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COLLABORATION AND ACCOUNTABILITY IN AGRICULTURAL RESEARCH: THE CASE OF INIA, URUGUAY

By

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Resource Development

1999

ABSTRACT

COLLABORATION AND ACCOUNTABILITY IN AGRICULTURAL RESEARCH: THE CASE OF INIA, URUGUAY

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This dissertation is about organizational development in a national agricultural research organization, using collaborative participatory action research. Sustainable cultural development is the target of this organizational transformation.

The case of INIA (Instituto Nacional de Investigación Agropecuaria / National Agricultural Research Institute) of Uruguay offers an opportunity to study issues that have practical implications for agricultural research. INIA is a decentralized, public, non-governmental agricultural research organization; a non-profit organization characterized by a flexible administration of human, physical and financial resources; delegation of authority and distribution of power, for organizing, planning, budgeting, and implementing research activities, deciding on its own management procedures; signing contracts and agreements with private and public national and international entities. In the new INIA, the farmers are involved in the management and contribute significantly to the budget. Farmers participate in the Board of Directors, Regional Advisory Committees, and Working Groups.

The scope of this study includes two essential issues: (1) How can we draw from related cutting-edge literature to create and develop a truly integrative approach to organizational design to fit a national agricultural research institute? (2) How can we apply collaborative action research to operationalize the design?

The focus of this research is to assess: how the INIA organization is evolving through internal and external participation in developing collaborative planning, monitoring, and evaluation, in order to improve the institutional performance and responsiveness to farmer needs, and how INIA is adhering to principles of the learning organization.

The main conclusions driven by the research questions are: a methodology was developed to assess effectiveness, efficiency, quality and relevance in relation to organizational performance, the collaborative evaluation process became a main programmatic input for internal environment analysis to create a permanent ascendant spiral cycle of continuous improvement; stakeholders have been collaborating in strategic planning with the researchers (proactive approach); a shared mission and vision were formulated and validated jointly; a demand-driven approach was developed; a learning process teamwork for a process of continuous improvement was established. All staff collaborated in the process of reformulating the human resources areas. Data from a survey at the end of the process show that the personnel considered it to be a very positive experience. INIA is encouraging partnerships, developing strategic alliances with public and private national and international organizations. The research agenda has changed. From a restricted focus on a productivity approach, INIA has evolved towards a more complex agenda, including intensification of the production but also building heavily on the concept of sustainability, and concern for the environment, quality, and food safety, with emphasis on an agro-industrial approach, taking into account the increasingly more exigent requirements of final consumers through the industrial sectors. INIA is increasingly concerned and working to improving its image. The findings are supported and confirmed by some external evidence during the last years.

DEDICATION

To my wife Giannina for her loving support and contributions

and to my children Aldo, Andrés and María Elena

for sharing and encouraging me

in this challenging and passionate vocational endeavor.

ACKNOWLEDGMENTS

I want to express my deep appreciation for the commitment of my home organization, INIA, and to acknowledge and thank it for giving me the opportunity to grow professionally, and for supporting me in this post-graduate effort.

I would also like to acknowledge to the valuable encouragement of the President of INIA, Ing.Agr. Pedro Bonino Garmendia, current and previous Board of Directors, directors, researchers and all personnel of INIA now, and CIAAB in the past, as well as colleagues and friends who continuously supported me during this particular period of work and development, and to the stakeholders and staff who have willingly collaborated in this research.

I would like to extend my deepest gratitude to Dr. George H. Axinn, my Advisor, for his excellent and exceptional support, encouragement, and understanding. I would also like to thank Mrs. Nancy Axinn for her editorial assistance. My special acknowledgment for their generosity.

I want to express my sincere appreciation to Dr. Frank Fear for his wise, energetic and enthusiastic advice, Dr. Tom Edens for his valuable suggestions and support during my work in the program, and Dr. Kim Wilson, for his constant and constructive guidance and friendship.

This academic program has been accomplished within the INIA/USA University Consortium for Generation of Technology Transfer in Uruguay, with the financial support of INIA/IDB Project, and I am profoundly grateful.

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LIST OF ACRONYMS

AGNP	Agricultural Gross National Product
CAR	Collaborative Action Research
CEP	Collaborative Evaluation Process
CGIAR	Consultative Group on International Agricultural Research
CSPP	Collaborative Strategic Planning Process
FAO	Food and Agriculture Organization of the United Nations
FPTA	Fondo de Promoción de Tecnología Agropecuaria
IDB	Inter-American Development Bank
IICA	Inter-American Institute for Cooperation on Agriculture
INIA	Instituto Nacional de Investigación Agropecuaria
ISNAR	International Service for National Agricultural Research
LPTCI	Learning Process Teamwork for Continuous Improvement
MERCOSUR	South Common Market
MTIP	Medium Term Indicative Plan
MTOP	Medium Term Operative Plan
NARO	National Agricultural Research Organization
NARS	National Agricultural Research System
NRC	National Research Council
RAC	Regional Advisory Committee
TAC	Technical Advisory Committee
TQM	Total Quality Management
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WG	Working Group

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Chapter I

INTRODUCTION

This dissertation is about organizational development in a national agricultural research organization, using collaborative participatory action research. Sustainable cultural development of that organization is the target of this organizational transformation.

All organizations face the need to transform themselves, given the challenges of the ever-changing world and the changes in the environments in which they operate.

The main objective of this dissertation is to describe how a national agricultural research organization, the one in Uruguay, engaged in an organizational development process to improve accountability through external and internal collaboration.

1.1 Why a Case Study of INIA - Uruguay

In order to explain why this case offers a rich opportunity to study scholarly issues that have practical implications for agricultural research, and an opportunity for change and development, a description of the country, the agricultural sector, and INIA (Instituto Nacional de Investigación Agropecuaria / National Agricultural Research Institute) with historical and contemporary circumstances is given in Chapter III.

INIA's primary role is to conduct almost all high level agricultural research for the country, and is vital for improving products to compete on the world market.

The rationale for studying INIA is based on the strong will and political decision of its Board of Directors to engage in a long term organizational development process, as well as their understanding of and interest in participation and learning at different levels by the staff and stakeholders.

Uruguay has a long tradition of democracy, which promotes participation of people in decision-making. Currently, the society is evolving a general consensus on the importance of quality (in products, processes, and management) to utilize specialized niches in international markets (sophisticated requirements of final consumers). Uruguay has a National Quality Award, based on the Malcolm Baldrige Award (INIA is a member of the National Board), and there is a national system responsible for quality certifications.

The Uruguayan agricultural research system was established in 1914. Even after a major reorganization in 1961, it remained as an administrative unit of the Ministry of Agriculture, without any formal participation of farmers, and with restrictions in human and financial management and frequent fluctuations in the budget. As a result, the effectiveness of research programs and the ability to respond to farmer's needs were limited. Subsequently, there was a consensus that a profound reorganization was still required.

In 1987, the Government sent a Proposal to the Congress, considering ideas of a group of researchers, farmer organizations, professional associations and others in the scientific community. As a result, an autonomous National Agricultural Research Institute (INIA) was created in 1989 by national Law (Delpiazzo, 1993).

The implementation of this modern legal entity authorized by this Law overcame the most important limitations and constraints in the objectives, human, financial, and physical resource management.

