardless of these institutional figures, in nearly all countries public or "government" institutions concentrate roughly 50% of the human and financial resources for R&D, and even more in smaller countries, in all cases they constitute the principal public policy instruments for the sector. The weight of universities is, in general, greater in countries such as Mexico, Brazil and Argentina, however their involvement in the system is more from an educational point of view and, although they do conduct research tasks, these are more of an academic nature with limited connection to productive systems.

Chart I.2: Institutions comprising SNIA's in selected Latin American countries

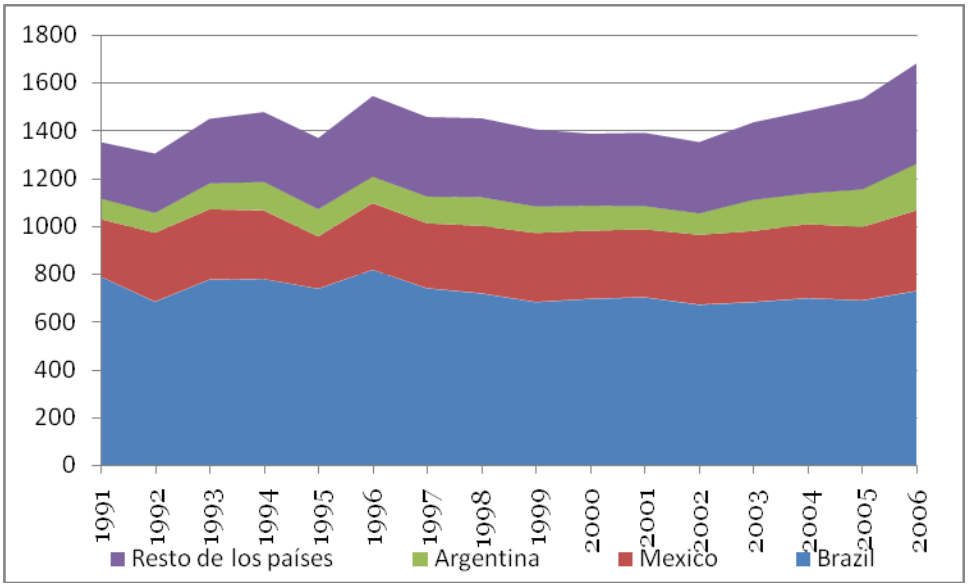
Country	Type of institution										Principal institution
	Total		Government		Universities		NGO		Private sector		
	Total	*%*	*Total*	*%*	*Total*	*%*	*Total*	*%*	*Total*	*%*	
Argentina	74	100	28	38	46	62		0		0	The *Instituto Nacional de Technology Agrícola* (INTA) in 2006 employed approximately half of the country's personnel and expenditures on agricultural research.
Brazil	112	100	62	55	30	27	5	4	15	13	*Embrapa* is the foundation sustaining the system of agricultural research in Brazil. It is estimated that, in 2006, this institution concentrated 57% of the country's investment in agroalimentary public R&D and employed 42 % of the personnel.
Chile	27	100	7	26	18	67	2	7		0	The *Instituto de Investigaciones Agropecuarias* (INIA) employs 40 % of the country's agroalimentary researchers, and concentrates nearly half of the outlays on agricultural R&D.
Colombia	33	100	7	21	13	39	13	39		0	CORPOICA employs more than one quarter of the country's agroalimentary researchers and represents more than one third of Colombia's investment in agroalimentary R&D.
Costa Rica	15	100	2	13	6	40	7	47		0	The INIA constitutes the main actor in the SNIA, employs one third of the national personnel dedicated to agricultural research.
Dominican Republic	13	100	2	15	4	31	3	23	4	31	The *Instituto Dominicano de Investigaciones Agropecuarias y Forestales* (IDIAF) employs more than 60% of human resources and receives most of the national and international funding devoted to agricultural research in the country.
El Salvador	6	100	1	17	2	33	3	50		0	The *Centro Nacional de Tecnología Agropecuaria y Forestales* (CENTA) represents nearly 80% of the human resources devoted to agricultural research in the country.
Guatemala	7	100	2	29	2	29	3	43		0	The *Instituto de Ciencia y Tecnología Agrícola* (ICTA) comprises 60% of the human resources allocated towards agricultural research in the country.
Honduras	11	100	1	9	7	64	3	27		0	The *Dirección de Ciencia y Tecnología Agropecuaria* (DICTA) is the main institution, although its operational capacity is restricted due to a lack of resources.
Mexico	186	100	41	22	132	71	3	2	10	5	The *Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias* (INIFAP) accounts for one fourth of the country's personnel and expenditures on agricultural R&D.
Nicaragua	8	100	1	13	6	75	1	13		0	The *Universidad Nacional Agraria* (UNA) together with the *Instituto Nicaragüense de Tecnología Agropecuaria* (INTA) has more than 80% of the human resources assigned to agricultural research.
Panama	7	100	3	43	1	14	3	43		0	The *Instituto de Investigación Agropecuaria de Panamá* (IDIAP) has more than 70% of the funding allocated to agricultural research in Panama.
Paraguay	6	100	3	50	3	50		0		0	The *Dirección de Investigación Agrícola* (DIA) employs half of the country's resources for agricultural research.
Uruguay	20	100	7	35	9	45	4	20		0	The *Instituto Nacional de Investigación Agropecuaria* (INIA) employs more than one third of Uruguay's agricultural research personnel, and financed 60% the outlays for agroalimentary R&D.
Total	**525**	**100**	**167**	**32**	**279**	**53**	**50**	**10**	**29**	**6**	

Source: prepared by the authors, based on data from ASTI reports, 2008.

I.4.4.1. Investments and human resources devoted to agricultural research

According to the information available, there is a pronounced under-investment when it comes to financing research activities, and the scarce available resources are highly concentrated in just a few countries (Graph I.2). Brazil, on average, accounts for 50% of the resources allocated to agricultural R&D in the region, Mexico, around 20% and Argentina, 8%, with the remaining countries for which information is available accounting for only something more than 20% of the total invested.[14] In institutional terms, there is also a high degree of concentration in the allocation of resources, with INIA's representing the greatest percentage, Uruguay's INIA receives 60% of total resources invested in the country, the INTA in Argentina accounts for 59%, and EMBRAPA in Brazil, 57%. From the point of view of the evolution of investment, although there has been -since the mid-1990's- an increase in the allocation of resources for these activities, it has been relatively low – at 0.9% per year – and also very uneven, with the countries of Central America exhibiting on average an year-to-year growth rate of -0.4% (Gert-Jan, et al.; 2008).

Graph I.2: Evolution of expenditures in millions of 2005 US$ in Latin American countries, breaking down share of Brazil, Mexico and Argentina in overall outlay



Source: prepared by authors based on ASTI data, 2011

[14] The preparation of these estimates has considered the following countries: Brazil, Mexico, Argentina, Colombia, Chile, Uruguay, Costa Rica, Nicaragua, the Dominican Republic, Paraguay, Panama, Honduras, Guatemala, Belize and El Salvador.

Chart I.3: Total expenditures in 2006 in 2005 US$

Country	Total		INIA's		Other governmental agencies		Non-profit Agencies		Universities	
	US$	%	US$	%	US$	%	US$	%	US$	%
Argentina	449	100	263	59	23	5		0	163	36
Brazil	1306	100	746	57	280	21	67	5	214	16
Chile	98	100	47	48	24	24	1	1	26	26
Colombia	153	100	56	36	19	12	49	32	29	19
Mexico	3690	100	801	22	894	24	1	0	1994	54
Uruguay	60	100	36	60	8	13	2	3	14	24

Source: prepared by authors based on countries' ASTI reports.

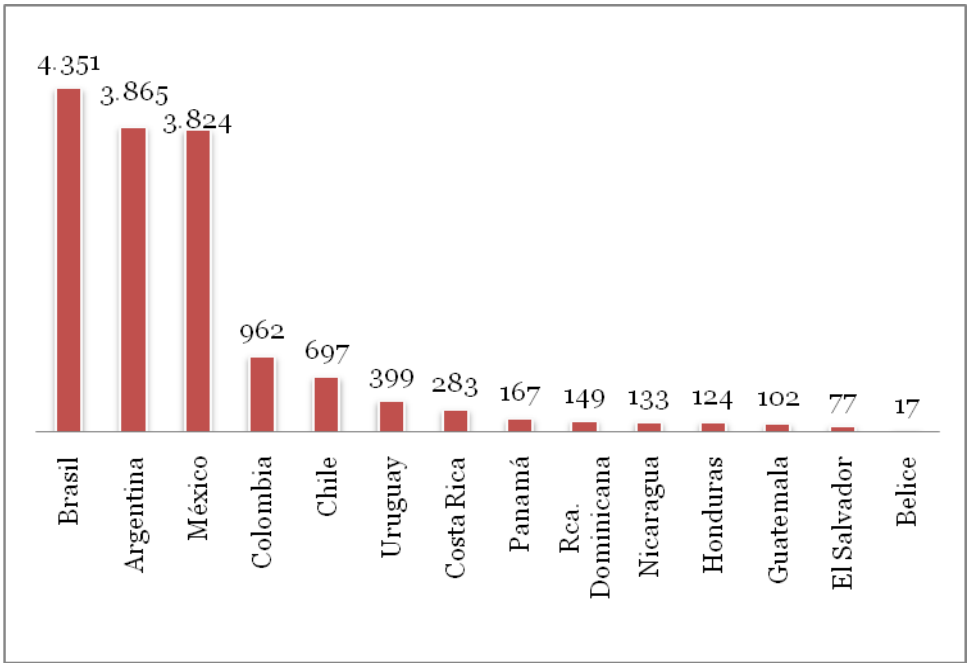
This trend towards concentration in just a few countries and institutions within each country, is also occurring with respect to human resources, which are essentially located in government institutions – INIA's and others – and account for more than 60% of the region's researchers, followed by Universities and institutions of higher education, although with about half the amount of resources. At the country level, Brazil, Argentina and Mexico have the largest contingents of researchers, followed by Colombia, Chile and Uruguay, on a much smaller scale.

Chart I.4: Number of Full Time Researchers by type of Institution in Selected Latin American Countries for 2006

Country	Total		Universities[1]		Government		NGO's		Private Sector	
	FTE	%	FTE	%	FTE	%	FTE	%	FTE	%
Argentina	3865	100	1678	43	2188	57		0		0
Belize	17	100	1	8	9	54	6	38		0
Brazil	4351	100	559	13	3587	82	117	3	88	2
Chile	697	100	200	29	475	68	22	3		0
Colombia	962	100	151	16	463	48	347	36		0
Costa Rica	283	100	135	48	91	32	56	20		0
El Salvador	77	100	11	14	60	78	6	8		0
Guatemala	102	100	16	16	69	68	17	17		0
Honduras	124	100	68	55	18	15	37	30		0
Mexico	3824	100	1890	49	1862	49		0	73	2
Nicaragua	133	100	89	67	44	33	0	0		0
Panama	167	100	24	14	124	74	20	12		0
Dominican Rep.	149	100	23	15	94	63	14	9	18	12
Uruguay	399	100	170	43	212	53	17	4		0
Total	**15433**	**100**	**5130**	**33**	**9408**	**61**	**716**	**5**	**178**	**1**

Source: prepared by authors based on ASTI data, 2008.

Graph I.3: Distribution of number of researchers devoted to agricultural issues in selected Latin American countries in 2006



Source: prepared by authors from ASTI data, 2008.

In terms of academic degrees, the regional overview is equally diverse, although within a low range, with Brazil located well above the regional average. This trend is repeated with regards to resources for research support, whose percentage is low in nearly all countries (an adjusted amount for this this indicator would be close to 3), though it reaches critical levels in Argentina, El Salvador and Mexico.

It is prudent to underscore the share of INIA's in the total distribution of human resources devoted to agricultural R&D, although they have the largest number of personnel the totals are not proportional to the allocation of resources. In other words, INIA's (in contrast, for example, with universities that also engage in instructional activities) do not exceed 50% for human resources, and as an illustration, in Mexico the figure is less than 25% of the total.

Chart I.5: Indicators of level of education and available support personnel from the public sector in selected countries

Country	% With PhD	% With Masters	Support Personnel per researcher
Argentina	17.2	40.8	0.8
Brazil	64.1	94.2	No data
Chile	25.7	61.9	1.8
Colombia	10.7	42	1.3
Costa Rica	14.3	55.3	1.2
Dominican Republic	10	72.6	3.2
El Salvador	0	19.7	0.9
Guatemala	7.5	34	3
Honduras	15.2	42.4	3.5
Mexico	37.9	77.9	1.1
Nicaragua	9.6	56.7	3.3
Panama	8.1	41.9	1.9
Paraguay	4.8	51.1	2.1
Uruguay	23.6	54.7	1.4

Source: prepared by authors from ASTI data, 2008.

Chart I.6: Share of INIA Human Resources in all SNIA's

Country	Overall		INIA's		Other governmental agencies		Non-Profit agencies		Universities	
	Total	%	Total	%	Total	%	Total	%	Total	%
Uruguay	399	100	142	36	70	17	17	4	170	43
Mexico	4067	100	1023	25	844	21	2	0	2197	54
Chile	690	100	279	40	187	27	22	3	202	29
Brazil	5375	100	2215	41	2041	38	240	4	880	16
Paraguay	128	100	64	50	4	3		0	61	47
Colombia	999	100	273	27	190	19	353	35	183	18
Argentina	3940	100	1910	48	272	7		0	1759	45

Source: prepared by authors based on ASTI country reports.

I.4.4.2. Some indicators of system capacities and productivity

The issue of productivity is a complex question for a research system and one that surely can be approached from multiple perspectives. The purpose of this study is not to evaluate productivity or the impacts that could be derived from investments in R&D made in the region, but whether it is useful to have indicators to evaluate institutions and institutional systems in terms of how they are performing with respect to their mandates. Given the lack of relevant information with sufficient level of aggregation for analysis, the intention is to look at the productivity potential and the impact of certain elements or investments, in areas that are critical for the process of agroalimentary technological development. In this framework the situation of plant breeding is analyzed – an activity considered central to agroalimentary research institutions, on the basis of how investments and programs of agricultural biotechnology are evolving – as an indicator of the

capacity of systems to adapt to new trends in science and technology. Additionaly, what is the performance of the national agricultural research systems in terms of scientific publications – as an indicator of the capacity of systems to connect with the world of science in general, and to provide feedback for future activities on the basis of academic debate.

The situation of plant breeding and biotechnology in the countries of Latin America and the Caribbean

Plant breeding and current capacities in crop biotechnology, mirror the overall circunstances of the availability of resources for research. In the case of plant breeding (see Chart 8), although there is no comprehensive data encompassing all countries, the information available from case/country studies carried out in 2007/2008 by *Plant Breeding and Related Biotechnology Capacity Assessments (PBBC*) of the FAO –which includes 14 countries from Central and South America- indicate that since 1990 budget resources allocated to plant breeding have been reduced by more than half, in addition funds available for plant breeders in 2005 were approximately 37% of what they were in 1990. Furthermore, levels of training for researchers dedicated to these activities have not been significantly modified (http://gipb.fao.org/Web-FAO-PBBC) (Trigo and Villarreal, 2009).

In the case of biotechnology there is no data to indicate what has occurred in recent years, however it is possible to get an idea from a 2007 study that analyzed the situation in the region, both with respect to capacities as well as the principal applications of biotechnology implemented at that time (Trigo, et al. 2010). According to this study, total investments in agricultural biotechnology in Latin American countries and the Caribbean, were approximately of US$133 million in current dollars, an almost insignificant figure compared to total investments in agricultural research (see http://www.asti.cgiar.org/), and even more so if compared with what the principal multinational seed companies invest (www.oecd.org/futures/bioeconomy/2030). In the case of biotechnology, there is also an extremely high level of concentration per country, with Brazil accounting for more than 50% of investment, and the five biggest countries (Brazil, Mexico, Argentina, Venezuela, Colombia and Chile) representing nearly 90% of total invested (Trigo et al, 2010). Within this panorama, in contrast to what is going on in other parts of the world where the private sector is more dynamic, in Latin America the public sector is the predominant actor – with perhaps 90% of the total work in R&D in biotechnology - and the bulk of applications involve traditional biotechnologies (plant tissue culture, molecular markers, diagnostics and others), with very few modern applications such as recombinant deoxyribonucleic acid (DNA), genetic transformation and functional and structural genomics, although this situation varies from country to country. In Honduras, El Salvador, the Dominican Republic, Bolivia, Guatemala and Panama, more than 90% of the techniques used, are traditional – with almost no use of the more advanced ones such as molecular markers – whereas in Brazil, Mexico, Argentina, and Chile a higher proportion of modern technologies is used (Trigo et al., 2010).

Chart I.7: Human and Budget Resources devoted
to plant breeding **in selected Latin American countries***

Year	Budget Resources Millions of 1996 US$	Human Resources in FTE's**
1990	38.2	463
1995	19.4	456
2000/2001	17.6	477
2003/2005	15.3	491

*Argentina, Bolivia, Costa Rica, Ecuador, El Salvador, Belize, Guatemala, Guyana, Honduras, Nicaragua, Paraguay, Peru, Surinam, Venezuela.
**Full Time Equivalent (FTE).
Source: Prepared by the authors with data from the FAO-PBBC(www.gipb.fao.org/WEB-FAO-PBBC/)

Academic production of the main SNIA institutions

Chart I.9 shows performance in terms of publications in peer-reviewed journals. The situation is once again one of low productivity and a high degree of concentration in few countries. Overall, the region publishes texts on subjects relevant to agroalimentary technological development at a level well below what would be expected given the importance and potential of this sector. Just as with other indicators, there is a high concentration in a few countries, with Brazil clearly leading with 51% of all publications from the region.

In this context the INIA's exhibit a significant share of scientific production (Chart I.10), in the case of Argentina representing 9% of all national publications on agriculture and biological sciences. Nevertheless, it is interesting to point out that this has not held up in recent years, where with the exception of EMBRAPA, INIA's have been losing importance in the scientific-technological domain. This trend is also discernible when comparing the performance of EMBRAPA with that of other major INIA's in the region (Graph I.4). Until the first years of the past decade there were differences in the volume of publications, explained chiefly as the result of different institutional sizes. In recent years, however, there has been a clear breakdown of the previous trends, with EMBRAPA showing accelerated growth in its scientific-technological production, compared with stagnation and loss of importance in scientific-technological outputs in other countries.

Chart I.8: Number of articles published by researchers and institutions in Latin America from 2006 to 2011

		Biochemistry, genetics and molecular biology		Agriculture and biological sciences	
		No. of articles	%	No. of articles	%
1	Brazil	23.002	51	40.041	51
2	Mexico	6.696	15	11.312	14
3	Argentina	6.795	15	10.403	13
4	Chile	2.857	6	4.915	6
5	Colombia	1.618	4	2.872	4
6	Venezuela	756	2	1.821	2
7	Cuba	890	2	1.136	1
8	Uruguay	760	2	1.025	1
9	Peru	434	1	910	1
10	Costa Rica	318	1	1.008	1
11	Panama	280	1	847	1
12	Ecuador	219	0	637	1
13	Bolivia	160	0	483	1
14	Trinidad/Tobago	127	0	250	0
15	Jamaica	144	0	130	0
16	Guatemala	53	0	91	0
17	Nicaragua	39	0	98	0
18	Paraguay	34	0	76	0
19	El Salvador	41	0	55	0
20	Honduras	20	0	76	0
21	Barbados	35	0	39	0
22	Granada	29	0	27	0
23	Bahamas	15	0	41	0
24	Dominican Republic	16	0	37	0
25	Belize	5	0	46	0
26	Guyana	7	0	36	0
27	Haiti	10	0	16	0
28	Dominica	10	0	14	0
29	Surinam	8	0	15	0
30	St. Kits/Nevis	6	0	16	0
31	St. Lucia	2	0	7	0
32	St. Vincent/Grenadines	0	0	8	0
33	Antigua/Barbuda	2	0	5	0
	Total	45.388	100	78.493	100
	Canada	48.587		34.066	
	US	332.381		163.883	
	Spain	35.893		33.355	
	China	125.217		74.863	
	India	38.618		33.028	

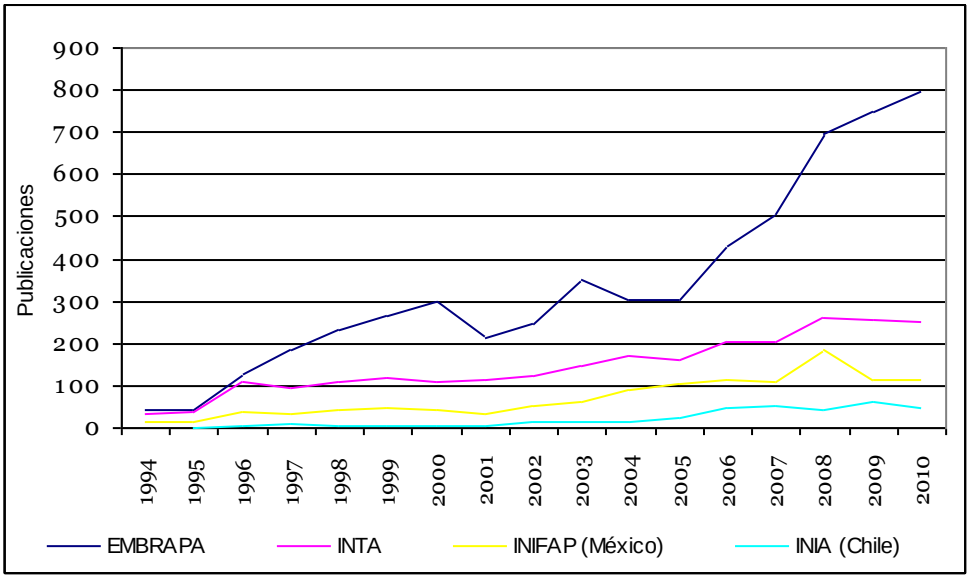
Source: prepared by authors based on Scopus, 2011.

Chart I.9: Articles published between 2006 and 2011 by field for selected countries and selected INIA's

	Agriculture and biological sciences				Biochemistry, genetics and molecular biology			
	Country		INIA		Country		INIA	
	Articles	%	Articles	%	Articles	%	Articles	%
Brazil	40.041	100	2.579	6	23.002	100	650	3
Mexico	11.312	100	496	4	6.696	100	137	2
Argentina	10.403	100	887	9	6.795	100	299	4
Chile	4.915	100	229	5	2.857	100	33	1
Colombia	2.872	100	41	1	1.618	100	17	1
Uruguay	1.025	100	70	7	760	100	23	3

Source: prepared by authors based on Scopus, 2011.

Graph I.4: Evolution of publications in SCOPUS of selected Latin American INIA's



Source: Prepared by authors based on 2011 SCOPUS data.

Capacities for coordinating and benefiting from technological development processes

In practical terms, the foregoing analysis helps to explain the extent to which existing structures can actually contribute to countries' technological development. In this light, given particular characteristics of agricultural technology, these contributions do not necessarily have to be in the form of original scientific contributions. Furthermore – and this is probably the most important point– it is through the role played by these structures that a country's productive systems is enabled to connect to the technological expertise generated beyond national boundaries; in other words, the capacity to take advantage of spillovers created by investments in research in other countries or in the international domain. In fact, as argued previously, this was one of the key objectives sought when the first national institutes were created. Taking this into consideration,

Sain and Ardila (2009) developed categories of the region's countries based on their capacity to generate spillovers - technologies relevant to their realities and problems that can also be of use to others. For this analysis, the authors developed an index of "scientific capacity" (number of researchers and publications), an index of "innovation capital" (number of researchers per unit of surface area and investment in research as a % of agricultural GDP) and an index of "imitation" capital (level of education and number of extension workers per unit of surface area).[15] The results are shown in Table I.1, the authors completed the analysis of the SNIA's by stating the SNIA's capacity for generating/exploiting spillovers, indicating each country performance in terms of the evolution of the aggregate productivity of its agriculture. They found a high correlation between investment, capacities and productivity growth.

Table I.1: Capacities of SNIA's to generate and exploit technological spillovers in Latin American and the Caribbean

Capacity for generation / utilization of spillovers	Description	Countries
High	Countries with a high capacity for generating technological spillovers outside the country, meaning they also have a high capacity for appropriating technological spillovers from outside the country.	1. Brazil 2. Argentina 3. Mexico 4. Chile
Medium	Countries with a low capacity for generating technological spillovers , but having a good capacity for exploiting technological spillovers coming from other countries.	1. Venezuela 2. Cuba 3. Colombia 4. Uruguay 5. Costa Rica 6. Peru 7. Panama 8. Jamaica 9. Ecuador
Low	Countries with a low capacity for generating technological spillovers and a low capacity for exploiting available spillovers inside the country.	1. Bolivia 2. Honduras 3. Guatemala 4. El Salvador 5. Nicaragua 6. Paraguay 7. Dominican Rep 8. Haiti 9. Belize 10. Rest of Caribbean

Source: Sain and Ardila (2009).

In summary, the region's research systems are of great variety, with a small number of countries concentrating the bulk of capacity, and the majority having pronounced levels of under-investment, which is reflected in their limited capacity and poor prospects of contributing effectively to the productive development of their countries.

[15] For a detailed description of the methodology used, see Sain and Ardila (2009).

I.5. New trends in the organization and management of technological innovation

The trends discussed in the previous sections have prompted several countries to reconceptualize arrangements for the organization and management of agricultural R&D, particularly in connection with the role of the state and its relations with civil society and the market. In this light, the following things are noteworthy: i) the abandonment of normative and voluntarist conceptions which assigned to the State the role of an active and practically exclusive agent in development; ii) disenchantment regarding the efficacy of the State's actions, calling into question traditional modes of public organization and management; iii) the inability of existing organizational structures to face new economic and technological realities, this has consolidated the need for a greater participation by society civil and greater democratization of decision making processes; and iv) the perception that market failures – the argument justifying state intervention in the economy- is accompanied by imperfections in political and bureaucratic mechanisms that enable those making decisions to maximize their own personal welfare instead of maximizing the social welfare for which they are responsible.

These and other ideas have given support to processes of reform intended to correct the dysfunctionalities of the public sector, redefining its role and functions. Programs are now in place for deregulation, privatization and transfer of services to the provinces and other forms of local government, and the creation of multiple forms of financing public interest initiatives executed by the private sector.

Many of these concepts have been explicitly incorporated into the institutional framework and the public policy associated with technological innovation in the agroalimentary sector. The work of agencies such as the International Service for National Agrarian Research (ISNAR – *Servicio Internacional de Investigación Agraria Nacional*), the International Institute for Food Policy Research (IFPRI - *Instituto Internacional de Investigación en Políticas Alimenticias*) and the FAO, along with a growing number of individual authors associated with other institutions have systematized ideas and distilled lessons derived from institutional reforms carried out recently by other countries.

Evaluation of reforms, in particular those implemented by Great Britain, the Netherlands, New Zealand and Australia[16] -countries that have undertaken more systematic and profound reforms- suggests that they have been guided by a combination of ideas and principles that could be synthetized in the following manner:

1) Science and Technical policy should promote institutional systems where public research is articulated with other institutions. Research networks and other mechanisms for inter-institutional cooperation that foster scientific exchange, cooperation and synergy, are central elements for dealing with the growing complexity of science. In particular the close association of research with university education improves the efficacy of research and contributes to updating and renewing scientific thought.

[16] For a treatment of this subject, see, for example: Martin and Johnston (1999), Byerlee and Echeverria (ed.) (2002) and Persley (ed.) (1998).

2) Within the Institutional System, normative functions -those concerned with defining science and technical policy and the allocation of research resources- should be separated from research and technology transfer activities. For this purpose, the establishment of councils integrated by public and private participants is an option of growing interest.

3) The financing of research is a powerful instrument for achieving the following things: i) the pertinence of research; ii) the coordination and cooperation of the different institutional components of the scientific and technical system; and iii) efficacy in the use the resources. In this light, part of the funds allocated to research should be used to finance programs and projects using competitive mechanisms.

4) Science and technology systems should have mechanisms for social control to ensure the relevance of their activities and the transparency and efficacy of their management. Mechanisms for social control include boards of directors to help define priorities and financing. They are a necessary counterpart to the administrative and bureaucratic controls characteristic of Public Sector administration.

5) Research institutions need organizational structures and management styles compatible with research. For this purpose, it is appropriate for research and technology transfer activities to be conducted in small operational units and a high level of decentralization and functional autonomy, including the possibility of operating within the private sector. Such organizations should have few hierarchical levels and horizontal management that allows for flexibility to adapt to the changing needs of the environment. Organizations of this kind allow for the development of an institutional culture and human resources policy in tune with the needs of scientific activity and the scientists own idiosyncrasies.

The relative importance and manner of implementation of these general principles has not been homogeneous in the institutional reforms analyzed. Nevertheless, these ideas have played a role in the conceptualization of changes undertaken, and are therefore a point of departure for discussion.

1.6 Issues for a new institutional paradigm for technological agroalimentary and agroindustrial development

What are the implications of all these elements on the institutional framework of agroalimentary and agroindustrial research and development organizations, and what are the investment strategies that can be gleaned from them?

The current technological scenario is characterized by a search for competitiveness in the totality of agricultural and agroindustrial activity. Even when other objectives are put forward, such as equity and sustainability, these are not proposed as antithetical, but rather as qualifications of competitiveness. Furthermore, it is recognized that from the point of view of competitiveness as well as of equity and sustainability, the technological dimension is only one of the components of strategies and the issue of innovation, understood to encompass processes, products, management, institutions and policies – is the goal to be achieved. Furthermore, production is increasingly

looked upon as a component of the process of value creation, and the axis of interest has been transferred from the creation of technological knowledge to the capacity to innovate, that is to say, the capacity to effectively incorporate new techniques – independently of where they come from – into productive processes, reassessing individual initiative as the central actor in the innovative process, in which technical and institutional innovations interact to sustain and provide feedback for the competitive performance of the whole.