The main objectives of the new institution are: a) to promote and to implement agricultural research activities in order to contribute to sustainable development of the agricultural sector, b) to advise the Government in relation to technology policy, and c) to encourage the development of the NARS (National Agricultural Research System) and to maximize the utilization of the available international scientific and technological knowledge.

INIA is a public institution under private administrative regulations. This arrangement, based in its structure and autonomy, provides an opportunity to promote two main aspects of organizational development: 1) stakeholder involvement and 2) human resource development.

For stakeholder involvement, the concepts of participation and decentralization are incorporated in the institution. In the new INIA the farmers are involved in its institutional management, priority setting and contribute to its budget, matching their funds with the government.

The Board of Directors, the highest authority of INIA, is composed of two representatives of the Government and two of the farmers.

There are five Regional Advisory Councils (RAC), one for each Experiment Station. There are also Working Groups (WG) for each commodity and/or system of production, with specialized farmers and professionals as members.

The budget is derived from a tax of 0.4 % applied to all agricultural commodities, and at least the same amount must be matched by Government funds.

The autonomy of INIA in deciding on resource management provided the opportunity for developing human resources, through a thorough reformulation of management policies and a comprehensive scheme for merit-based grading, salary, promotion and reward administration, training, and performance appraisal system of all personnel. It takes into account the specific requirements of researchers and support staff.

A five-year Medium Term Operative Plan (MTOP) was formulated and implemented in 1992 (INIA, 1993). The evaluation of this plan and the formulation of a new planning process for the next five-year term, (the period of the intervention of this study), were assigned high institutional priority by the Board in October 1995.

The author has been working in the organization for the last three decades, and has been developing close working relationships with staff members and stakeholders of INIA.

1.2 Problem Background

At the beginning of the 21st Century, profound changes at the world level in contemporary forces are affecting local society, with implications for the national agricultural research organization and agenda. There is a need for change in organizational development to face these new realities.

Agricultural research organizations are increasingly related to global changes and the forces driving this external context, characterized by the complexity, connectedness and interdependence of economic, technological, environmental and sustainability issues.

Therefore, participation and collaborative modes will be required.

Capra argues that the great challenge of our time is to create sustainable development organizations and communities. Organizations have to address global problems that cannot be understood in isolation. The solutions to these systemic problems require a radical shift in our perceptions, our thinking, our values, a fundamental change of worldview in science and society. Viable solutions are those that are sustainable (satisfying present needs without diminishing the prospects of future generations). A holistic and ecological worldview is emerging, seeing the world as an integrated whole rather than a dissociated collection of parts. Deep ecology considers the world as a network of phenomena that are fundamentally interconnected and interdependent (web of life). Key characteristics of integrative thinking are intuitive, synthetic, holistic and nonlinear. Likewise, essential values are conservation, cooperation, and quality. Symbiosis (mutual benefits and synergy) became a vital contemporary idea in organizational development, through collaboration, partnerships, and alliances. "The basic tension is one between the parts and the whole. The emphasis on the parts has been called mechanistic, reductionist, or atomistic; the emphasis on the whole holistic, organismic, or ecological. In twentieth-century science the holistic perspective has become known as "systemic" and the way of thinking it implies as "systems thinking" (Capra 1996:17).

Research by the International Service for National Agricultural Research (ISNAR, 1997) in relation to globalization and its major implications for agriculture research, emphasizes the consequences of trade liberalization, an increased market orientation, multiple-source innovation models, regional cooperation, and the expanding availability of imported technologies. Their research shows that NARS should adjust their policies and portfolios of research activities in light of changing conditions of competition in international markets and new opportunities to acquire technologies and knowledge from abroad through collaborative agreements.

The interaction between agriculture and the environment is another ISNAR concern. Agriculture, by its very nature, is intimately related to the natural environment. The role of resource management in maintaining agricultural productivity is gaining recognition in science. Conflicts of interest over resource use are multiplying, and the effects on other sectors of resource use for agriculture (and vice-versa) are becoming increasingly clear. Community participation in research planning, monitoring, and evaluation is one point of inquiry. Another is enhancing the role of NARS as environmental policy advisors and designing policy-oriented units for environmental assessment. By promoting awareness and conservation of the natural environment, ISNAR will encourage interdisciplinary approaches to the study of food security, human health, and environmental conservation.

The world is becoming increasingly complex but our style of thinking rarely matches this complexity, viewing it more simple than it actually is (Morgan, 1990).

Senge (1990) remarks that most of the problems faced by humankind concern our inability to grasp and manage the increasingly complex systems of our world. Problems are becoming increasingly complex and interconnected.

Bawden (1991) argues that a systemic paradigm requires rethinking the current views of the world, by improvements in agricultural and rural development. What must be learned is how to come to terms with complexity and chaos and develop learning trategies that help to deal with such dimensions, and embrace the new science and praxis of complexity.

He recognized that reductionist science with its positivistic philosophical roots and experimental research practices has generally served agriculture well for around 150 years. Technological innovations based on the propositions generated through this paradigm have played a profound role in the extraordinary productivity growth that has occurred in agriculture across the globe. However, even though successful in accomplishing increasing productivity, it had negative consequences such as distortion and degradation of biophysical, socio-economic and cultural environment.

Organizations are being reinvented and reinforced to better meet the new realities of the coming Century. Organizational restructuring is giving way to organizational repositioning. A problem-based approach is being replaced by a values-based, vision-driven approach; a development approach has replaced a change approach, which means that it is necessary to envision the future and to organize and align their resources toward that future state (vision). That is through strategic planning. Collaboration in terms of cooperation, partnering, and creating strategic alliances has replaced competition. Thus, improving connections internally (laterally) and externally (vertically) is required. Management has been replaced by an emphasis on leadership; the environment is simply too competitive, turbulent, and unpredictable (Fear, 1996).

According to Axinn and Axinn (1997), the view of international development is being replaced by an acknowledgment of global interdependence. We have much to learn from each other, and we all need each other's support. This global caring and sharing requires international development collaboration. Sustainability and participation will be continuing issues. Participation, decentralization and accountability are intimately related issues. For organizations, decentralization is a way of encouraging more participation and of encouraging accountability to stakeholders.

1.3 Research Problem

For INIA, the bureaucratic form fit successfully during a different era. The key today is to be able to retain the essential elements of structure, organizational effectiveness and efficiency, while packaging the organization's approach within a more flexible, adaptive, responsive, and humanistic frame of reference.

However, affirming this in theory is easier than applying it in practice. It needs to be embedded in the organization's culture. Therefore, to make this transition the organization has to be engaged in a long-term process, with artful implementation, coaching by a competent leadership style and approach, with a high level of trust and confidence, as well as continuity. Otherwise, the organization might fall back into the old style of operating, or into a worse situation than before, because of the frustration of the increasing expectation of success in organizational development.

From an overarching perspective, the framework to drive the INIA transformation, proposed at the beginning, can be enriched by new initiatives throughout the transformation.

Unresponsiveness of agricultural research organizations to stakeholders and agricultural development issues is a main concern. Stakeholders and staff, working in a collaborative way, can complement their perspectives to better understand and comprehend the whole system of production, identify the priority needs, and the relevance of the research outputs.

The strategy of organizational development involves active participation of internal staff and external stakeholders to improve organizational accountability.

A competitive organization requires the ability to grow and learn from experience, and consequently to change the capacity of evaluating and reflecting on collective actions, seeking to improve future performance by utilizing the results (connectedness).