In this framework characterized by a diversity of demands for products and technologies (biological and institutional, protected or non-protected, managerial, etc.), capacities required (traditional and "modern" sciences both social and administrative, computer technology) mechanisms for technology transfer and financing, the current technological institutions appear mostly to be quite inadequate. Designed on the basis of a vision in which innovation is chiefly oriented toward an increase in physical productivity –and the profitability of primary production— for relatively homogeneous potential users, in an isolated agroalimentary sector, and whose principal challenge is to induce mass exploitation of the available technological supply, they fall far short of reflecting the current situation. In the following paragraphs, some of the elements that would appear to be of importance for the design of the institutional adjustments and the investments required are discussed.

I.6.1. The framework of national innovation systems

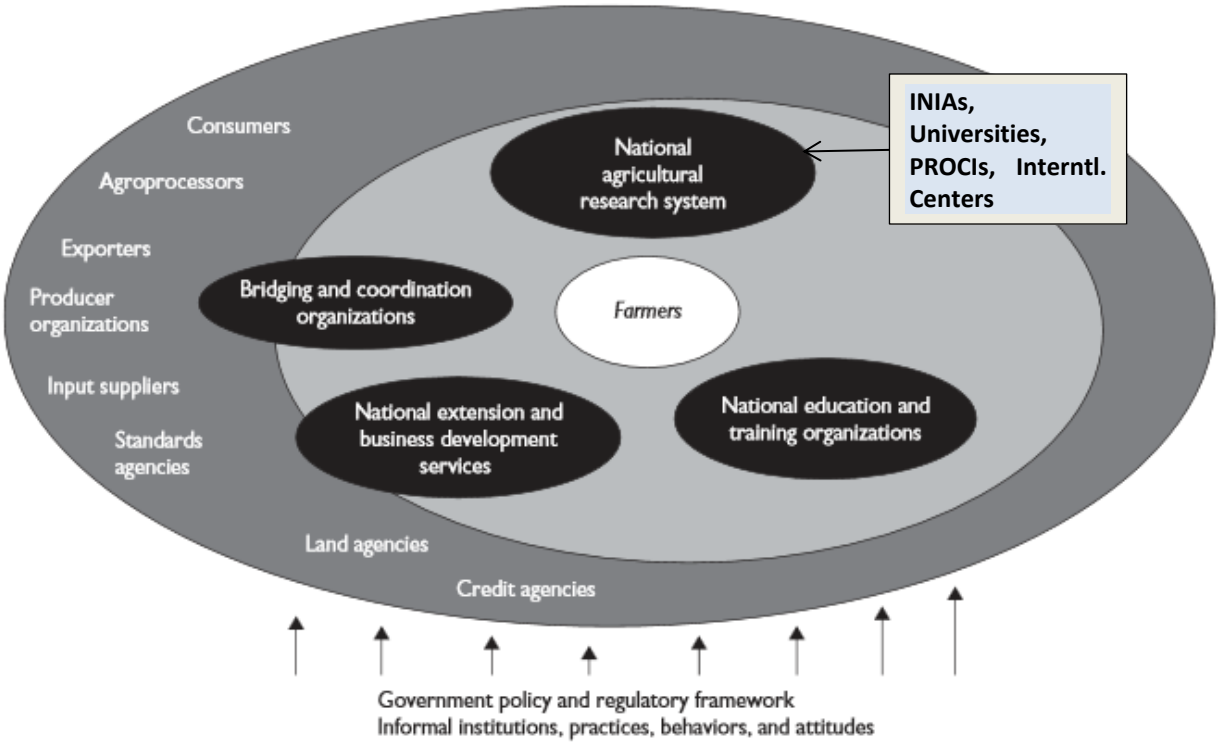
To think in terms of innovation – as is the current trend – rather than in terms of research as done traditionally, requires much more than a change of terminology. Research, as a concept that sums up actions in the scientific–technological field, is associated with innovation, but the latter is a broader and more complex process affected by other variables, apart from the availability of new knowledge and technologies, and, in many cases, totally independent of whether or not they exist. Innovation occurs at the level of economic actors and is strongly affected by the conditions of the market, financing and infrastructure. Incentives and other economic and cultural elements determine its possibilities with respect to the risk of confronting change and bringing what is new to the market. According to the Oslo Manual (1996), when focusing on innovation systems, actors should be seen in the context of institutions, public policies, competitors, providers of inputs, consumers, value systems and social and cultural practices, affecting its operation. Furthermore, the innovation identity is strongly associated with particular knowledge and production circuits – agroalimentary, industrial, etc. – where it is necessary to recognize different types and spaces of knowledge generation (including different structures and functions of public and private institutions), traditions involving technology transfer, reciprocal feedback between producers and users, and schemes fostering innovation and enhancing competitiveness, which are highly idiosyncratic for each "system."[17] Hence, the need not only to look at innovation systems in terms of their generals components, but also to see their sectorial particularities.

As previously mentioned, change towards a more integrated vision of reality such as innovation, is

[17] Sutz, Judith, 1998, La caracterización del Sistema Nacional de Innovación en el Uruguay: enfoques constructivos, Nota Técnica 19/98, Instituto de Economía da Universidad Federal do Rio de Janeiro - IE/UFRJ, Rio de Janeiro, March, 1998.

a step in the right direction. It makes it possible to put research needs in context and evaluate them more effectively, while assessing the limitations of technological strategies conceived solely in terms of research. It is evident that opportunities for innovation and new technological demands go way beyond the capacities existing today within public sector institutions, which, in addition to funding, require other competences to enable and ensure an effective articulation between R&D processes and markets. Scientific capacities are needed not only in agricultural sciences but also in chemistry and other food sciences, engineering, process design, market management, etc., located at universities, public and private, national and provincial, -and, in some cases international- research centers, engineering firms, chemical inputs companies, processors, harvesting companies, etc. In fact, these capacities are in different organizations since their development answers to different kinds of logic; the quest is how to coordinate them around concrete needs for innovation in specific sectors. Even when the capacities involved may be generic, their application must respond to specific needs, in order to achieve success. From this perspective, a central consideration is what the most effective mechanisms are to: i) place activities of agricultural research in the context of agricultural innovation systems; and ii) how to connect them to innovation systems at the level of the economy as a whole. Just as it is difficult to ignore the links between agroalimentary systems of research and innovation, it is also necessary to locate them in the broader context of the institutions, policies and instruments that encourage and guide innovation in the overall economy.

Figure I.1: National System for Agricultural Innovation



Source: Adaptation of Presentation by W. Janssen, in INNOVAGRO.

I.6.2. The need to recognize and manage a growing diversity

The foregoing trends indicate that in the future, agroalimentary and agroindustrial technological systems will face, on the one hand, more complex and differentiated demands, and, on the other hand, will have to interact with a greater diversity of scientific-technological institutions, both national and international, in the search for responses to these demands. Geographic diversity has always been recognized, normally as a response to agroecological questions or operational needs. Only in very few cases has it been done to establish more effective links with the demands of technology, much less with other levels of the agroindustrial chain.[18] In the future, R&D processes will be successful not only if they are able to respond to the needs of specific clientele or agroecological systems, but also if they can respond to the logic and behavioral dynamics of agroalimentary chains. This is hard to achieve based on a partial vision of processes and centralized planning. In the past, the separation between agroalimentary and agroindustrial

[18] The case of EMBRAPA in Brazil is a good example. Despite the fact that it covers the entire territory of Brazil, has responsibilities in agriculture and forestry, and has 38 centers and experimental stations, it functions on the basis of centralized planning. At the regional and state level it only has advisory boards, which perform a relatively minor role in the guidance and management of the institution. The same can be said of the other research institutions in the region; only INTA in Argentina, since the middle of the last decade, has been implementing a decentralization program that assigns Regional Councils the role of separate research centers, made up of representatives of agricultural institutions, the scientific comunity and the provincial political sector. They do play a role in the orientation and allocation of institutional resources.

markets and the scarcity of human resources with adequate levels of training could have justified arrangements divided by sectors and with some degree of centralization. Although some of these problems still persist, advances in computer technology and communications are relativizing the costs associated with greater decentralization. At the same time, the growing interrelationship between agroalimentary and agroindustrial elements makes it indispensable to incorporate the vision of these segments into the different levels for the orientation and implementation of institutional policies.

A number of institutions have grown with capacities – and in many cases mandates – to respond to the new sets of problems. Universities, specialized centers, and NGO's, constitute a significant pool of capacities that are frequently under-utilized. The reasons vary, and go from questions of mandate – the emphasis on education in the case of universities, for example – to the availability of resources, however the reality is that traditional agricultural research institutions are no longer the only actors and, in more than one situation, they also do not have the capacity to address certain problems. The question is, then, how to mobilize the capacities of these different institutional domains in a coordinated fashion.

In this context, institutional and operational governance are critical elements to respond to this growing diversity in an effective manner. A first level of action requires the revision of the structure of government agencies, in a way as to adequately reflect the diversity of sectors and interests interacting in the process technological innovation. A second related aspect, conceptualized independently, considers the need for decentralization policies to transfer to regional or local levels not only the operational management of research activities, but also part of the decision making process of resource allocation to projects – those of local or regional character—as well as technological linkages, and certain components of human resources management. This decentralization should be accompanied by specific mechanisms to integrate the capacities of different institutional environments on the basis of particular objectives.

I.6.3. Institutional frameworks of small countries

The issue of the size of economies and the impact it has on investment capacity and the scale of work regarding research institutions is an unavoidable matter in the region. (Schahczenski, 1990; Eyzaguirre, 1996; Graziano da Silva, *et al.*, 2008; Trigo and Piñeiro, 2009). In essence the issue is associated with the lack of economies of scale, or to put it another way, the fact that small countries run up against limitations associated with the number and size of institutions dealing with the range of problems and/or the provision of services confronted by the public sector.[19]

Regardless of the criteria used, the problems are the same. The costs of infrastructure, personnel, and equipment are susceptible to large-scale use, however have certain inflexibilities with respect

[19] The definition "small country" is in and of itself a relative one, and can be applied to a wide variety of countries depending on the dimension that defines it. It can refer to geography, population, the economy or a combination of several categories. Most international organizations use criteria of population and the economy, which are the ones that in the final analysis determine market size and levels of investment. Another factor to consider in this discusion is agro-ecological diversity, which for some functions or services such as those associated with technology in general, is another factor to take into account, influencing the idea of relative size.

to a minimum size beneath which services or functions cannot be effectively covered. In the past, many of these problems have been solved with outside resources, whether development funds or international bank loans, that made it possible to "unlink" institutional development from the particular conditions of each country. These processes have created institutional vulnerability, since in some cases it has allowed for oversized structures, which have had difficulty surviving when the international aid is withdrawn or reduced. Restrictions can also be felt in connection with the specialized human resources required, a matter that seems to be an increasingly significant constraint as the complexity of demands increases, and with it, the level of specialization needed for an efficient provision of services.

Then what are the alternatives? One key point is to recognize that although scale is a common factor, the diversity of situations that arise is not solely associated with variables directly related to "size." Options may have variations, however all requiere a focus and integration of efforts and the possibility of relaxing the restrictions of scale through collaboration and complementation with other countries. These two aspects are not entirely independent, inasmuch as there are certain functions that can -only with certain difficulty- be subjected to cooperation arrangements with other countries. At the same time, other functions, such as those associated with plant and animal health are feasible through cooperative and/or complementary arrangements with other countries, although the possibilities for doing so will depend upon the kind of production system that prevails, or the geographical location.

I.6.4. New public-private balances

As previously stated, the public sector has constituted the nucleus and pivot of national systems for the generation and transfer of technology, concentrating the bulk of resources and capacities for R&D, and in practice taking on direct responsibility for meeting all of the sector's technological needs, or at least attempting to do so. This is changing and, although in the immediate future it shall continue to perform a crucial role, the trends described above make it possible to anticipate a need for change in emphasis.

It is not the purpose of this document to analyze specific priorities, but in general it can be anticipated that the role of public institutions will evolve towards a greater concentration in the development and maintenance of strategic capacities with less direct participation in development of new technologies, except in certain areas of clear social content – such as technological support for family agriculture, or for regional production – or in areas such as management and conservation of natural resources and environmental issues, which have a strong component of public goods. Even in these cases it is to be expected that the participation of public entities will not be permanent, but rather in the form of initiatives of definite duration, for specific clienteles, and with the participation of other organizations. In other sectors, logic would indicate the public sector should participate by providing capacity, making the most of economies of scale in the use of resources, however the costs of development of required technologies should be borne by the direct beneficiaries.

In this context it is to be expected that future public institutions should be made up of structures of a reduced operational character, but stronger in terms of strategic planning and capacities for inter-

institutional coordination. Actions having to do with stages of development and fine tuning – whether for product or process technologies– are to be addressed within the framework of a growing private sector participation, and even within non-permant arrangements structured in accordance with the characteristics and needs of each particular situation or problem.

Beyond direct participation in R&D activities, the State has an active role to play in connection with regulatory frameworks – such as biosafety and intellectual property - and the structuring of financing mechanisms for technological innovation; areas from which the state has tended to be absent up until now, except in questions of plant and animal health. In countries where there is little tradition of investment in R&D, and if incentive mechanisms and venture capital are not available, it would be difficult to expect that such a tradition can be reversed in a way that is commensurate with needs.

I.6.5. Links between research and technology transfer

In the case of technology transfer, there should be better use of the wide range of actors currently available in rural settings in recent decades. This diversity and differentiation of functions represents a capital that ought to be recognized and exploited within the the research domain, in such a way as to carry forward the development of institutional and management concepts appropriated to functions that each one of the components is intended to fulfill. This does not entail disregarding the need for interaction between research and transfer/extension/rural development, but rather recognizing that each component has its own identity which requires to be fully recognized. The frame of reference and the intervals for research pertain to academia and the world of science and technology; the frame of reference for extension/rural development programs, is one of concrete results and actions on the ground, even in its political dimension. To disregard one or the other means sacrificing elements of efficiency and effectiveness in the use of resources. Actors in the field of technology transfer have become diversified in recent decades, and in practice knowledge and technologies resulting from research do not flow through a traditional transfer or communication mechanism, but rather through a complex network of public and private actors, which in many cases overlap and duplicate one another.

The way forward points towards re-focusing research institutions, and, at the same time establishing a sort of "institutionalized space for exchange" with the actors of the transfer system while taking advantage of modern knowledge management technologies, to ensure that: i) the vision of the various actors is reflected in the research priorities; ii) the results are made available to different kinds of producers in time and form; and iii) the system provides itself with feedback from lessons learned. These connections should be developed based on the concept that research institutions should be the ones to assume responsibility for "pathways to impact" of their products and, consequently, for devising partnership strategies with actors in the transfer space and recognizing the specific attributes that characterize agricultural production. The development of mechanisms of this kind is a way to move forward in the practical implementation of innovation systems as a framework for a more effective research work.