Total Quality Management (TQM) is a useful reference, as a holistic framework for moving organizations from being inward, bureaucratic, and structural to becoming more outward looking, stakeholder-sensitive, and people-centered organizations.

The success and long-term sustainability of an organizational transformation depends, mainly, on the coherence with which an organization undertakes broad-scale change.

The purpose of engaging the organization in a continuous improvement process, is to move the organization from where it is to where it should be, based on a shared mission as a point of departure, a shared vision providing the target, and involving external stakeholders and internal staff in defining organizational relevance, effectiveness and success.

In other words, the goal is a values-based, vision-driven, demand-oriented, stakeholder-focused, staff-sensitive, organization in a mutually accepted ethical framework.

1.4 Problem Statement

The problem to be addressed in this research was identified: to improve agricultural research's accountability through external and internal participation in a collaborative process.

INIA had the initiative and interest to encourage, sponsor and develop this dissertation work.

The essence of this study has been: a) to create a framework to be applied, and, b) to implement it.

The rationale for this study is as follows:

We know, according to the literature, that there is a paradigm shift of organization moving from hierarchies to networks and from rational-bureaucratic models of management (centralized and top-down hierarchical structures) to learning organizations (people-centered development management, with internal and external participation in planning, monitoring, and evaluating processes). And we know that many frames focus on important issues which contribute to different dimensions of the organization, with their own strengths and weaknesses.

An appropriate design can be formulated, but when it is put into operation, the implementation is difficult, and even more, it may fail. In the field of organizational development there seems to be a great gap between what is being written about organizations (literature on creating learning processes), and how most organizations actually operate in reality (still exhibiting bureaucratic characteristics of rigidity and control). The change from a controlling to a learning orientation appears to be much easier said than done.

Therefore, the scope of this study includes two essential issues:

(1) How can we draw from related cutting-edge literature to create and develop a truly integrative approach to organizational design to fit a national agricultural research institute?

(2) How can we apply collaborative action research to operationalize the design?

The focus of this research is to assess:

- how the INIA organization is evolving through internal and external participation in developing collaborative planning, monitoring, and evaluation, in order to improve the institutional performance and responsiveness to farmer needs.
- how INIA is adhering to principles of the learning organization.

Two major issues need to be addressed in this organizational development study:

- the external environment (how the organization connects with external stakeholders) and the ways that the organization may be more accountable, responsive, relevant and useful to those stakeholders.
- the internal dynamics (the ways of improving human resources development within INIA).

Participation of internal staff and external stakeholders is the subject-matter.

The definition of external stakeholders is: people who have a stake (or a vested interest), and are affected by and have questions about the research activities, including farmers, extensionists, policy makers, agro-industrialists, scientists, and government.

The definition of internal staff is: people working in the organization, including directors, heads, supervisors, researchers, technicians, administrative staff, and laboratory and field personnel.

1.5 Research Questions

Several questions have driven this research. They are:

1. From a structural approach, how to assess the effectiveness, efficiency and quality of agricultural research activities?
2. From a systemic approach, to what extent are stakeholders involved in supporting the research programs to ensure that the research undertaken is what is needed? Is the institutional ability to respond to client demands increasing?
3. From a human resource approach, how is the staff involved, how is their interest and commitment strengthened, and how does the institution respond to their interest?
4. From a learning organization approach, what is the organizational commitment and capacity for learning? How is the mental openness for generative learning, the shared mission and vision inspiring the future, the system thinking view, and teamwork learning developing?
5. From an ecological approach, how are the linkages with other organizations improving? How is the collaborative mode (internal multidisciplinarity and external networking) increasing? How are sustainability, environment, and quality issues taken into account in the research agenda?

1.6 Outline of the Dissertation

Following this Chapter is Chapter II including the literature review. In Chapter III the context of the Case study of INIA, Uruguay is described. Chapter IV describes the methodology, the development of the strategy for applying the CAR (Collaborative Action Research) in the case of INIA, and the procedure of the implementation of that strategy.

The most relevant findings from the process are presented in Chapter V.

A summary of the main conclusions driven by the research questions, some reflections and further implications, external evidence related to this process and research limitations are presented in Chapter VI.

Chapter II

LITERATURE REVIEW

2.1 Key Concepts Related to Agricultural Research Systems

Key relevant concepts included in this section are globalization, participation, decentralization, accountability, autonomy, evaluation, collaboration, teamwork, and sustainability.

2.1.1 Globalization

Globalization as a concept refers both to the compression of the world and the intensification of consciousness of the world as a whole. The environmental impact concerns, which face agricultural research organizations, involve global problems. They are systemic complex problems, interconnected and interdependent. Solutions to these major problems require a significant change in the worldview. Sustainable solutions are required. This is the great challenge of our time: to create sustainable development organizations and communities. Partnership and quality are essential values of the integrative thinking (Capra, 1996).

A series of transformations over recent years has dramatically changed the world economy. Globalization has influenced international development as well as key corporate functions including production, marketing, as well as research and development. The economic, social, ecological and technological bases used by the agricultural sector have been changed in an irreversible way. In relation to environmental problems, economic policies of the past gave inadequate attention to environmental issues. Consequently, the current level of environmental degradation is serious at the world level. Global warming, the decrease in the amount of atmospheric ozone, water and air pollution, soil erosion, and current levels of fish, forest and wildlife harvest are some of the subjects under consideration. It is now generally recognized that better information, better analysis, and local participation in policy making and monitoring, can improve priority-setting and policy design. Farmers′ perception of their environment as decision-makers is going to affect their behavior in managing the farm. There is evidence that in specific circumstances, local and indigenous knowledge have been successful in defining how to adapt and manage production systems to the environment (World Bank, 1992).

The increasing interdependence among nations raises new opportunities and challenges for NARSs, requiring them to re-assess their objectives, priorities, programs, and organizational structure. In a truly global R & D marketplace, careful evaluation of capital investment becomes even more critical. Globalization raises new questions about the need to invest in local public capacity to undertake agricultural research. Globalization is revealing a great deal of unnecessary duplication of effort. For NARSs leaders, opportunities for using technologies developed in other countries are increasing rapidly. Each country has to evaluate what is more cost-effective and beneficial, to invest in research carried out in the country or to acquire the related technology from abroad (Tollini, 1998).

The implications of globalization for agriculture research, in terms of competition in international mark and new ways of generation and adoption of technologies and knowledge, have been identified. by ISNAR (1997). It is suggested that NARS should response to these new realities through collaborative modes, establishing institutional arrangements.

These ideas are also supported by Axinn and Axinn (1997:123), emphasizing that "the view of international development has been replaced by an acknowledgement of global interdependence. We have much to learn from each other, and we all need each other's support. This global caring and sharing require international development collaboration (genuine between insiders and outsiders, professionals in different disciplines, etc.)".

2.1.2 Participation

People affected by any development activity must participate in the design and implementation of the activities in deciding what should be done, in order to satisfy their needs in the long term, and to achieve sustainable development.

One of the most critical reasons for success is that people who are supposed to benefit from the outcomes have a voice in deciding the content, the objectives, and the methods used by the system. The extent to which the clientele participate in all aspects of planning and implementing the program is directly related to its success (Axinn and Axinn, 1997).

Organizations tend to assume that farmers are really not competent to decide what should be the objectives and the content of agricultural programs, because farming people often have very little formal schooling and no advanced scientific degrees (scientists should make those decisions). This is substituting the knowledge of outside experts for that of the clientele. This becomes a top-down delivery system approach in which others decide what farmers need to know. Scholars and practitioners of development have a consensus that top-down approaches tend to be much less effective than participatory, farmer-centered approaches (the clientele participate in determining the agenda, the content, the communication channels to be used, and even the personnel to staff the system). It recognizes the effectiveness of systems organized by groups of farmers.

Some social and cultural systems do not have the tradition of participatory decision making; it is easy to recommend participation, but it may not be implementable. Participation of those most affected by the change and equity are essential components of sustainable development (Axinn, 1995).

Whyte (1991a) emphasized the contribution of farmers on participatory processes in agricultural research and development in Latin America. He developed participatory action research, a strategy for the integration of professional social researchers with people involved as active participants in all the stages of the research process, and in applying the implications of their findings.

Institutions have to be developed so that local organizations can establish procedures and practices that encourage local participation. This is essential for getting results sustained over time. Central organizations often impeded participation. Participation by a wide variety of stakeholders requires institutions to expand, encourage, and manage that participation. It is crucial to develop processes for decision making and implementation; processes that include different interests and allow for interaction and learning (Bryant and White, 1984).

Freire (1970) describes traditional banking methodology, which essentially means one way direction. This concept can be applied to technology transfer. Scientists should listen to farmers too, and learn to understand by receiving feedback from them (problem-solving strategy). Both, intent on reality, are both subjects, coming to know it critically, re-creating this knowledge through common reflection and action. Instead of pseudo participation, there will be committed involvement

Chambers (1983) indicates the two cultures - academic and practical- share the top-down, core-periphery, center-outward biases of knowledge. The third culture, of the rural people in a particular place, is the true center of attention and of learning. To understand and to judge agricultural problems better, outsiders have to see things from the other end.

Recently, Chambers (1993) analyzing the modes of learning, states that outsider professionals have learned through rural development tourism (brief visits), and large-scale questionnaire surveys (collect respondents), but both frequently mislead. The solution would be the adoption of participatory modes of analysis and sharing knowledge (participatory rural appraisal).

Technology generated in central places (monopoly of knowledge) by agricultural researchers and packages of practices developed are transferred to farmers. Since change in economic, social, and political conditions is so fast, with a rapidly moving target, the solution seen is faster with better feedback, information systems, monitoring and evaluation. Agricultural research is supposed to serve farmers, and it is suggested that the value of research is the extent to which farmers adopt its results. The "farmers first" principle dictates that researchers begin with farmer's knowledge, problems, analysis and priorities.

However, Lockeretz, and Anderson (1993), offered an alternative to the elitist position adopted by some researchers, who want to do the job alone, developing a balance between the complementary roles of the two groups. It is wrong for researchers to claim the right exclusively, and is also wrong to confer this right on farmers as an alternative. Farmers and researchers have different purposes, kinds of experience, and relationships to agriculture. Neither can do the job alone, but if they are allowed to complement each other, each can make a valuable contribution. They emphasize that the choice is not "farmers first" versus "farmer not at all", and mechanisms, such as Advisory Committee, are adequate forums for farmer-to-researcher and researcher-to-administrator communication.

2.1.3 Decentralization

Decentralization is a strategy to achieve participation. Systems of production are the target, farmers (people who till the soil and tend the livestock), are the main clients of national agricultural research organizations.

The critical linkages of the larger social system, affecting change, determine if it is an acquisition system (controlled by the people involved) or a delivery system (deciding what the farmers want and need). It is important that the indigenous knowledge available is taken into account in the design and implementation of sustainable production systems (Axinn and Axinn, 1997).

Antholt (1994) concerned with technical change and institutional modernization in agriculture, indicates the importance of decentralization, client ownership and responsibility to gain accountability. Even more, beneficiaries should be expected to support, in part if not in whole, research and extension services. He says that, not unexpectedly, the NARSs have, by and large, been in the public sector, centrally-managed and with limited accountability to farmers for their performance. Farmers seldom were expected to have responsibility, even partial, for supporting these research institutions, resulting in minimal linkage and often-absent institutional accountability. Farmer organizations, as well as other associations and NGOs, can be expected to take on greater responsibility for the direction as well as support of those institutions involved with agricultural technology identification, generation and dissemination. Perhaps the most important initiative to take is to shift the primary focus of power and responsibility for research and extension to the clients.

2.1.4 Accountability

"Accountability is the measure of control, accountability is the reason for decentralization. Thus the heart of the policy issue is: whom should the agricultural research system be accountable? ..... if agricultural research is to be accountable to farming people, then it must be decentralized." (Axinn, 1990:10). This means that if agricultural research has to be accountable to external and internal clients, then, they should participate in decision-making.

Cost-sharing is very important in accountability. In agricultural research, if farmers contribute financially to the program, even in a low percentage, they ought to be in agreement with the objectives of the program (Axinn and Axinn, 1997).

The opposite side of the accountability coin is expecting the beneficiaries of research and extension to be responsible for some of the support, even if it is only a proportion of total costs. It gives the beneficiaries ownership and drawing rights on the services, it contributes to the issue of financial sustainability, and if ownership and responsibility rests with clients, the basis for more demand-driven, responsive service is established (Antholt, 1994).

Chambers (1993), in the new professionalism, reverses the values, roles and power relations of normal professionalism. It puts farmers first (last-first paradigm), in terms of priorities. When farmers are put first of all, for identifying and setting priorities, it is not merely for whom, it is by whom to develop.

Accountability is a crucial aspect of administration. The success of a development program in any particular locality tends to be directly related to the extent of accountability by the staff of the development organization to the people of that locality (Axinn, 1995).

When a development organization owes its accountability only to higher level members of a bureaucracy, it takes very different types of actions than a development organization that is accountable to its clientele. The direction of accountability in many organizations is spelled out in their doctrine (mission).

In agricultural research there are contrasting examples. When the agricultural research system is developed by centralized decision, the instructions come from central administration, to whom the organization is accountable. Farmers rarely visit the research farms, and the farms don't have too much to offer to local farming people. Professionals doing agricultural research are not accountable to local clients, so the research results are of little value to local people.

In the case where the agricultural research system is operated by the growers, the staff is in daily contact with farmers; they conduct applied research on the problems currently faced by the producers, and are well-known by them. The system is more accountable to the growers.

Where local personnel are accountable to their local clientele, they tend to receive services appropriate to their needs and interests.

Cano (1981) in research conducted two decades ago, found that most of the Latin American agricultural researchers represent lack of accountability to clientele (farmers). Most of them feel top priority in their accountability to the profession (mainly via publications in international professional journals), to impress other colleagues rather than being interested in the quality of their work and the significance of their findings. They also want to be accountable to administrators and senior officials in their bureaucracies (to rise in the organization). However, none of them consider owing any accountability to farming people. New agricultural research organizational models are changing this perspective.

Antholt (1994) reviewed the performance of agricultural research and extension, and he indicates that institutional modernization needs to begin now to deal with the issues of relevance, responsiveness and costs-effectiveness of research and extension.

Imperative reactions to these issues include client ownership and responsibility to gain accountability.

Even more, beneficiaries should be expected to support, in part if not in whole, research and extension services.

He points out that, not unexpectedly, the NARSs have, by and large, been in the public sector, centrally-managed and with limited accountability to farmers for their performance.