I.6.6. Revitalizing international cooperation schemes

International cooperation has been a key element in the development of the region's agroalimentary research from the onset. In fact, the very institutional model adopted was strongly influenced by international cooperation, and the existence of a regional system for research and technology transfer, made up of national institutions, the CGIAR centers operating in the region, sub-regional centers such as CATIE - *Centro Agronómico Tropical de Investigación y Enseñanza* and the *Caribbean Agricultural Research and Development Institute* (CARDI), cooperation programs (PROCIs) at the sub-regional level, a variety of thematic networks arranged by product or discipline, the Forum of the Americas for Agricultural Research and Technological Development (FORAGRO – *Foro de las Américas para la Investigación y el Desarrollo Tecnológico Agropecuario*), and the Regional Fund for Agricultural Technology (FONTAGRO – *Fondo Regional de Tecnología Agricultural*), has been frequently mentioned as one of the region's strengths *vis à vis* other regions of the world, and as being responsible for a large share of successes in technological development, both with crops and management of natural resources (Echeverria and Trigo, 2010). Even at the present time, in some regions such as Central América, international cooperation continues to provide the basis for research capacity and technological development in agriculture (see http://www.sicta.ws).

In recent times, however, the system has been losing dynamism and the capacity to contribute to the region's agroalimentary technological development. This is not the place to put forward an in-depth analysis of the reasons, but undoubtedly, elements such as the reallocation of resources for development cooperation to other regions of the developing world, and the clear deficiencies in the capacities at the national level – as discussed above – are factors that have influenced this trend. Funds from multilateral sources have been crucial to supporting the system, even when in cases such as with the Program of Cooperation for Agroalimentary and Agroindustrial Technological Development of the Southern Cone (PROCISUR – *Programa Cooperacional para el Desarrollo Tecnológico Agroalimentario y Agroindustrial del Cono Sur*), financing from the countries in question has been predominant, but this has been the exception and not the rule. In this light, FONTAGRO has been a key element in upholding the spirit of cooperation that has always characterized the region, but the curtailment of funds channeled through this mechanism has reduced its potential impact. On the other hand, weaknesses in taking advantage of the technological spillovers have also acted as a disincentive to cooperation. Without the capacity to internalize knowledge contributed by other parties, there is little point in the existence of a mechanism for cooperation and exchange.

In this context, it is necessary to review the existing cooperation mechanisms and adjust them to the present time, particularly, because of the importance they have for small countries. These countries always face difficulties to develop the required capacities for technological development, and far from diminishing, this tends to become a more severe limitation as a consequence of the size of the gaps in human resources for research and the investment requirements in certain areas such as biotechnology. It would appear that the region should look inward and revitalize the role of international cooperation. On the one hand, the international crisis and the poverty focus in development aid, make it unreasonable to expect much dynamism in support from outside the region. On the other hand, the region's existing experience with resource

mobilization, as in the case of FONTAGRO, as the fact that in contrast to what has happened in the past, a number of countries in the region now have substantial capacity for dealing with most issues on the agenda, are opening up an array of opportunities that ought to be explored and exploited.[20] Actions that should be put in place include: i) compilation of good cooperation practices, documenting existing experiences and how they can be used in the light of present challenges; ii) policy actions geared towards strengthening and promoting FONTAGRO as a mechanism for mobilizing cooperation resources among regional countries and elsewhere, to facilitate a better use of this platform that now appears to be under-utilized owing to the scarcity of resources; iii) to press ahead with a revision of existing structures in order to modernize and provide, including the possibility of creating technological and innovation platforms keyed to specific themes; and iv) to assess how to connect the private sector more effectively– both the commercial as well as the philanthropic spheres – with cooperation efforts, so as to recognize the role that it is performing today and, above all, to take advantage of its potential for sustaining activities and connections to innovation processes. Much of what exists today is addressed to the realities and priorities of a different time, not only with respect to sources of funding, but also with regard to the strategic issues to be considered and the actors to summon for the task. International cooperation continues to have a central role in new scenarios, but in order for it to be regarded as useful, it must adjust to the new reality and define an effective strategy for dealing with it.

I.6.7. Financing as an active instrument of R&D policy

Two issues must be addressed in relation to financing, one related to levels of investment; and the other to mechanisms through which investments are channeled to particular institutions and activities. The two are related, but must be addressed separately.

The issue of investment levels is essentially political. It may be that one mechanism or another - governmental funds to institutional budget allocations, specific allocations, etc. – could be appropriated for certain situations, but in the final analysis, it is a political decision dealing with the prevailing strategic vision for technological development and innovation. Evidence indicates that the countries that have moved forward along this road, such as Argentina with INTA, and more recently Brazil with the creation of EMBRAPA, Uruguay with the reform of the INIA at the end of the 1980's, and Colombia with the creation of parafiscal funds, among others, all have found a way to articulate investment arrangements that are suited to their circumstances and that have been reasonably sustainable over time.

Mechanisms are related to functionalities and also to evolution and institutional development in each particular case. In this light, government funds, although they appear to be essential for the development and maintenance of strategic capacities, do not seem to be the most efficient for dealing with high institutional diversity and demands, as well as changes in the public-private

[20] The experiences of Brazil's EMBRAPA developing an initiative similar to its *Africa-Brazil Agricultural Innovation Marketplace* (www.africa-brazil.org) for LAC countries, of INTA from Argentina in relation to Haiti and other countries of Central America (see http://inta.gob.ar/documents/horizonte-agropecuario-no85/) , and some activities of INIFAP of Mexico in Central American countries, are examples of initiatives that are being developed and could provide the basis for future scaling up.

nature of technologies. Consequently, the search for new financing mechanisms is a felt priority need. In this light, it is not a matter of disregarding the importance of traditional budget mechanisms based on institutional allocations – indispensables for maintaining the capacities required by a modern system technology development – but they must be complemented by other more versatile and focused instruments that make it possible to do the following: i) integrate resources and capacities of different institutions in terms of priority problems; ii) promote and facilitate greater participation by the private sector in financing of R&D activities; and iii) connecting financing circuits to groups of actors and no only to individual actors.

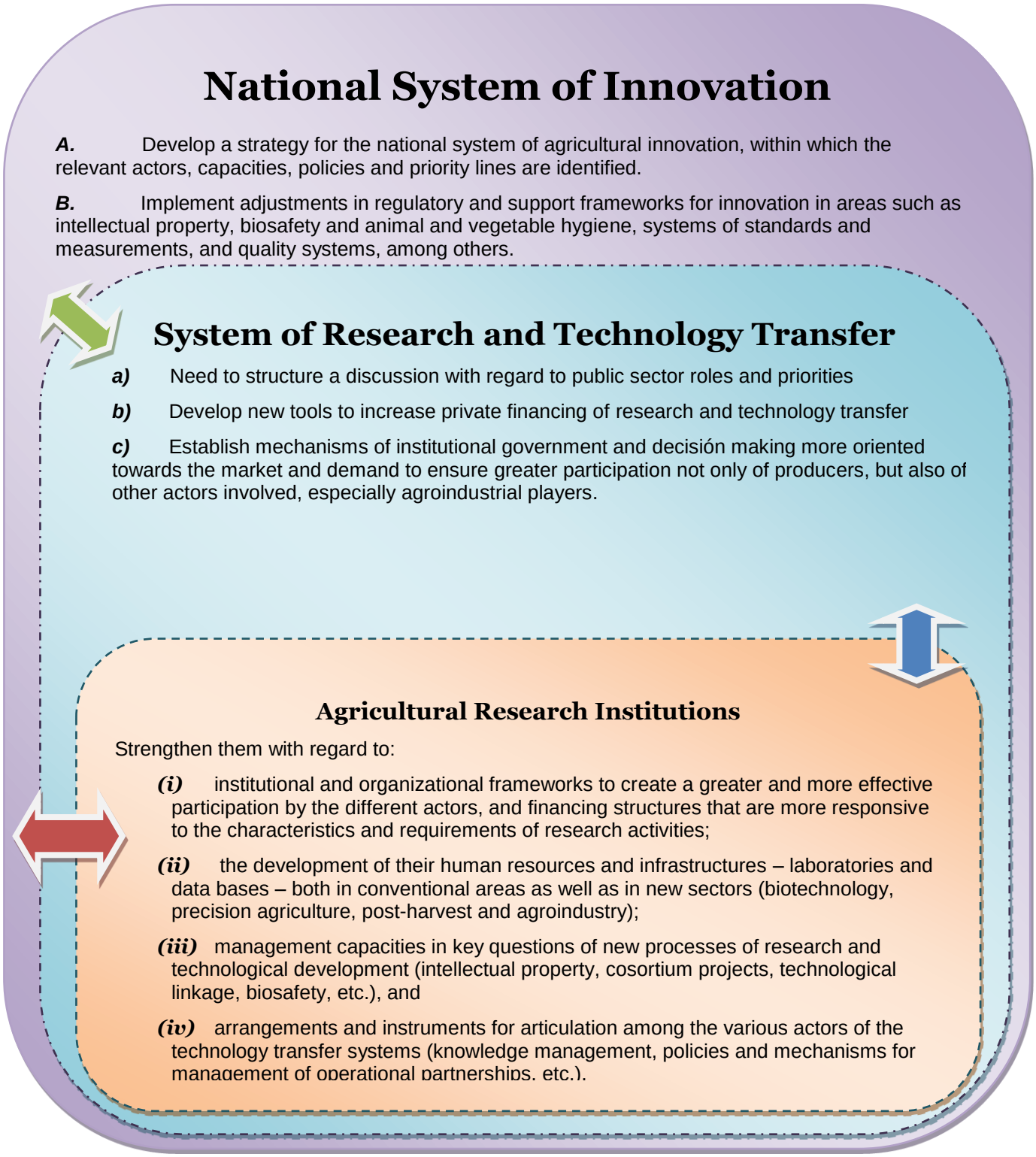
One important element in relation to these new arrangements is not to emphasize who undertakes R&D activities, but rather, the efficiency in the use of resources and who pays for them. The design of these instruments needs to recognize the peculiarities of the agroalimentary sector and the fact that in some cases, although economic logic points towards private financing, or co-financing, the real possibilities of making it happen are slight or non-existent. To be profitable, R&D activities require a minimum market size or area of application, as well as a certain degree of organizational and managerial development; in some situations these elements are not present. In such cases the issue ought not to be privatization, but rather to connect those who benefit from them – primary producers, companies producing inputs, processing or distributors, NGO's – to decision making and financing processes, while research is maintained at existing organizations, whether public universities or others, where it is possible to take advantage of economies of scale and make efficient use of strategic resources, such as scientists in priority areas, laboratories and complex equipment. Although advances have been made towards new arrangements, they are still in a preliminary stage, and many public institutions lack the organizational and managerial flexibility to benefit from them.

I.7. Components of a strategy for strengthening the role of agroalimentary research in promoting innovation

There are two essential elements to strengthen agricultural research and its capacity for mobilizing innovation processes in the agroalimentary sector. One is that research institutions are far from serving as "connectors" to the sciences relevant to agricultural development and food security. Regardless of whether or not they have ever done so, the fact is that at present, they are far from dealing with pending challenges, and their deficiencies are not solely in terms of capacity, but also in being isolated within the national research systems and, consequently, unable to serve as mobilizers of capacities located in other institutions – universities, NGOs, producers' organizations, etc. The second aspect is the growing focus on innovation as the objective of research efforts. The fact that what is stated is a correct perspective – innovation is actually the ultimate aim sought by society – the reality is that very little progress has been made in recognizing the differences and boundaries that separate the domains of research and innovation and establishing the policies and institutional links required by these new perspectives. Therefore, very little progress has been made beyond declarations, and the reality is that institutions continue to do basically the same thing they always have done, and the processes of under-investment and deterioration do continue, while the opportunities offered by the new realities of agriculture are being lost.

In this scenario, a strategy for strengthening agricultural research ought to consider three levels of work: policies and national system of innovation (SIN) and SNIA; the system of research and technology transfer and its operational mechanisms (SITT); and the current agroalimentary research institutions. In Figure I.2 on the following page, and in Annex I.1, is a summary of the principal orientations that each action should have at each level.

Figure I.2: Synthesis of strategies and specific actions to strengthen agricultural research with a prospect of promoting innovation



The national system of innovation, including the sectoral system of agroalimentary innovation.

As has been emphasized, although current thinking is increasingly in terms of innovation, the reality is that institutions and policies are still far from reflecting this change of vision. In most cases, there are no institutions or policies that allow for placing agricultural research efforts – their orientation and levels of investment – in a context of innovation that recognizes: i) that innovation includes, but goes beyond, research; and ii) that in order to promote innovation, more comprehensive strategies and policies are required and that they are not necessarily associated with the world of new knowledge (markets, financial services, etc.). In terms of Figure 1, actions undertaken to strengthen agricultural research and technology transfer should follow an innovation framework, and be coordinated with the policies and priorities derived from them. Recognizing that innovation is a complex phenomenon and the role of economic actors – including those of the agroalimentary sector – it becomes necessary to work on the following things:

(i) Strategies for the national systems of agricultural innovation, within which actors, capacities, relevant policies and priority lines are identified. Ideally, this should be derived from the national innovation strategy, but in its absence – as is the case in most countries in the region – sectorial efforts joining agriculture and food with science and technology, should be undertaken with the aim of providing a framework for research and technological development, and making explicit the necessary conditions for innovation. The preparation of diagnostics of the

Box I.5: National System for Research and Technology Transfer for Sustainable Rural Development (SNITT) in Mexico

The SNITT is an interesting experience in terms of moving forward with integration of the three proposed levels of work. In this light, it is a consulting body of the Intersecretarial Commision for Sustainable Rural Development, operating as part of the Secretary of Agriculture, Livestock, Rural Development, Fisheries and Foodstuffs, and which operates as a mechanism for coordination, harmonization and linkages of the functions of the various offices and institutions of the public, social and private sectors, to undertake the generation of research and in particular for technological development –its validation and transfer—, considering research and training of human resources as a priority investment in sustainable rural development. In particular, the objective of SNITT is "to coordinate and harmonize the actions of public institutions, social and private bodies that foster and conduct activities of scientific research, technological development, validation, and knowledge transfer in the agricultural domain, tending towards identification and attention to both major national problems in matters such as the immediate needs of producers and other agents in rural society." In its capacity as catalyzer and mobilizer, SNITT has, since its creation in 2002, become a central actor in agricultural R&D in the country, not only through its direct participation, but also by ofering a platform for inter-institutional integration of capacities, and "vertical" articulation among policy venues, of research itself, and of organized productive sectors.

From 2009 up until now, SNITT has mobilized 50 mega-projects of national scope both in the sectors of agrículture, livestock and fisheries-aquaculture, as well as in transverse issues (climate change, plant health, efficient use of water, protected agriculture, agroenergetic crops, etc.), involving more than 300 institutions and 900 researchers. At present there is a growing consensus that since its creation, SNITT has been a decisive factor in improving, on one hand, the connection between the system's various public and private actors, and on the other hand, seeing to it that specific R&D activities actually reflect the goals of public policies for the sector.