Farmers seldom were expected to have responsibility, even partial, for supporting these research institutions, resulting in minimal linkage and often-absent institutional accountability.

Various alternative methods have been tried out by agricultural research systems to improve their funding situation. These include competitive project grants, cost recovery, patenting, and selling agricultural produce. Certain authors suggest that such methods may not in fact greatly increase the research budget; rather, their main impact comes from sending a signal to the stakeholders of research that the system is responsive to their expressed needs (Alston and Pardey, 1995). The accountability effect, with indirect consequences for funding, is thus greater than the direct effect on resource availability.

These nontraditional funding mechanisms require well-developed accountability procedures if they are to be credible and acceptable to the main source of funding (Elliot, 1998)

The exact nature of the accountability and responsibility relationships will vary from country to country.

Of central importance is the need to insure that the relevance and responsiveness of agricultural research and extension, as viewed by farmers, clearly and meaningfully affects the welfare of the scientists and extension personnel involved. This means placing real ownership in, and accountability of, public research and extension organizations into the hands of the client community, particularly farmers.

Axinn (1978) discussing "Basic dichotomies in agricultural research", remarks that there seem to be two polar ideal-type approaches to Agricultural Research Systems. The one might be labeled "Decentralized and Ruralized", while the other could be called "Centralized and Urbanized". In this topic, Axinn wrote that accountability is one of the most serious and most neglected dimensions of agricultural research.

The product of any agricultural research system tends to reflect the control of that agricultural research system (where farmers participate, it certainly does benefit them).

People who till the soil and tend the livestock should have voice in the decisions about agricultural research. They comprehend the whole farm as a system, and they learn what they need to know to survive on it (holistic approach). Thus the policy issue is how much control of agricultural research should be in the hands of farmers? Policy designed to promote a sustainable agriculture, and preserve ecosystems should include farming people.

It requires decentralization not only in the physical locations, but mainly in the decision making and control about agricultural research.

In order to measure the control phenomenon, these questions should be answered: where is the accountability?, to whom are the agricultural research staff accountable?, who will reward them if they do good work?, who will punish them if they do not produce?

Accountability is the measure of control, and the reason for decentralization. Thus the heart of the policy issue is: to whom should the agricultural research system be accountable?

If agricultural research is to be accountable to farming people, then it must be decentralized, and take advantage of the indigenous knowledge systems, along with the global scientific knowledge system.

Autonomy is a key concept associated with more effective and efficient agricultural research organizations.

The heart of the matter is accountability. It is the most significant policy issue facing agricultural research; and a way to link farmer participation with policy planning (Axinn, 1990).

Collaboration between insiders and outsiders is related to success. The challenge to administration is how to plan, organize, staff, and direct development activities so as to ensure maximum collaboration among those who have interest in them (stakeholder).

2.1.5 Autonomy

According to Valverde (1990) in Latin American agricultural research the more significant constraints were lack of administrative flexibility and excessive management by government, and limited financial resources were allocated. Because of that, during the 1970's and early 1980's, governments began decentralizing some development planning and management functions, reflecting a shift from dependence to some level of autonomy.

The concept of autonomy relates to the delegation of authority and distribution of power, and has legal, administrative, and organizational aspects. Autonomy has direct repercussions on the size, hierarchy, authority, complexity, specialization, and centralization or decentralization of an organization. The greater the degree of autonomy, the more the organizational variables tend to search for maximum expression, and decentralization becomes imperative.

Autonomy can be analyzed as an expression of the administrative flexibility acquired when decentralized organizational structures, such as the Latin American countries Institutes, are created. A decentralized public institution is autonomous in terms of its direction, administration, management, and operation, always taking into account that these activities are in keeping with the socioeconomic development policies of the country and agricultural sector.

However, in the Latin American country's NARS the structure, organization, and management of financial and human resources generally operate entirely within the norms of the Ministries of Agriculture and Finance as well as the national regulations of personnel management. These norms and regulations are suited to routine office work, but they are not flexible enough to accommodate exceptional situations such as those involved in agricultural research activities.

According to World Bank, NAROs should be placed under new autonomous legal entities with sufficient flexibility to efficiently manage financial, physical, and human resources for the needs of agricultural research. The main reasons are: a) greater administrative flexibility (diverse source of funding, efficient and timely application, and human resource management), and b) greater involvement by stakeholders to help focus research on client needs, enhance scientific rigor, and promote a sense of stakeholder ownership of the institution.

"Autonomy for the new research organization provides more flexibility, but also demands more accountability to the ultimate objective of any research organization, the generation and utilization of improved technologies to meet societal needs. The funding agency must establish effective mechanisms for measuring performance against societal objectives and ensuring accountability, including: contractual arrangements based on output produced rather than input employed, and appropriate, realistic and clearly understood performance measures" (World Bank, 1998:9).

2.1.6 Evaluation

Agricultural research is a creative, innovative, and uncertain activity, and just a part of it produces results to be adopted and contributes to the improvement of the systems of production. It can be visualized as a cycle of management decisions, beginning with need assessment and planning, continuing with implementation and reviewing the research activities (monitoring and evaluation). "The primary focus is on evaluating the effectiveness and efficiency of the research program, including decision-making procedures, leadership, and the adherence of scientists to accepted standards of research execution and reporting" (Mc Lean, 1988:18).

During planning, the needs of stakeholders should be assessed; goals, strategies, and plans established (ex-ante evaluation). To be effective, agricultural research must generate technologies useful for farmers. To ensure this, farmer perspectives should be included through their participation, from the beginning of the planning.

In the implementation phase, monitoring (on-going evaluation) checks on research activities in relation to plans, results, and changing circumstances. It prevents activity deviation by warning, in order to make adjustments, modifications and corrective actions. During this observing period, the feedback from farmers also plays an important role. Knowledge and experience gained during the planning are applied and assure an appropriate implementation.

At the end of the cycle, a reflexive period to make a review (ex-post evaluation) is required to decide if continuing, introducing modifications, or concluding it, and addressing new problems.

Therefore, evaluation is appraising the quality of research during the whole cycle, whether it is proposed, on-going, or completed, in terms of its relevance, effectiveness, efficiency, and impact. Farmer participation should be present, particularly in assessing relevance (appropriateness and importance of objectives and results in relation to needs), and impact (long-term effects of research) to accomplish users′ satisfaction with research.. External peer review for evaluating professional standards of research quality, integrating teams with internal researchers is also recommended.

There are many reasons for monitoring and evaluating (to check on progress, to assess productivity and results, to monitor resource utilization, and to decide on future support). Accountability and decision making are the main uses. "Accountability refers to the responsibility of an individual and organization to account for the proper use of resources. Accountability requirements have traditionally been met through periodic reports on resource use and activities; however there has been a growing demand for more and better evidence of the results and impact of agriculture research. Monitoring and evaluation are also used to help with decision making during planning, implementation, and periodic reviews of research activities. Accountability and decision making should be linked" (Horton et al, 1993:6).

Outsider participation is crucial for more credibility of the process, gaining in objectivity, bringing different skills and perspectives. However, a disadvantage has to be considered as they may not be acquainted with the culture of the organization. Participation, involving insiders and outsiders, is sometimes difficult due to complexity and costs implied, in terms of human resources, time and funds, preparation and conduction of meetings, as well as resistance from researchers to be evaluated, among others. A careful procedure for managing the process, planning and designing of a checklist and timetable for data collection, analysis and reporting are required.