Source: http://www.snitt.org.mx/p_cientifica.html and Trigo (2007).

situation (actors, roles, resources and capacities, interrelationships) and specific proposals for organizational-institutional mechanisms that ought to be present to carry things forward, are also necessary, and

(ii) The implementation of adjustments in regulatory and support frameworks for innovation in areas such as intellectual property, biosafety, animal and plant health, systems of standards and measurements and quality systems, among others.

The research and technology transfer system.

In recent decades, even in the smaller countries, universities, non-governmental organizations, and private companies have developed capacities that are not always fully exploited. In this context, governmental institutions will continue to be important. However, increasingly they ought to function within an institutional division of labor that takes into consideration recent changes, not only in the location of capacities, but also the kind of technology required and its public-private nature. In this context it is becoming indispensable to discuss the roles and priorities of the public sector, not only with regard to the provision of "public goods" – which has always justified State investments – but also the new scenarios described above.

In parallel, new tools must be developed to increase the private financing of research and technology transfer, as well as mechanisms for institutional governance and decision making oriented to the market, ensuring a greater participation for producers, but also other actors, especially in agroindustry. In some cases this will be possible within the realms of the national systems for agricultural innovation, but regardless of how much progress is achieved, specific and proactive actions will be necessary on at least two fronts.

- As far as planning is concerned, actions aimed at bringing about a better integration of agricultural research institutions to the science and technology system, and this ought to take place in the framework of agricultural research projects based on recognizing the diversity of agents and capacities, and establishing an agreement on the roles and priorities work. In some situations there are strategic plans by means of which INIA's define entry mechanisms, however these are institutional visions not generated from the perspective of coordination and collaboration with other actors.
- It is necessary to define common strategies that reflect, on one hand, a set of the most effective capacities and options available for medium and long-term goals; and at the operational level to make sure that work is actually carried out in accordance with these goals. This probably demands the incorporation of institutional innovations along the lines of councils or agencies to promote science, technology and innovation – like those that have already been set up in countries such as, Brazil, Argentina, Chile, Uruguay and Peru. Emphasis should be placed on setting up instruments that enable and foster work in inter-institutional consortia, of a national and international character, as well as the effective incorporation of the private sector (companies, NGO's, etc.) into technological development efforts.

Agricultural Research Institutions.

The public research institutions need to be strengthened to address the challenges that have been identified. As noted, these institutions may have lost the status as the sole actor they held in the past, however they will continue to have a central role in the future in the region's innovation systems. Perhaps in the smaller countries their role will be as a sort of "antenna" for capturing and adapting knowledge and technologies relevant to their particular problems; in others, their functions will be oriented towards expanding the frontier of knowledge, but in all cases, their role will continue to be as strategic as it has been in the past. There are numerous possibilities for innovation and there are opportunities to take advantage of technological spillovers created by the investment and developments occurring elsewhere, however all available evidence indicates that to do this effectively, capacities at the national level would be indispensable. Considering the current situation of public research institutions today and the challenges that they must face in the immediate future, there is a need to address the following:

(i) Their institutional and organizational frameworks must be strengthened, with the aim of allowing a greater and more effective participation of the different actors, in addition financial support must be in place to the current structures may respond better to the characteristics and requirements of research (level and stability over time);

(ii) The continuing development of their human resources and infrastructure – laboratories and databases – both in conventional areas as well as in new sectors (biotechnology, precision agriculture, post-harvest and agroindustry);

(iii) The improvement of management capacity in key issues of research for technological development (intellectual property, consortium projects, technological linkages, biosafety, etc.); and

(iv) Arrangements and instruments to allow for a better articulation with the various actors in technology transfer systems (knowledge management, policies and mechanisms for the management of operational partnerships, etc.).

The weight of the activities mentioned in the foregoing paragraphs and the definitive form for the adjustments and changes required will depend, of course, on the characteristics of each country and the way and intensity of the trends discussed in this document. The goals, work settings and instruments associated with each level of work, are explained in Annex I.1.

I.8. Final comments on operational questions and policy timeframes

The challenge of strengthening the role of agroalimentary research to promote innovation can be synthesized in terms of four essential aspects. In the first place, agriculture is repositioning itself with respect to its role in development policy, whether because of food prices, or due to the need to respond effectively to climate change, or because of the new realities of a world with more expensive energy. The role of agriculture as an tool for solutions is being reassessed, together with a growing recognition that technological development and innovation are ineluctable components of any future strategy. A second aspect has to do with the acceptance of innovation as a

framework that justifies investment in the development of new knowledge and technologies, within a process -still taking shape- where little has advanced in terms of strategies and policy. People think of innovation but still seek to act upon it based on the concepts and institutions of research, without fully recognizing the differences between one process and another. In the third place, it is recognized that agroalimentary research institutions are part of a broader system of science and technology, that contains them and enhances their capacity and scope, but little has been done or is being done to break away from the secular isolation these institutions have had with respect to the other institutions engaged in science and technology. Finally, a fourth aspect, has to do with "success" of research institutions, and the fact that only a small number of countries have the capacity to deal with the challenges that lie ahead; most institutions do not have the means and resources to work in the new scientific demands, or even to take advantage of what their neighbors have done in areas of mutual interest.

The proposed strategy is then to recognize this reality and focus on building the human resources and institutional capacities to capture the opportunities offered by innovative steps that are better connected to the objectives and needs of society. This is, of necessity, a long-term effort. Expanding the scientific base, training researchers in new areas and the development of new institutional venues needed to bring the system's actors together, are processes that mature slowly. On the other hand, the urgency for developing the "new agriculture" appears to be more pressing. The political processes that have nourished the repositioning of agriculture in the region and at the global level, are of such a magnitude that they could only with difficulty meet the urgency for building new institutions. When the time comes to put forward the operational approaches to the new institutional set up, it must be ascertained that the propositions offer a full menu to ensure that a good job is done in mobilizing what is on hand today – even if it falls short in light of the magnitude of the challenge – as the new components are constructed.

This document has not gone into specific analysis for the sake of rapid exploitation of what is on hand today –a task that would be impossible to execute at the general level in which this discussion has been put forward– nevertheless, it does appear that what is actually being attempted falls short of expectations, therefore, an effective and politically intelligent strategy should include an effort to adapt and bring to bear existing knowledge and technologies. The how-to of these efforts will inevitably be different in different cases, reflecting the nature of past problems and investments, but it is imperative that the effort be undertaken.

Annex I.1: Summary of areas of intervention for strengthening agricultural research institutions and national agricultural innovation systems

Level of intervention	Objectives	Scope of Work	Instrumental actions
National System of Innovation/ System of Agricultural Innovation	Promote definition of medium- and long-term objectives and, as needed, venues with capacity and mandate concerning policy and instruments to promote innovation	Maximum levels of political-administrative decision making, Ministries of Agriculture, Ministries of Science and Technology	* Situation diagnostics and drafting of organizational and policy proposals for the sector * Activating mechanisms for coordination of intersectorial policies
	Improve current situation and remove specific obstacles to the proper functioning of innovation processes associated with horizontal factors (financing, regulatory frameworks, etc.)	* Institutions linked to promoting and financing science, technology and innovation * Agencies in charge of regulatory frameworks (IP's, biosafety, plant and animal health)	* Support programs for entrepreneurial and innovative initiative *Creation/adjustment/modernization of regulatory frameworks in relevant areas * Creation of spaces for coordination between institutions comprising SNI.
National system of agricultural research	Focusing of efforts on priority problems and mobilization of full range of existing Science & Technology capacities	Institutions (both public and private) of the science and technology system	* Drafting of a national plan for science and agricultural technology * Promote creation of consortia and capacities with other national and international institutions * Mechanisms geared towards facilitating working with the private sector (companies, NGO's, etc.)
Agricultural research institutions (INIA)	Ensure availability of strategic capacities in priority issues / areas for policy and priorities of the country	INIA's	* Institutional and organizational modernization * Ongoing development of human resources and infrastructure, in both new as well as conventional areas * Strengthening management capacity (IP's, management of consortia, technological linkages, biosafety, etc.) * Mechanisms for knowledge and strategic partnerships management with actors in technology transfer.

Part II. Innovation Platforms in Latin American and Caribbean Agriculture in the 21st Century

II.1. Introduction

In today's world a small farm, a big company, a public institution, a region or country are all, without exception, horizontally connected through knowledge sources of various kinds, and vertically through actors who regulate and provide services, infrastructure, trade, information, communications, policy and, of course, technology. In this light, it is hard for organizations – whether small or large, structured or not- to undertake on their own major processes of innovation, defining the latter in their more simple form as the benefit to society derived from the adoption of new knowledge, technology or a product. A number of authors have addressed this subject recently, for example, Barrera (2011), the World Bank (2008), Rajalahti, Janssen and Pehu (2008) and Juma and Yee-Cheong (2005).

In this framework, organizations or companies, whether small or large, can benefit from acquiring other sources of information, experience, lessons learned and –unquestionably – technology developed by others that could be validated and adapted in their own environments. Cooperation and complementation of capacities –in essence, working together on a problem or opportunity of common interest - is the lowest common denominator for the different *platforms* that will be considered this document. In their simpler and more concrete conception, these platforms enable components and actions, aimed at positive results and impacts (innovation), to join together and energize each other in order to take advantage of an opportunity or confront a constraint. The foregoing is of course desirable though not necessarily easy, and requires, as shall be seen below, certain conditions and favorable settings to enable the expected benefits to materialize.

Cooperation, complementing of capacities and regional information exchange have a long history in the agricultural sector in Latin America and the Caribbean (LAC), where various mechanisms have been designed and activated to foster their development. Among the notable thematic networks the technological consortia, it is worth to mention the Forum of the Americas for Agricultural Research and Development (FORAGRO – *Foro de las Américas para la Investigación y Desarrollo Agropecuario*), the Regional Fund for Agricultural Technology (FONTAGRO – *Fondo Regional de Tecnología Agropecuaria*), Cooperative Research Programs (PROCIS), as well as projects of various kinds, including non-governmental organizations (NGO's), companies and advanced universities of North America, Europe and Asia with institutions in LAC. At the national level, the Produce Foundations in Mexico, Parafiscal Funds in Colombia and the technological consortia of the Southern Cone countries (PROCISUR), among several others, reveal significant cases of cooperation and joint effort among sector organizations, producers' groups and companies. Arrangements and initiatives differ a great deal between more developed and less developed countries, and are directly influenced by established national policies and incentives. Very recently a strong interest has been observed in so-called Technology Platforms (TP's), innovation platforms (IP's) and national systems for agricultural innovation (SNIA's). There is no consensus regarding terminology and the scope and management of these mechanisms, although the central critical point is to seek and catalyze the articulation of efforts and capacities to overcome constraints or make the most of an opportunity.

The aim of this section, therefore, is to foster better comprehension in the design and management of platforms, in the broadest sense, for the regional agricultural sector. Platforms of little complexity will be considered, but more sophisticated situations will also be analyzed – as it is the case of IP's – where intellectual property and contractual elements are already coming into play as an intrinsic part of the picture.

II.2. Purposes

As hinted, the purposes of the document are as follows:

- To argue and document the importance and relevance of joint research for a common purpose or interest;
- To analyze and differentiate the different concepts used in practice and in the literature (networks, consortia, projects, platforms of various kinds, etc.);
- To selectively discuss cases and examples of platforms and similar mechanisms and distill some of the lessons learned from them;
- To discuss principles and strategies for the design, management and financing of different kinds of platforms; and
- To offer recommendations in relation to priority platforms that could be subject to support or co-financing by the public and/or private sector.

II.3. Platforms, Consortia and related Concepts

The term "platform" by itself proves somewhat vague for the purposes of this document. Although it was decided to adopt it, given the frequency of its use in practice and in literature, moreover considering that other terms such as "project," "consortium," "network" or "alliance," do not necessarily show a better fit. The definitions of these concepts by the Royal Academy of the Language (*Real Academia de la Lengua Española*) are indicated in Chart II.1, comparing their versions in Spanish with those assigned by the *Apple* online dictionary in English. When the word "platform" has appropriate qualifiers added to it, the level of comprehension increases significantly, for example: technology platform, information platform, launching platform, cooperation platform, training platform, etc.

The concept of "technology platforms" (TP's) is perhaps most commonly used, and has been broadly applied with diverse definitions and attributions. TP's, given their nature and focus on science and technological development, do not necessarily consider the final purpose of their action: adaptation and adoption of results, and ultimately, the final impact on society (innovation). For this reason they can be called open platforms where - with some exceptions- knowledge or technology is found in the public domain, and it can be classified as pre-competitive. TP's are perhaps one of the modalities traditionally used mostly in Europe and North America, although there are experiences of interest in other regions of world, including LAC.

The European Technology Platforms (ETP's) constitute a major experience from which lessons for Latin America and the Caribbean are derived (Idea Consult, 2008). The aims and scope of the ETP will be considered subsequently in this document.

In Latin America there is significant experience with the so-called technological consortia. Their explicit objective is to deal with market failures affecting entrepreneurial innovation through partnership strategies that help internalize knowledge spillovers, coordinate the use of active complementary elements and share the technological risk for investments in innovation made by private sector agents (Alvarez et al., 2010). One characteristic of the consortia is cooperation between firms, through formal agreements for project design in which joint investment in research and development aims at increasing scientific and technological knowledge and applying it to the creation of new and improved processes and products (Hagedoorn, 2002, cited by Alvarez, 2010). This definition, nevertheless, does not contain any explicit reference to the public financing of this kind of initiative nor to participation by universities and /or research centers. The role of research centers and of public financing appear in what Kalkstein (2007, cited by Alvarez, 2010) calls "innovation consortia," which he defines as follows: *programs financed publicly, which aim at expanding and improving the level of interaction between centers engaged in research and companies, producing high quality research as a result.*

On the other hand, the term "Innovation Platforms" (IP) has had a very vague connotation and the definitions available in literature do not shed much light on their characteristics and how they are managed. In the press and in informal discussions one often hears the term, "research platforms for development" as a synonym for innovation platforms or innovation systems, once again affording little conceptual clarity. If we consider it in the strict sense, the concept of an IP would prove revolutionary because one would have to consider in its design and management –in addition to its scientific component – the necessary mechanisms (legal framework, infrastructure, standards, commercialization channels, etc.) to allow knowledge and its resulting products to be adopted and to have a positive impact on society. In this framework, and in contrast to the TP, IP's can be considered closed and competitive, and therefore –as a necessary condition – the private sector should be part of them, its results and products are to be protected and it is very probable that they will not be immediately available in the public domain. It is necessary to point out that in practice it is possible not only to observe but also to encourage a *continuum* of actions whereby TP's produce technology (pre-competitive stage) and this, if it is feasible to generate the necessary favorable conditions, can evolve in to IP (competitive stage). Some concepts and definitions of technology platforms, innovation platforms and related terms found in other documents, are indicated in Chart II.2.

Considering that the concept of the IP is the least developed in the literature and as a point of departure, this document proposes – for theoretical and practical consideration – the following definition for IP's:

An IP is a mechanism that links scientific and technological development with the adoption of results and impact on society, based on a contractual agreement that combines and defines -a priori- a common vision encompassing the parties, capacities, responsibilities, investment, intellectual property and benefits.

It is recognized that the foregoing definition could be in conflict with the thinking of those who believe that innovation does not necessarily require prior technological development, nevertheless,

given that the point of departure of this document is science and technology, the authors prefer to maintain the formulation given. In the sense indicated, it is not to be expected – even though it is recognized that there are and can be justifiable exceptions – that an IP is a permanent structure, but rather an agreement or contract to carry out significant and complex activities from a scientific and management point of view. An IP can include public and private actors from the same country or from different countries and ultimately has a defined spatial and temporal framework. In the context described, IP's do not take the place of established institutions, but rather complement them by addressing challenges that require capacities and resources beyond the reach of a single actor. In addition – based on the proposed definition - activities currently referred to as technological platforms and innovation platforms are more conceptually similar to technical-administrative R&D networks or structures, whereas others that do not use these terms may come closer to the definition of an IP.

Considering or accepting a concept such as the previous one poses a challenge since it involves a theoretical definition to some extent, given that there are few examples –as shall be seen below – that strictly fit the case, although some get to be fairly close. This should not restrict its consideration, design and management since IP's can represent a significant option for generating results and impact in territories, countries and among countries, using mechanisms for cooperation and complementary strengths on high priority problems or opportunities: biotechnology, food security, bioinformatics, traceability and plant and animal health, among others. In essence, IP's, along with similar mechanisms, can and should become instruments of great interest for the agriculture of LAC in the 21st century.

The stated definition keeps the concept from being too open, dispenses with other things that might be called IP's and in this sense -it is hoped- it would make a contribution to regional thought and debate on a particular mechanism of interest. Nevertheless, and precisely because there are not many specific cases in the region that, strictly speaking, can be called IP's, it would be prudent to broaden the conceptual framework and discuss the continuum of pre-competitive technological platforms that can be, or may become by design or by chance competitive and innovative initiatives. In essence, in select cases and within the 21st century framework, IP's could be a key goal – given economies of scale and of scope and potential impacts. Nevertheless, for practical reasons it is prudent to consider that circumstances are not entirely ripe for the massive launch of IP's, in this line of thought TPs' could be a desirable intermediate stage in those cases or countries where legal and management capacities are still not altogether appropriate.

With the purpose of strengthening the conceptual framework it should be clarified that what has been described thus far refers to formal platforms whose design and management would be starting from scratch. In practice, it would be useful to seek spaces where more informal IP's can be structured that connect actors and respond to opportunities (*serendipity*) that are not necessarily planned ahead of time. The latter, as an essential condition –in order to be classified as IP's – must have the goal of generating or capturing and adopting knowledge and technologies that have positive impacts on society (innovation). In Chart II.3, some characteristics of TP's and IP's are set forth and compared.

At the risk of overstating the point, it is necessary to emphasize the importance of driving and structuring platforms that are national, as well as regional and international. The strategies, principles and recommendations derived from lessons learned are in essence the same, although national ones might exhibit less complexity in their management for reasons of proximity, a common legal framework and lower costs. Of the five cases discussed in the following sections and in Annex I, three are national platforms.

In addition to the definition considered above, the following general objective is proposed for IP's:

Significant scientific initiatives among public and private actors drive the capture or development and adoption of knowledge and products –of interest and benefit to society- in a defined space (territory, agroecological zones, etc.) and within a finite period of time agreed upon between the parties.

One central concept is that platforms in general, and IP's in particular, by their nature do not exist or cannot exist in a vacuum, and ultimately depend on and are nourished by visions of future capacity and experience in the public, academic and private sectors of a country or among countries. In some cases these capacities are substantive approaching veritable Agricultural Innovation Systems (Rajalahti, Janssen, Pehu. 2008),[21] in which the strengths of the public sector, academic and private companies are widely providing a suitable environment for the design and development of IP's. In other cases, where national systems may be weaker, the setting up of IP's will require a substantial strengthening of local capabilities, resources and management or the complementing of capacities among weak and strong national or international actors. Although IP's may not find a suitable environment in small or technologically weak countries, on the other hand, their development in these settings, while slower, could be an important factor for creating and strengthening national capacities and knowledge systems in the long term.

II.4. Experiences and Lessons Learned from National, Regional and International Platforms

The diversity of initiatives with platform characteristics is very extensive but their assessment and critical analysis are limited by one or a combination of the following factors: limited implementation time; at their inception, planning for or commitment to a formal assessment of results and impacts was not explicitly determined; the arrangement and management of the platform was informal or documentation is slight. In this framework, an impact analysis or simple cost benefit analysis is not possible, however, it is feasible based on documentary and circumstantial evidence to obtain a series of useful conclusions for the future.

Annex II.1 contains a brief description and an attempt to analyze the accomplishments and limitations of five initiatives that can be considered to be IP's or that at least approach the concept and definition. Based on this representative sample, it is possible to observe a part of the current universe of platforms, their limitations but also their immense future potential, if the policies and

[21] Defined by the authors as, "*a network of organizations, companies and individuals focused on developing new products, processes and new kinds of organization for economic use, together with the institutions and policies that affect their behavior and performance"*

incentives are the rights ones. The sample includes the following:

- European Technology Platforms (ETP's)
- Entrepreneurial Technological Consortia (Chile, Argentina, Uruguay and Colombia)
- Asociación Argentina de Productores y Siembra Directa (AAPRESID) (Argentina)
- Bioprospecting, National Institute of Biodiversity (Costa Rica)
- Flagship Program in Sustainable Agriculture (*Flagships*, CSIRO, Australia)

The first two examples - ETP's and Entrepreneurial Technological Consortia – are two cases where complementation and cooperation between the public and private sectors has been designed from the outset, seeking synergies and economies of scale. In both types of platforms it is still too soon to judge whether or not a process of innovation will take place, and ultimately, its adoption and impacts on society. On the other hand, the evidence shows a very significant gain in intermediate products, particularly strengthening of capacities, technological development, information exchange and continuous learning, all of which would justify the investments made. These two cases, in turn, have the particularity –although actions are concentrated in individual countries – of having a more regional strategy or vision and of having planned *a priori* for the experiences and lessons learned to traverse the borders of the countries.

The case of direct seeding in the framework of AAPRESID is not based on a grand *a priori* design, but rather, it demonstrates the visionary capacity of different actors to exploit opportunities, in short, to read and interpret the potential of utilizing complementary strengths (producers, companies, researchers, extension participants) for the achievement of a greater good. The economic impact of this initiative, as indicated in Annex II.1, has been extraordinary and shows global projections.

The bioprospecting initiative in INBio is undoubtedly ahead of its time. The principles and strategies it used (agreements with companies to look for compounds and molecules with pharmaceutical activity and biotechnological interest) were subsequently adopted by the Biodiversity Convention agreed upon in Rio de Janeiro in 2002. In this case, except for specific contributions to conservation areas, no substantial income has materialized from the royalties negotiated, although intermediate products were created of great value to the country: technologies, capacity building and knowledge of biodiversity, now reflected in the impressive national inventory of species available online.

Finally, the flagship programs in Australia show, without a doubt, a major pathway to the platforms of the future: A rigorous design of the initiative, ambitious and concrete goals, and substantial human and financial resources to sustain and achieve those goals. In addition, this initiative has the strength of structuring multidisciplinary teams and the capacity to attract the best actors from the private, academic and public sectors. It is still too early to assess its impact (the flagship program of sustainable agriculture will have its first formal external evaluation in late 2012), however, initial evidence indicates major a potential.

The last three cases represent national experiences; some already mature, such as AAPRESID where impact has been substantial while others, such as the Flagship Programs of Australia, as

noted, still await assessment of its results and potential impacts.

It is important to recognize that there are many other initiatives which, due to limitations of space and time, will not be considered in this document, among which the following can be cited: *Sub Saharan Challenge Program (Africa); Public Private Partnerships* (ISNAR); *Biosciences Platform* (BeCa, East Africa); BiotechSur (Southern Cone); Papa Andina (Peru); Fondo Regional de Tecnología Agropecuaria (FONTAGRO); Fondo Latinoamericano para Arroz de Riego (FLAR), to name just a few.

A brief description and why the five initiatives deserve consideratio can be found in Annex I, several lessons of a general nature that can be inferred from them are listed below:

- The result and final products are bigger or better (economic impact as in the case of AAPRESID, significant increase in knowledge and capacities in the case of the other platforms) than if the effort had been individual.
- Work with teams where different cultures predominate motivate and compel partners to think and develop "outside the box" strategies.
- Although quantitative analysis has not been conclusive in all cases, the evidence indicates – in a framework of complementation of capacities- the existence of economies of scale in each one of the platforms.
- Intermediate products (capacity building, knowledge, new ideas and visions) appear to be particularly valuable have brought enrichment and are highly appreciated by the partners.
- On a less positive note, and in particular for partners or actors that do not know each other well beforehand, transaction costs can be high, particularly if proximity is not optimal.

II.5. How a platform is structured, and strategies for its design, management and financing

It is appropriate, before putting forward certain principles and strategies, to answer some basic questions: Who drives the formation of the platform? Why? What are the minimum favorable conditions for activating them?

Perhaps the most accurate answer to the foregoing questions involves a combination of factors: opportunity, vision, capacity, resources, an appropriate legal framework and principally a leader or a leading group capable of driving and structuring an initiative of this nature. Visionary ideas often come from an individual "champion" or from a team that develops the heart of the new initiative and brings potential partners to the table to analyze its potential and pre-feasibility. As indicated, it may involve a highly structured *a priori* design or a creative but informal effort (*serendipity*) that may bring together elements that multiply instead of adding up, and there may also be an urgent need to solve a problem requiring the efforts of an ensemble of actors. In all cases, individual capacities already existing or still to be developed are to a great extent the point of departure. Finally, it is critical to have a legal framework with favorable policies and incentives, in particular, with respect to the business climate. It is well known that in some countries the start of a new business may only require a few days or weeks, while in others, the process may take months or years, and given the diversity of its conditions, LAC shows the full range of possibilities!

The time required to structure a platform is ultimately variable, depending on its complexity; based on experience from the cases considered, the estimate is from six months to one year as a normal range. In situations involving organizations and consolidated companies, coordination of the platform (both scientific as well as managerial) is facilitated to a great extent when one of them – with little effort and investment, and by mutual agreement with the other partners- can carry out this function. When this is not the case, it is necessary to create a minimal structure where a formal or informal council of participating partners defines the vision, policies and budgets, and a small executive coordinates and executes actions. In this second case cost tends to be slightly higher.

In Annex II.2 a budget is shown – it should be noted that this is solely for purposes of illustration – for a regional biotechnology platform, in which the main activity consists of priority projects subject to public bidding. For national or regional platforms that require a coordinating board or council and an executive officer, an operating budget -once again, solely for purposes of illustration– for the start and continuing operation of the platform (excluding research and technological development costs) is shown in Chart II.4. It is prudent to point out that the budget for national platforms in big countries, such as Brazil, Argentina or Mexico, may need a higher investment, similar to that of a regional platform, due to higher costs for personnel, travel and coordination.

Platforms in general must consider some, and for more advanced ones such as IP's, a substantial number of the principles and strategies described below in their design, management and financing. These elements comprise a distillation of experiences and lessons learned from the various platforms considered in this study. Their degree of contractual formality is relative, although in cases involving the private sector, it is quite certain that some of these elements must be included in letters of understanding or agreements that the parties end up signing.

Definition of a common vision and objectives. In essence, interested actors place on the table their expectations of achievements, products and impacts and a pre-feasibility assessment of the initiative in question. At this stage, experience, scientific and intellectual leadership and the ability to negotiate -of one or several actors- and expedite opportunities and possible pathways, improves the options for success.

Initial negotiation. Responsibilities, inputs, alternative or complementary actors, and the road map they expect to follow, are analyzed and defined. At this point, having accurate and well-founded information (a knowledge system) on the business or initiative proves remarkably valuable.

Capacities. The critical assessment of strengths and complementation of capacities required for the agreed upon goals is without a doubt another necessary step. In essence, it is a matter of defining who does what.

Management and administration: Legal and contractual elements, and the flow of information and communication are agreed upon between the parties. At this stage, the initiative's Business Plan is unveiled.

Financing and co-financing. This goes hand in hand with the previous item, and is perhaps one of the more sensitive and critical matters in the relationship between partners. Their own resources, bank loans, grant funds, donations or subsidies can be considered.

A priori definition of intellectual property. If there is another sensitive issue for partners in the private sector, without a doubt it must be the definition and allocation of intellectual property rights. This may take various paths: protecting all knowledge generated or only some components, and negotiating licenses subsequently with third parties, sharing property between partners or assigning it to one of the partners in exchange for royalties.

Negotiation and allocation of potential profits (or losses). This is also a critical decision that must be made ahead of time, in particular if the goal is to go directly to the market, or through franchises or licensing.

Scientific feedback, adjustments and management of the initiative. It often happens that in spite of careful business plans it may be necessary to eliminate a planned work path or open a new one, in the light of practical or experimental evidence that this is justified. A good communication system and dialogue to redefine things in motion is highly useful for maintaining the value of investments.

Exit clauses and conflict resolution. Early termination of an agreement for various reasons, and how to resolve conflicts, should they arise, is essentially an art. There are numerous examples and possibilities: One of the institutions or companies must withdraw from the agreement; financing did not work out as expected; the key researcher on one of the components quits; the business plan, research protocol or the possibility of scaling the results does not work in practice, etc. Negotiating contract termination or seeking alternative ways out must be well conceptualized from the outset.

Internal and external evaluation. Failure to plan internal and external evaluations of TP's and IP's is one of the more common errors, and not establishing base lines for measuring advances and progress is another. The analyses and conclusions of this publication have been affected by this deficiency found in most of the described initiatives.

II.6. Recommendations

The 21st century agriculture presents opportunities for setting up select technology and innovation platforms in the region. Some of these platforms could be structured and financed with financing from the private, public, academic and regional philanthropic sectors.

In the first place, in Annex II.2, a biotechnology platform is described, which has not yet been put into practice, however it was discussed with the organizations mentioned. Evidently –with such adjustments and additions as may be deemed appropriate - this constitutes a priority initiative given that it already has a degree of intellectual maturity and installed capacity in the region to get it started.

Additionally and in order to have other options, other platforms are briefly described below, not all of them necessarily classified as IP's, which it would be worth to implement in the region.

Their inclusion is based on the arguments stated below, and on the author's own experience:

- They constitute significant challenges that could be hardly met by a single actor.
- They require complementary capacities and experience, as well as diverse geographic areas from the point of view of research.
- They constitute high priority regional activities from a biological, environmental and socioeconomic perspective.
- They are based on clear demands (productivity, competitiveness and sustainability) agreed upon in different regional fora in recent years.

Adaptation to climate change and gene banks: Among the missing elements -from the point of view of the agricultural sector- are platforms that facilitate the identification, generation and trading (market trading in a true sense) of tolerant and resistant genes held by the private, public and academic regional sector. The exchange of resistant genes, on a market with clear rules, would exponentially increase the region's capacity to maintain comparative and competitive advantages in the face of the threat of climate change. In addition, it would result in significant economies of scale, avoiding duplication of efforts.