The Stufflebeams's Context-Input-Process-Product (CIPP) model proposes four decision types, generated by crossing and ends dimension with an intended-actual dimension. Within this model, context evaluation is continuous, while input, process, and product evaluations are conducted when needs, problems or opportunities are present. All these evaluations can be used in either a proactive (decisions still to be made) or retrospective mode (to provide accountability for decisions made). The CIPP model fit with the system theory. It is a rational approach, very well operationalized (Stufflebeam, 1971).

Guba and Lincoln (1981) compared evaluation models and the emergence of responsive evaluation that takes the concerns and issues of stakeholder audiences. The first was the Stake's responsive model of evaluation, in order to increase the usefulness of the findings to stakeholder, which can serve different purposes and information needs of audiences. Differences between responsive and preordinate (more conventional approaches) are in orientation, value perspective, design, evaluator role, methods, communications, and feedback.

Patton (1982:55) defines collaborative evaluation approach as "one in which the evaluator works directly and in partnership with a group of stakeholders to focus key evaluation questions, design the evaluation study, interpret results, and apply findings. The collaborative process is one of shared decision making about key aspects of the evaluation. The people who have a stake in the evaluation collaborate in solving evaluation problems and making research decisions. The evaluator is active-reactive-adaptive".

The great achievement of our age is the capacity to generate, store, retrieve, transmit, and instantaneously communicate information, but the great problem is keeping up and using information. The challenge is figuring out what is really worth knowing and then getting people to actually use what is known. The central problem is getting people to use information. In agriculture the major activity of extension services is trying to get farmers to apply scientific knowledge. There is an incredible gap between the knowledge and the application of that knowledge, between generating evaluation information and actually applying evaluation information for program decision making and improvement.

Program evaluation is the systematic collection of information about the activities, characteristics, and outcomes of programs for use by specific people to reduce uncertainties, improve effectiveness, and make decisions with regard to what those programs are doing and affecting. This emphasizes: a) the systematic collection of information, b) a broad range of topics, c) for use by specific people, and d) for a variety of purposes. It focuses on gathering data that are meant to be, and actually are, used for program improvement and decision making. Evaluation is aimed at action. Its emphasis as utilitarianism in evaluation (utility, relevance, practicality, and meeting the information needs of specific decision-makers). Technical quality and methodological rigor were the primary concerns of researchers. Research and evaluation are concerned with data accuracy, validity, and reliability. A major reason for evaluating policies and programs is to make sure that what we want to have actually happen (Patton, 1986).

2.1.7 Collaboration

A collaborative mode of involvement is crucial in agricultural research at two levels: genuine reciprocal relationship between insiders and outsiders, and among individuals from different specialization levels (interdisciplinary approach).

Instead of competing, by collaboration it is possible to get synergic results from cultural diversity, sharing mutual support, working jointly, from planning together, and seeking for long-term relationship.

In the collaborative mode, each collaborator needs from the others, and at the same time can give to the others (Axinn and Axinn, 1997).

From an administrative perspective, it is possible to plan, organize, staff, and direct a human group in which all members are collaborators with each other, but also where collaboration is not the mode, and those in authority expect all others to follow orders, as they are told, and do not see themselves as collaborators.

Different types of functions may require different types of collaboration. A research organization is more productive when it takes a highly collaborative team approach. The leader's role is to ensure that each member makes inputs regarding what, why, and how should be done, and jointly make the decision when consensus has been achieved among all members.

Collaborative administrative style supports sustainability development.

Experience suggests that the more collaboration among the people involved, local community and personnel of organizations, the greater the chance that the activities will achieve success which will be sustainable over time (Axinn, 1995).

The Meaning of Collaborative Mode

Gray (1989) describes collaboration as a process through which parties with different perspectives of different dimensions of a problem constructively explore their differences and search for solutions that go beyond their own limited vision of it.

Collaboration is taken to imply a very positive form of working in association with others for some form of mutual benefit. The intention is captured in the meaning of the word "working together"; "to work jointly with others, especially in an intellectual endeavor", requiring a different leadership, culture, structure and organization, starting together since the planning phase, working together towards some common aim, such as the case to collaborate on a research project. Also, among organizations working in harmony retaining autonomy, integrity and identity (inter-organizational collaborations), in which each collaborator (person, organization, or nation) contributes and gains from it.

Positive forms of inter-organizational relationship are also described by using terms such as cooperation, co-ordination, coalition, network, strategic alliance, partnership and bridge, in contrast to the negative connotation of terms such as conflict, competition, co-option, and collusion. Collaboration replaced the way of beating the competition (Huxham, 1996).

Strategic alliance, joint venture, public-private partnership, coordinated service delivery, community development are terms now in common usage. Understanding collaboration is important and it is happening across the world because it is valuable as a way of effectively achieving results to complex problems. Collaborative arrangements are purely voluntary, and the reasons for increasingly working together are financial incentives for complementarities; efficiency arguments by avoiding duplication of efforts and ensuring co-ordination into a coherent whole; self-interest motivation to achieve results that are not possible alone; and also political for good practice.

Collaboration has three dimensions: organizational form (transformational organization advancing in a shared vision); structural form (from networks to the creation of entities); rationale (collaboration and participation are linked in the intention to involve those affected).

Creating Collaborative Advantage

Collaborative advantage is concerned with the creation of synergy among collaborating organizations, achieved when something unusually creative is produced that no organization could have produced on its own. Collaborative alliances have been identified as a logical and necessary response to turbulent conditions with unanticipated consequences, such as NARS, by building a collective capacity to respond to this dynamic environment. Through collaborative efforts, the stakeholders gain appreciation of their interdependence, improving the responses to the problem, and achieve increased reciprocity, efficiency and stability among themselves. Creative solutions are needed that exceed the limited perspectives of each individual stakeholder.

Consequently, the trend to form alliances among organizations to collaborate to compete or gain collaborative advantage have emerged as a response to turbulent conditions. In order to keep up with technological changes and compete in global markets, organizations have been forced to take on partners of all stripes, to undertake cross-sectorial alliances to stay competitive, to manage externalities and to shape the future of the global environment (Peters and Waterman, 1982).

Several contextual incentives have been identified that have stimulated the formation of alliance: global interdependence, rapid economic and technological change, increasing competitive pressures, blurred boundaries among organizations, differing perceptions of environmental risk. Sustainability of collaborative organizing efforts lies in their ability to create and command value, by achieving commitment.

A framework for classifying collaborations can be conceptualized along two dimensions: the factors that motivate the parties to collaborate (a shared vision or a desire to resolve a conflict), and the type of outcome expected (exchange of information or a kind of agreement). Through the process of collaborative formation, there is a general sequence of phases regardless of the nature of the problem under consideration: problem setting (convening the appropriate stakeholders and getting a commitment); direction-setting (stakeholders explore the problem and reach agreement about alternatives); implementation (steps to ensure follow-through on the collective strategy) (Gray, 1989).

Components of a Collaborative Workplace

The principal components of a collaborative workplace are: collaborative culture (core values), collaborative leadership (sharing and involving everyone), strategic vision (guiding principles and overall goals of a customer-driven organization, internally aligned and strategically focused its unique and value-added role), collaborative team processes (work processes managed by collaborative teams of aligned people who take responsibility for success and learn skills to become self-sufficient), collaborative structure (realignment of information system and human resources to ensure the success).