A platform of this kind, given the current limitations on genetic exchange between countries, could be managed by a Center or several Centers of CGIAR in the framework of its research programs (*CGIAR Research Programs or CRPs*), which have the advantage of expedited exchanges authorized by treaties of access to plant species of the FAO. The coordinators of the platform, through consultations and regional workshops, could as a first step establish an inventory of genes resistant to, and tolerant of, climate change that are available through their own programs, through countries and transnational companies (which have patented a great number of them); define priority genes for trading; agree upon market rules for each gene of interest (no cost, exchange, sale); negotiate the agreed upon genes and the specific conditions; evaluate and validate these genetic materials through international trials and release the more promising ones through national institutes and organizations. A platform such as this is complex and costly, possibly with a budget of at least US$5 million per year, and yet its potential for impact would be very high.

Bioeconomy: Often referred to in the literature in English as *Knowledge Based Bioeconomy* or KBBE. Through strategic investments in science and technology, innovative uses of plant and animal biomass are sought, including new generation bioenergetics and the prospecting and development of new products and services through natural and cultivated biodiversity.

This initiative has been maturing over the last three or four years and its implementation would have the benefit and experience of several European countries and their partners in LAC. It will require at the start a definition of leadership (possibly Argentina), an agreement on initial priority issues and projects, agreements between European and regional partners, business plans and management mechanisms, coordination and evaluation of the projects and platform. Based on experiences with similar activities in the region the range of costs for specific projects should be

between US$0.5 and US$3.0 million.

Capacity building and bringing things up to date on cutting-edge issues: There is a considerable degree of consensus on the need to speed up replacement of the generation of researchers in the region. The current population is aging, and with few exceptions is not being replaced with the speed and level of strategic investment needed both in traditional subjects as well as in cutting-edge_issues. Considering regional installed capacity in countries such as Brazil, Argentina, Mexico, Peru and Colombia, as well as in CGIAR centers, CATIE and other organizations, it ought to be feasible to structure –with an emphasis on smaller countries- a platform that makes possible accelerated training of professionals in cutting-edge_issues of interest in 21st century agriculture. An initiative of this nature can also be co-financed with other actors, including the region's philanthropic sector under the leadership of the IDB.

This activity should commence with research and development of a regional consensus on issues and subjects to be emphasized, a prioritization of countries whence trainees will be coming, and a plan and a calendar for capacity building for the next 10 years, including conditions and incentives under which this opportunity is to be offered to outstanding researchers and the commitments they undertake to bring the capacities they acquire back to their countries and to the region. Without a detailed study it is not feasible to guess the size of the initiative and the magnitude of investments required, which would undoubtedly be sizeable.

Productivity and competitiveness: This is one of the more important challenges for the region in the face of prospective population growth, the scaling in food prices, world trade opportunities and the deceleration in the growth of the total productivity of factors. A platform of this nature could identify priority items and value chains and invest in the intensification and strategic diversification of productive systems within a management framework that is friendly to natural resources. An initiative of this nature would be very well complemented with biotechnology and capacity building platforms, and could be led by a consortium of CGIAR Centers and organizations such as EMBRAPA and INIFAP.

It is necessary to proceed on the basis of an analysis of investment priorities, a selection of items, value chains, leaders of initiatives and implementation of an ambitious program (ideally by competitive bidding) in genetics and crop and livestock management that answer to expectations of productivity, competitiveness and smart management of natural resources. The partners are a critical factor, and ultimately a close interaction would be hoped for among the public, private and academic sectors.

Extension in the 21st century. The intensification and diversification of products and markets in commercial agriculture, and the generation and transmission of knowledge throughout the length of value chains in family agriculture require research, as well as modern and up-to-date "extension" tools. Computer technology campaigns, directed at both specific groups as well as the mass media, cellular telephony supported by satellite tools, capacity building and field days through the Internet allow for opportunities not even suspected just a few years ago. This revolution in the generation and transmission of knowledge -in some cases already documented and with measurable impacts – merits a substantial effort and investment in the region, and could

be led by institutions such as the FAO or IICA with the participation of the public, private and academic sectors.

This initiative requires, in the first place, a series of workshops to divulge lessons learned from extension systems used over the past 40 or 50 years, an analysis of modern extension tools for the 21st century that are appropriate to categories of countries (small, large, developed, with slight development, etc.), an assessment of the tools available indicating the advantages and disadvantages of each, and a determination of regional pilot sites where research on extension programs would be done. This should also be complemented by formal evaluations and the subsequent dissemination of experiences and recommendations. It would be precipitous to put a price on a platform of this nature without a prior study, yet it should be emphasized that the initial investment (for the first three years) would be substantial, whereas follow up and dissemination activities would have a lower relative cost.

Chart II.1. Selected definitions in Spanish and English, according to the Real Academia Española (1) and the online Apple dictionary (2)

Term	Spanish (1)	English (2)
Innovación (Innovation)	• Acción y efecto de innovar. • Creación o modificación de un producto y su introducción en un mercado.	• Action or process of innovating. • A new method, idea or product.
Plataforma (Platform)	• Tablero horizontal, descubierto y elevado sobre el suelo, donde se colocan personas o cosas. • Conjunto de personas, normalmente representativas, que dirigen un moviment reivindicativo.	• A raised level surface on which people or things can stand. • An opportunity to voice one's views or initiate action.
Consorcio (Consortium)	• Participación y comunicación con una o varias personas. • Agrupación de entidades para negocios importantes.	• An association, typically of several business companies.
Red (Network)	• Conjunto de elementos organizados para determinado fin. • Conjunto de personas relacionadas para una determinada actividad, por lo general de carácter secreto, ilegal o delictivo. • Ardid o engaño de que alguien se vale para atraer a otra persona.	• A group of people who exchange infomation, contacts and experiences for professional or social purposes.
Alianza (Alliance)	• Acción de aliarse dos o más naciones, gobiernos o personas. • Pacto o convención. • Unión de cosas que concurren a un mismo fin.	• A union or association formed for mutual benefit, especially between countries and organizations.
Proyecto (Project)	• Planta y disposición que se forma para la realización de un tratado, o para la ejecución de algo de importancia. • Designio o pensament de ejecutar algo.	• An individual or collaborative enterprise that is carefully planned and designed to achieve a particular aim.

(1) Real Academia de la Lengua Española, Twenty second edition
(2) Apple on-line dictionary.

Chart II.2. Selected concepts and definitions of TP's, IP's, innovation systems and technological consortia that appear in the literature

Technology Platforms	Innovation Platforms	Innovation Systems	Technological Consortia
Systemic infrastructures for the organization and coordination of processes of innovation characterized by a high degree of complexity, division of functions and specialization of activities and competencies. In this light, platforms operate both at the techno-logical as well as the organizational level *Consoli and Patrucco. 2007*	IP's are spaces that enable individuals and organizations to work together to focus on issues of common interest or concern. They have become popular as a means of bringing together diverse actors in agricultural research for development *(ILRI Clippings, 2010)*	An innovation system is defined as a network of organizations, companies and individuals focused on developing new products, processes and forms of organization for their economic use, together with the institutions and policies that affect their behavior and performance *(Rajalahti, Janssen, Pehu, 2008*).	Their objective is to solve market failures by entrepreneurial innovation, incentives to associative strategies that help to internalize knowledge spillovers, coordinate the use of complementary elements and share the technological risk of investments made by private sector agents (Alvarez et al., 2010)
European Technology Platforms started in 2002 and began to attract and develop significant long-term research and development strategies in areas of interest to Europe. The ensemble of ETP is based on a focus from the bottom up whereby interested parties take the initiative and the European Commission evaluates and guides the processes. *(Idea Consult. 2008)*	These are mechanisms for collaboration between agents interested in a thematic area or technological field that allows for a fluid exchange of knowledge, experience and information to generate products and services to foment competitiveness of the thematic area or technological field to which the Platform is dedicated. *(Alvarez, 2011)*		

Chart II.3. Some characteristics, objectives and actors in TP's and IP's

Platforms	Characteristics	Objectives	Actors
Technology	Open. Knowledge or technology is found in the public domain and classified as pre-competitive.	Development of knowledge and technology, for the most part available to anyone interested. Bringing together of actors with complementary capacities and resources.	Public and academic sectors – sometimes with the participation of the private sector.
Innovation (formal)	Closed. Based on formal negotiation and designed for specific *a priori* purposes. The knowledge or technology is protected and may or may not be placed in the public domain, depending on contractual agreements.	Development of knowledge and protected technology oriented towards new products and services. Bringing together of actors to multiply capacities.	Private sector with private sector, or private sector with public or academic sector
Innovation (informal)	Closed. These tend to be opportunistic (*serendipitous*) and are negotiated once there are promising results and opportunities to formalize collaboration. The knowledge or technology is protected and may or may not be placed in the public domain, depending on contractual agreements.	Development of knowledge and protected technology oriented towards new products and services. Bringing together of actors to multiply capacities.	Private sector with private sector, or private sector with public or academic sector.

Chart II.4. Illustrative operating budget for national and regional platforms in thousands of US$

Activity	National Platform			Regional Platform		
	Year 1	*Year 2*	*Year 3*	*Year 1*	*Year 2*	*Year 3*
1) Pre-feasibility meeting	10	0	0	25	0	0
2) Feasibility and consultation	30	10	0	70	15	0
3) Design meeting	10	0	0	25	0	0
4) Coordinator	60	65	70	110	115	120
5) Assistant	30	33	35	50	60	65
6) Coordinator Travel	10	10	10	20	20	20
7) Office rental	20	20	20	24	24	24
8) Equipment and maintenance	15	5	10	25	10	10
9) Information and comunic.	10	10	10	15	15	15
10) Annual Board meeting	10	10	12	25	25	30
11) Preliminary evaluation		0	15	0	0	30
11) Contingencies approx. 5%	10	8	9	20	14	16
TOTALS	**215**	**171**	**191**	**409**	**298**	**330**

ANNEX II.1

CASE 1. EUROPEAN TECHNOLOGY PLATFORMS (ETP'S)

WHY IS THIS INITIATIVE OUTSTANDING?

ETP's strengthen the work between the private and public sectors, helping to develop areas of knowledge, European economic growth, the provision of public services and the restructuring of traditional industrial sectors. The European Commission does not own the platforms, although it does support their creation and maintains a dialogue with them on critical research issues. The agendas that the platforms construct support the definition of future research budget, creating consensus and synergies, and aligning the efforts of the different actors. Several of the platforms focus on the overarching theme of bioeconomics, such sectors (agriculture, foodstuffs, biotechnology, etc.) derive their products from biomass and whose annual value amounts to the astronomical sum of €1.5 trillion.

BRIEF DESCRIPTION

An external evaluation of the ETP's makes it possible to analyze and internalize lessons learned. Platforms are implemented in three phases: i) emergence and organization; ii) definition of a strategic research agenda; and iii) implementation of the agenda. The evaluators note that ETP's have had success in phases (i) and (ii) but that the transition to phase (iii) has been more difficult given that it requires strategic decisions and financing by partners. Overall, other elements of the evaluation are very positive:

- ETP's are open and transparent in their design and management
- The representation of different sectors in ETP's is good, except for NGO's and consumers
- Partners of ETP's assess their strategic work from the point of view of focusing on the needs of areas of interest
- Communication and coordination have increased, as well as the synergy in the definition of priorities
- National and European Union financing have increased, private financing as well, though to a lesser extent. Future financing is an open question.
- Many of the challenges present at the creation of the ETP's still persist, but some of them need to be adjusted to a new reality.
- In general, satisfaction with ETP's of the different actors is high, in particular, federations of the sector and public organizations. Most actors would renew their participation.
- The scarce availability of information makes it difficult to better structure the evidence of roles and achievements of ETP's, this needs improvement.

Sources:
http://cordis.europa.eu/technology-platforms/

IDEA Consult. 2008. Evaluation of the European Technology Platforms (ETPS). Final Report. Brussels, Belgium. 146

CASE 2. TECHNOLOGICAL CONSORTIA IN LATIN AMERICA: CHILE, ARGENTINA, URUGUAY AND COLOMBIA

WHY IS THIS INITIATIVE OUTSTANDING?

The Chilean consortia were implemented recently, their objective is to "join forces" of companies and other organizations such as Universities, Institutes and Technology Centers to share costs and benefits derived from R&D, appropriate externalities generated by the activities of innovation and reduce transaction costs. In the case of Argentina, Colombia and Uruguay, the aim is that associative programs among different agents of the economy would drive research projects and scientific-technological innovation. A recent technical note of the IBD constitutes one of the first attempts to evaluate this experience. According to the authors, the existence of R&D spillovers makes it difficult for innovators to appropriate the returns on this investment, which would justify complementary contributions and investments by the public sector.

BRIEF DESCRIPTION

The short time that has elapsed since their implementation and the learning curve required justify having the available results reviewed in the future. The evaluation reveals the following:

- Formalization of the consortia has been through a new legal entity (32.4% of cases) and the formation of an *ad-hoc* company (29.4%).
- For nearly 50% of the sample of companies, the time it took from the idea until the start of consortium activities is between 6 months to one year.
- Companies and institutions have a low degree of previous cooperation (around 62%), which helps explain the high transaction costs encountered by consortia in their early stages.
- In general, the objectives of consortia have little relation to improving capacities and innovation, but rather enhancing the competitiveness of sectors and regions: the beekeeping cluster of northwest Argentina and the milk consortium in Chile.
- The main contributions of the Consortia have been access to knowledge (marketing, international markets, trained personnel) and joint developments with companies.
- The least important contribution is associated with applying for and getting patents for intellectual property.
- It can be inferred that the Consortia have been more effective in reducing asymmetries in access to technological innovation and assessing the capacity building and advisory input of the universities.
- Impacts seem low in innovation of products and processes and obtaining patents, which introduces doubts as to whether consortia solve the market failures that justify their existence. That is to say, they would appear to be generating benefits of a more intermediate nature: capacity building and access to knowledge.

Source:
Álvarez R, J Benavente, C Contreras, J Contreras. 2010. Consorcios Tecnológicos en América Latina: Una primera exploración de los casos de Argentina, Chile, Colombia y Uruguay. Banco Interamericano de Desarrollo. NT127, Washington, DC.

CASE 3. ZERO TILLAGE TECHNOLOGY IN ARGENTINA

WHY IS THIS INITIATIVE OUTSTANDING?

It constitutes an important example of: i) success in research and innovation on a global scale; ii) an "open" system; iii) public-private, at some times, but private-private, at others, depending on what issues or functions are being dealt with; iv) it is evolving over time; and v) "informal," but with certain minimal rules. Its initial development was conceived to internalize negative externalities, induced by the conventional preparation of soil, and ultimately to contribute to productive sustainability.