As a rule, the members of a collaborative workplace collaborate internally in order to compete externally. They are part of a highly productive and creative organization. Their energies are directed toward meeting customer needs. "Collaboration is the premier candidate to replace hierarchy as the organizing principle for leading and managing the 21st century workplace. It is a principle-based process of working together which produces trust, integrity and breakthrough results by building true consensus, ownership, and alignment in all aspects of the organization" (Marshall, 1995:4).

The classic tension in organization is between the need to divide the work and the difficulty of coordinating work after it has been divided (differentiation vs. integration).

In structural design the main issue is to accomplish both how to divide the work and how to coordinate it after dividing. Division of labor brings the problem to integrate the different roles within an organization. Connections are very important internally and externally in organizational development (to help others grow).

Fragmentation and fractionating of the knowledge system are particularly main two problems in NARS, evolving from the emphasis in modern science on specialization and expertise. There is an inverse correlation between the expansion of human knowledge and the decline in the capacity to deal with real problems. Plurality is inherent in a holistic view of knowledge (Kothari, 1988).

Organizations that intend to make substantial use of integrating, managing and improving teams to do work, must be designed, or redesigned to support this new way of doing work, in which teams are the core performing units (team-based organizations).

Cross-functional teams are recommended in quality management to make improvements in organizational transformation processes, as well as speed, cycle time and time-to-market, particularly in dynamic, complex and uncertain environments, as the case of NARSs.

The team organization structure, which includes the work teams, other integrating mechanisms, and the management and leadership roles of the organization, provides the basis upon which to design the integration and performance management processes of the organization (Mohrman et al, 1995).

Encouraging vertical and horizontal team work and cooperation within and across functional lines (cross-functional teams) is essential for empowerment, problem solving, process quality and productive improvement. Also, interorganizational partnerships must be created both internally and externally. Teamwork and participation, involving everyone in the organization as well as suppliers and customers, lead to creativity and innovation, particularly important in NARSs. TQM views the organizational structure as a system of interdependent processes, linked laterally over time through a network of collaboration (internal and external). Individuals cooperate in team structures (quality circles, steering committees, and self-directed work teams), and the reward systems recognize individual as well as team contributions and reinforce cooperation (organizational change) (Dean and Bowen, 1994).

Organizations try to achieve formal coordination vertically (chain of command, rules, operating procedures, planning systems) and laterally (more informal and flexible through meetings, task forces, committees, roles, matrix structures) (Bolman and Deal, 1991).

The concept of boundaryless organizations behavior, emerged recently, suggests that the structures will be tending to free movement across those same boundaries, creating new patterns of collaboration, learning and productive work.

Using a metaphor of comparing organizations with a building, four types of boundaries characterize most of them: vertical (levels and ranks of people), horizontal (functions and disciplines), external (organization and its suppliers, customers and regulators), and geographic (nations, culture and markets).

No longer will organizations use boundaries to separate people, tasks, processes and places; instead they will focus on how to permeate those boundaries (to move ideas, information, decisions, talent, rewards, and actions where they are most needed). To find more innovative, creative ways to generate and generalize ideas is essential. Organizational communications (internal and external clients) contribute to share ideas and improve competitiveness (important for NARSs.).

The new organizational success factors (speed, flexibility, integration, and innovation) are making boundaries less relevant. It is necessary to form collaborative, collegial, and consultative arrangements, and to forge a new model of collaboration making the relationships successful in the long run, such as new channels of communication between cross-functional teams, customers, and suppliers and across geographies, through the effect of technology development. Ongoing dialogue and action require organizations to change their basic supporting infrastructures to reinforce and encourage cross-boundary collaborations. The main characteristic of high-performing teams is their mobilization around a shared goal. In boundaryless organizations, the power of teams comes from their drive to achieve goals (Ashkeenas et al, 1995).

Collaboration has costs, investment of time and energy. It involves patient listening to each other by specialists, and from outsiders, hard work to establish a common framework and operational mode to solve problems. It is also an act of sharing, of interpersonal trust and appreciation, of mutual support, a quantitative and a qualitative phenomenon (incremental growth potential, to be measured in the long term).

A research team, increasingly necessary in NARSs, is more productive and with greater chances that the activities will achieve success, be sustainable over time, when it takes a highly collaborative approach, in which the leader´s role is to encourage each member, and jointly make decisions when consensus has been achieved.

2.1.8 Teamwork

The Need of Teamwork in NARSs

Scientific and technological progress engenders teamwork in research. The growth of team research is not due entirely to the increasing scale of research projects, the advance of knowledge has come to depend on the active collaboration of scientists with specialized skills drawn from a number of distinct research areas. Contemporary technological and social issues as the science evolves towards greater involvement in practical complex problems, inevitably shape the organization of research into multidisciplinary teams.

Teams can be defined as any group of people who need each other to accomplish a result. The relevant learning in an organization is done by people who have the power to take action and are involved in the main processes (internal and external). In this wide definition, a team might mean a worldwide network of specialists, communication through electronic mail, telephone, and occasional face-to-face meetings. Thus, one critical element of team learning is developing a collaborative way to design the broader infrastructure which determines how teams are identified and supported in their work. Team learning, the process of learning how to learn collectively, is the most challenging discipline- intellectually, emotionally, socially, and spiritually (Senge, 1994).

Multidisciplinary team research is thus a manifestation of the increasing connectedness of the whole scientific and technological knowledge. It is difficult to solve a problem within an isolated research tradition, the way is to conduct the research by a closely interacting group of people, contributing from their different points of view and particular expertise to the common effort.

It is easier to argue than to implement in a multidisciplinary approach the contribution of specialists from different scientific backgrounds. Everyday intellectual and technical collaboration from very different research traditions is a must for an effective team research. A multidisciplinary team working on a well-defined research project often is an effective means for breaking down barriers. One of the main effects of scientific and technological progress is to hasten a trend from individual to collective modes of work (Ziman, 1994).

Sustainable agriculture requires the recognition of internal dynamics of ecosystems, complex array of interactive processes, interdependence and interactions between ecosystems, as well as the indigenous knowledge and primary interests and actions of the end-users. It focuses on both end-user and societal benefits (human needs and environmental, social, and economic goals) and puts the traditionally "last" first by including the farmer in the identification, design of potential solution, and formulation of recommendations, and the final decision on the appropriateness of the technology (Chambers, 1989).

The development of a new paradigm for agriculture and natural resource management includes an integrative, interdisciplinary and multi-institutional approach to research and extension activities, centered around the end-users and an improved understanding of the ecosystems and their human, social, physical and biological dimensions.

Successful adaptive interdisciplinary research must begin with, and end with users. If they are involved from the earliest stages in identifying problems, designing solutions, and evaluating the outcomes, by using community meetings, end-user group interviews and key informants, the adoption of the proposed solutions is facilitated. This methodological focus on end-users is premised on the assumption that rural households are creative, experimental, and excellent decision makers in their own right, and utilize indigenous knowledge. Farmer to farmer model starts with a farmer-scientist diagnosis and a common definition of problem developed in concert, then, seeking solutions through interdisciplinary research.

Uphoff (1992) working on inter-disciplinary and practical institutional collaboration, identifies potential sources of constructive social energy: ideas, ideals and friendship. All of them are both-and (vs. either-or) and positive-sum (vs. zero-sum) thinking, and can make significant contributions to development by maximizing the use of existing resources through cooperation rather than conflict such that a win-win situation is created.