BRIEF DESCRIPTION

After a period of stagnant production and productivity, at the beginning of the 1970's, a series of independent but interconnected events drove a new technological cycle that led to a rapid growth in the production of grains and vegetable oils, in particular, zero tillage and the introduction of a variety of genetically modified soy. The Argentine Association of Producers and Direct Seeding (AAPRESID - *Asociación Argentina de Productores y Siembra Directa*) was created in 1989; it grew very rapidly and established itself as the primary transformation front. AAPRESID was created by small and medium-sized producers, initially about 20 of them, and subsequently grew until it encompassed the universe of everyone interested in the sector transformation. This accomplishment was the result of agreements and collaboration between farmers, researchers, extension participants and private companies using zero tillage as their key axis and point of departure. The work evolved from problem identification to the development, evaluation, dissemination and adoption of technological alternatives, generating not only mechanisms for information exchange, but also the microeconomic conditions and appropriate policies to support the process.

This initiative's significant accomplishments can be summed up as follows:

- The area of minimum tillage went from 300,000 to 22 million hectares between 1991 and 2008
- New technologies and areas incorporated into production created an estimated 200,000 new jobs, reversed soil degradation and helped to reduce the increase in food prices
- Estimated profits amount to the astonishing sum of US$34 billion!

Sources:

Trigo, E., E. Cap, V. Malach and F. Villarreal. 2009. The Case of Zero-Tillage Technology in Argentina. IFPRI Discussion Paper 00915, prepared for the project on *Millions Fed: Proven Successes in Agricultural Development*. 32 p.

CASE 4. BIODIVERSITY PROSPECTING. INSTITUTO NACIONAL DE BIODIVERSIDAD (INBio), COSTA RICA

WHY IS THIS INITIATVE OUTSTANDING

The first bioprospecting agreement between INBio and the Merck Company was signed in 1991 and was, without a doubt, ahead of its time. The main elements in this contract were analyzed and to a considerable extend incorporated into the Convention on Biodiversity arrived at in Rio de Janeiro in 1992. Despite the fact that agreements with pharmaceutical and biotechnology companies have not represented the "gold mine" from a a financial point of view expected by some, they did provide significant knowledge (national inventory of biodiversity, now online) and added technical capacities to the country. The most important thing is that they set a standard in terms of how to negotiate access to and benefits from the biodiversity of a country, respecting the legal and ethical framework agreed upon in Rio.

BRIEF DESCRIPTION

INBio restricts access in three dimensions: purpose, quantity and time. A company may evaluate vascular plant extracts for activity against skin cancer (purpose). The access may include extracts from 100 species for which the company will have exclusive rights for a period of three years, for example (quantity and time). The company expects that INBio will guarantee the samples are obtained legally and that they will not be delivered to a competitor for the same purpose.

The benefits are negotiable, and, when indigenous communities are not involved, they may include the following:

- Costs of research and support for conservation provided by companies
- Technology transfer. Contractually agreed upon and defined according to the strengths of the company and the needs of INBio
- Capacity building. Normally for short periods in company laboratories and in processes or technologies of interest to INBio
- Royalties in Exchange for intellectual property rights (solely for active compounds or molecules active) held by the company
- Sustainable use. Samples to be taken should not cause harm to natural ecosystems

If there are indigenous communities in the territories where bioprospecting is conducted, the issue of access becomes more complex and prior consent agreements and negotiation of benefits are definitely required.

Sources:

Mateo, N., W. Nader and G. Tamayo. 2001. INBio. Bioprospecting. In Encyclopedia of Biodiversity, Volume 1. Academic Press, p. 471-488.

Mateo, N. 2009. *"Bioeconomía Basada en el Conocimiento como Jalonador de Desarrollo Económico y Sostenibilidad Industrial."* Presentation at UNIDO Conference. Concepción, Chile, Nov. 2009.

CASE 5: COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION (CSIRO). SUSTAINABLE AGRICULTURE FLAGSHIP PROGRAM, AUSTRALIA.

WHY IS THIS INITIATVE OUTSTANDING

CSIRO, with some 7,000 employees, has been worked in a rather compartmentalized fashion, but faced with the evidence of significant challenges that cannot be tackled by any single group, has taken the decision to structure ten flagship programs to solve specific problems and take advantage of new opportunities. With this purpose, it has assigned 200 scientists from 10 of its 14 divisions (400 people in total) to the Flagship Program in Sustainable Agriculture with an annual budget of A$62 million, approximately half of which comes from private partners. The goals are concrete, ambitious and of very broad scope: increasing the productivity of agriculture and the forestry sector by at least 50% and reducing the intensity of carbon emissions by at least 50% by 2030.

BRIEF DESCRIPTION

The initiative is based on sustainability throughout the length of the value chains for four components: i) emissions reduction and carbon storage in soils; ii) agricultural productivity minimizing environmental impact (eco-efficiency); iii) increasing the value of productive systems in territories; and iv) collaboration with Australian and international partners in livelihoods for rural communities. The specific goal points to total factor productivity growth of at least 2% per year over the next 20 years.

The initiative is multidisciplinary: agriculture, biophysics, economics and social sciences. Co-investments and one-time and long-term strategic alliances of up to 15 years are being negotiated. The Program has a grant fund to support clusters and research projects, as well as capacity building and graduate fellowships. The principles guiding joint projects include shared strategic vision, matching up of capacities and negotiation of risks, benefits and intellectual property.

In co-investment projects, the Flagship Program provides technical capacity and partners gain access to intellectual property developed for their purposes, while CSIRO retains intellectual property rights for use in other areas and for subsequent development.

The initiative began less than three years ago and will have its first formal external evaluation at the end of 2012.

Sources:
http://www.csiro.au/partnerships/NRF.html

Dr. Brian Keating, Director, *Sustainable Agriculture Flagship*, personal communication.

ANNEX II.2

MODERN BIOTECHNOLOGY FOR PRODUCERS AND SMALL- AND MEDIUM-SIZED AGRICULTURAL ENTERPRISES: A PLATFORM FOR REGIONAL COOPERATION

Introduction

This idea that has not been put into practice has nonetheless been discussed – generating a good amount of consensus on its relevance and feasibility - with the President of EMBRAPA, the General Directors of IICA and CATIE, the Director for Latin America of CIAT and the Executive Secretary of FONTAGRO, in the framework of the meeting of the INIA's of Ibero-America, held in Tenerife in October of 2010.
It is included here, with some adjustments, as a conceptual and practical example of what could be a significant regional platform.

The context

The key matters of interest to the agricultural sector -productivity, competitiveness, safety, food security, the impact of food prices, access to markets, climate change, degradation of natural resources- have been well documented and are present in the analyses of opinion and the policies and strategies of public, academic, and private organizations as well as regional and international agencies.

This initiative aims at strengthening and complementing the existing capacities in the region to address specific limitations and opportunities for regional agriculture, in particular increases in productivity and the management of natural resources, as well as improving the business climate for modern biotechnology.

Background

The positive impact of modern biotechnologies – the use of molecular markers in conventional breeding, virus prevention, somatic embryogenesis, massive *in vitro* propagation – for small and medium scale producers (PME) is undeniable. Genetically modified organisms (GMO's), on the other hand, have had a greater impact on intensive large-scale agriculture and in circumstances where biosafety and intellectual property programs are clearly established. The evidence of their impact on PYMES and small and medium scale agriculture is still not conclusive, but it could be if the interplay of policy, investment and knowledge systems were appropriately pursued.

Although agriculture in the region exhibits extremes of technological development –where in some areas producers use intensive systems with high levels of inputs and high productivity- most farms (about 85%) fall in the category of PME agriculture, often with weak relations to value chains and markets, and with technologies and genetic resources that do not correspond to the challenges and expectations of the 21st century.

The opportunity

It is generally accepted that investment and political will are required for development commensurate with the size and importance of the rural and agriculture sector. This has been shown with solid data in the WDR 2008[22], as well as repeatedly by international and regional agencies such as the FAO, CEPAL, IBD and IICA.

Some of the needs and challenges, on which appears to be a high level of consensus on investing financial resources and political capital, are the following:

- Public - private cooperation and complementation to drive innovation in PME agriculture and in productivity and sustainability of value chains.
- Strengthening of centers of excellence, knowledge networks and capacity building.
- Management of natural resources where agricultural and forestry production are located, particularly water and soils.
- Advanced sciences (biotechnology, genomics, computer science, nanotechnology).
- Capacity for climate change adaptation and mitigation of productive systems.
- Use and generation of energy from alternative sources and smart use of agricultural biomass.
- Protocols for safety, traceability and animal and plant health.

Target population and objectives

This is an ambitious initiative with long term prospects, for which reason, as stated below, the goals and objectives would be equally ambitious.

- PME and PYMES producers of the region make significant advances in agricultural productivity and access to markets through the use of modern biotechnology tools, accompanied by the rational and sustainable use of genetic, soil and water resources.
- Consumers, including those segments with fewer resources, benefit directly from the availability of products of better quality and accessible prices.
- The sector's leading institutions, through a platform of cooperation and complementation of capacities, achieves direct impacts on producers and consumers, also helping to build the capacity of the region's next generation of researchers.
- The countries of the region have first-hand information and experience for improving the regulatory and policy framework for modern biotechnology.

Regional actors

The region displays a wealth of mechanisms and organizations for research and development, although financing and incentives to drive coordination and complementation among them to set up TP's and IP's exhibit significant limitations. As an additional element and challenge, there is an aging population of researchers and a shortage of a next generation of professionals to take their place.

[22] The World Bank. 2008. World Development Report: Agriculture for Development. Washington D.C, 365 p.

The proposal, expectations and the operational mechanism

It is expected that a group of leading organizations with a long history in the region (for example, CATIE/IICA, CIAT, CINDESTAV-Mexico, EMBRAPA-Brazil and FONTAGRO) would be willing and available to implement a platform that i) facilitates impacts in the short- and medium-term –on the region's producers and consumers – through strategic investments in modern biotechnology and formation and renewal of human capital, together with the private sector; ii) has the good sense to complement capacities and joint action geared towards having an impact in the rural sector; and iii) serves as a pilot case and example for the development of similar initiatives of a regional character.

The interested organizations and some of the possible activities, including genetic transformation –when appropriate or relevant – are laid out below in their initial form, subject to negotiation and subsequent adjustment:

Institution	**Categories, activities…**	**Description and strategy**	**Target population and products**	**Expected impacts and times**
CATIE, Costa Rica	Timber plantations; Musaceae; tropical fruits; coffee			
CIAT, Cali, Colombia	Beans; cassava; pasture and forages; rice			
CINDESTAV, Mexico	To be determined			
EMBRAPA, CENARGEN	Bioenergetics; others…			
IICA	Policy framework for mwmber countries			
FONTAGRO	Management of competitive grant funds			

The institutions indicated would act as a **nucleus** for the platform and will issue invitations to participate in specific projects –through competitive bidding processes led by FONTAGRO- to companies and organizations of the private, public and academic sectors, endowed with the capacities and resources to accomplish the specific objectives set forth in each case.

Results and products expected from investment

General:

- Identification and definition of scenarios, strategies and policies for research, investment and development in modern biotechnology in the framework of a long-term horizon (2012- 2020).
- Substantial strengthening of regional capacity in biotechnology through actions and incentives for innovation and the training of specialists (replacement generation).
- Demonstration that concerted action and a substantial investment in biotechnology can help to reverse the stagnation of one of the most important livelihoods in Latin America and the Caribbean.

Specific:

- Strengthening of research and innovation among public and private actors with direct, measurable impacts on competitiveness and management of natural resources.
- Significant accomplishments in productivity and the quality of selected production systems validated and adjusted to key value chains identified *a priori*.
- Implementation and management of a regional platform that facilitates for less developed countries the exploitation of new opportunities and strengthening of their capacities, and for more developed countries, promotes cooperation and complementing of actions of mutual interest.

Negotiation and investment

Negotiation:

The principal partners, in addition to undertaking the initial negotiations (objectives, components, expected results, etc.) described above, would also define the following strategies and elements prior to the start of activities for each program or platform project:

- Complementation of individual strengths and capacities for the agreed upon objectives. In short, who does what?
- Management and administration, in essence the initiative's business plans.
- Financing and co-financing, considering either own resources, loans, grant funding, donations or subsidies.
- *A priori* definition of intellectual property, for example protection of knowledge generated, licenses, royalties, etc.
- Allocation of potential profits (or losses), particularly if the goal is to go directly to the market.
- Scientific and managerial feedback and adjustments, for example, eliminating a planned work path or open a new one, in light of practical or experimental evidence.
- Conflict resolution and exit clauses, in the event of non-fulfillment by either one of the parties, or financing that does not work out as expected.
- Internal and external evaluation of the initiative, in the first place determining the base lines

and defining the strategies for partial and final evaluation of the initiative.

Information of interest on legal agreements (particularly for commercial use of biodiversity) can be found in Kate and Laird (2000) and in Reid et al. (1993).

Investment:

Considering the scope of this initiative in strengthening and renewing capacity, significant increases in the productivity and competitiveness for priority areas and their potential impact on technology policy, it is expected that it should have mixed investment, through a possible combination of the following sources:

- Financing or technical cooperation from the IBD to structure and set up the initiative, plus certain select components
- Cooperation of the regional philanthropic sector, both the traditional one as well as the business one (corporate responsibility)
- Private investment of venture capital in select components
- International foundations and the European Union
- Contributions from partners mainly in cash (up to 50% of investment)

The investment for this initiative –strictly for purposes of illustration - and subject to subsequent revision and negotiation, is presented in the following Chart for the first five years, renewable for an additional five years and based on a mid-term and a final evaluation. It is assumed, although this may vary, that one of the organizations of the initial "nucleus" will take responsibility for the initiative, that the supreme authority will be a Board made up of one representative from each "nucleus" organization, that there will be a platform coordinator and that the initial partners may compete among themselves, but always inviting other partners to join them.

Indicative Budget (in US$1,000s)

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1. Initial meeting / pre-feasibility	20	0	0	0	0	**20**
2. Pre-feasibility / consultations	75	25	25	25	25	**175**
3. Platform design meeting	20	0	0	0	0	**20**
4. Grant funding	4800	4800	4800	4800	4800	**24000**
5. Platform coordinator	120	120	125	125	130	**620**
6. Rent and office equipment	35	25	25	25	25	**135**
7. Information and communication	20	25	25	25	25	**120**
8. Travel by coordinator	25	25	30	30	30	**140**
9. Annual meeting of partners/board	25	25	30	30	30	**140**
10. Technical workshop	0	40	40	60	60	**200**
11. Administrative costs	100	100	120	120	120	**560**
12. Evaluation	0	0	75	0	100	**175**
13. Contingencies	25	25	25	25	25	**125**
TOTAL	**5265**	**5210**	**5320**	**5265**	**5370**	**26430**

Notes to budget:

1. Initial meeting of partners to define vision and pre-feasibility consultations
2. Definition and biological, socioeconomic and environmental feasibility of priority areas and production systems for the first year. Various consultations.
3. Partners meeting for final mounting of platform including management and administration
4. Financing of eight projects per year with an average of $600,000 each
5. Salary and insurance of coordinator
6. Rent and office equipment for the institution coordinating the platform
7. Communications, information and a latest generation Web page
8. Travel to projects and partner organizations
9. Meeting of Board of partners
10. Annual technical workshop (second year going forward) for presentation and discussion of results
11. Costs related to management of competitive funds (FONTAGRO)
12. Mid-term and final valuation
13. Contingencies estimated as a fixed annual sum

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