According to Covey, synergy works as is a correct principle, effective in an interdependent reality, team work, team building, the development of unity and creativity with other human beings. "Win/Win is a frame of mind and heart that constantly seeks mutual benefit in all human interactions. Win/Win means that agreements or solutions are mutually beneficial, mutually satisfying. It is a better way, a higher way" (1989:207).

In complex organizations such as NARS, few problems arise in such form that they can be solved by the use of any single discipline. By working in the field with participation of different expertise, the team learns and arrives at a far more useful and scientifically valid research strategy than would be possible simply analyzing a problem from the standpoint of one discipline, overcoming the single-discipline limitation (Whyte, 1991b).

Project appraisal is dominated by the hard technical disciplines, and the soft ones (ecology, anthropology, sociology) tend to be marginal to the planning process (Chambers, 1983).

ISNAR studies suggest mechanisms of inter-institutional coordination and collaboration that would improve the effectiveness and efficiency of linkages between actors and institutions to increase the involvement of small farmers and the communication channels (Farrington et al, 1994). Effective management requires a skilful combination of strategies involving human resource development, stakeholder participation, and institutional reorganization (Busch and Bingen, 1993).

Senge (1990) indicates requirements for an effective team are the importance of energy, enthusiasm and effort alignment through a clarity of shared vision and systems thinking; dealing with the current reality of conflict and learning how to work with, rather than against, the defensive routines; and learning team skills. Learning teams learn how to learn together.

Research questions have to be the problems occurring in the multifaceted outside world, not simply from the intellectual curiosity of researchers, overriding disciplinary boundaries. Agricultural problems must dictate the structure of research, thus, multidisciplinary research is especially suitable for sustainable agriculture.

Multidisciplinary, meaning any alternative to single-discipline research (in a loose way), and interdisciplinary when there is more interaction among them, but currently both labels are used, as cooperation by several disciplines in trying to explain the same phenomenon (Lockeretz and Anderson, 1993). The interdisciplinary format is a mechanistic, aggregative, and integrative process rather than a transformative process which is what really takes place. What actually happens can be better described as trans-disciplinary (extra-disciplinary) knowledge rather than interdisciplinary orientation. For true interdisciplinarity to develop it is the individual who has to become interdisciplinary, not the group. It is possible to refer to transdisciplinary as a term that implies even more than multidisciplinarity, connecting across the frames, developing a analytical capacity (Fear, 1996).

Technological challenges of NARSs in the 21st century are related to the new biotechnologies (molecular biology and genetic engineering) that make agricultural research more directly dependent on disciplines, and in specialized laboratories, far from farmer's fields. There will be a need for adaptive research and feedback, and new links will have to be designed among these laboratories, farming people, extension, local agencies, government and NGOs, private firms, national and international development organizations. Participation by stakeholders requires institutions to expand, encourage, and manage that participation, for decision making and implementation, and for interaction and learning (Bryant and White, 1984).

The challenge to administration is how to ensure maximum collaboration among those who have a vested interest (stakeholders). Decentralization efforts will not succeed without strengthening organizations that facilitate the active participation of rural people in the development and policy-making process (FAO, 1996). The evolution of NARSs is toward to a corporate culture based on collective efforts, cross-functional work, coaching, enabling farmer satisfaction, and quality principles.

Toward Collaboration and Interdisciplinarity in NARSs

The first step is to realize that this approach is needed. Now, everyone invokes interdisciplinarity. It is important to identify a research topic that requires cooperation of every discipline involved. It is not just "work together". Interdisciplinary research is useful and mutually stimulating when a problem has been identified and then scientists with knowledge and skills relevant to its investigation are brought together to work on it.

The attitude to interdisciplinarity emerges when scholars from diverse disciplinary backgrounds work together around a clearly identified problem. Two other prerequisite of the success are a temperamental openness of the participants and their capacity to tolerate ambiguities, a high level of intellectual comprehension which enables them to transcend their specialized training, sharpen their academic sights and produce a new language of communication in the process of defining a given problem.

Just including the right scholars on the research project is necessary but not sufficient condition, it does not guarantee that it can do the right kind of multidisciplinary research. Conversely, not every study needs team members from all the relevant disciplines.

Agricultural research is sufficiently multidisciplinary and too specialized. Multidisciplinarity in alternative agriculture is not an end in itself, it is only a means to an end (a process of knowledge that is integral, sensitive and capable of creative intereaction with reality). Multidisciplinarity in form does not always mean multidisciplinarity in spirit. Both multidisciplinary and single-discipline approaches will continue to be important.

Institutional reasons for fragmentation are the reward system, funding mechanisms, the departmental structure, the channels of professional communication, therefore, institutional changes are required to improve it. Institutions have to provide intellectual stimulation, frank dialogue, a self-questioning search and a model of integration based on plurality and multiplicity of view-points, an atmosphere in which intellectual curiosity and creativity are stimulated and individual worth is recognized. Through dialogues, debates and focused workshops, this research seeks to explore new modes of participation. The problem-oriented approach has confronted the scholars with the challenge of transcending the rigid boundaries of disciplines, and with the need to avoid a fragmentary approach to knowledge.

The way scientists view the world also tends to fragmentation through the unidimensional understanding of the nature of knowledge. Scientific thinking is based on reductionism (dividing complex phenomena into simpler components), analysing the whole as the sum of its parts. In contrast, agroecology (framework for long-term sustainability of agricultural systems) is described as holistic while conventional sciences are atomistic. Disciplinary development can be a force for both synthesizing and fragmenting scientific research. Reductionism assumes that nature, and reality, are simple. However, NARSs have to face complex and dynamic realities, composed of mulitple-simultaneous, interdependent cause-effect-cause relationships (Senge, 1990).

Multidisciplinary research and on-farm research are associated with alternative agriculture. Farmers′contributions can improve the planning, priorities, designing, carrying out, execution, evaluating and diffusion of research projects. If research purpose is to serve farmers, they have to incorporate their voice into the research process. But, farmers′ and researchers′ respective responsibilities must be clear, the researchers must adapt the experiment to what they judge each farmer can do; and farmers should have some sense of owning the research. Relationship between farmers and researchers will enable research to best meet its obligations to farmers, while also meeting its obligations to society as a whole. A balance must be sought between the complementary roles of the two groups.

The farmer-first principle dictates that researchers begin with farmers′ knowledge, problems, analysis and priorities (Chambers, 1993). It presupposes that farmers are the only beneficiaries of agricultural research, and does not consider other groups that support public research and are affected by it (environmentalists, safe food advocates, society). The choice should not be farmer-first versus farmer-not-at-all. Research undertaken in response to farmers′ demands tends to be shorter-term and more highly applied, and to give low priority to environmental effects, off-farm socio-economic consequences, and long-term resource implications. Mechanisms, such as farmer advisory committee are adequate forums, leading to agricultural researchers spending more time listening to farmers′ problems.

A well-planned research program requires a mix of projects long-term and short-term; component and system-level; concerned with specific production systems and with general processes; and local, regional, and national. Researchers, farmers, and other groups affected by research look at the same question differently, and properly so. Farmers and researchers have to complement each other with their different purposes, kinds of experience, and relationships to agriculture. Neither can do the job alone, but if they are allowed, each can make a valuable contribution (Kothari, 1988).

Self-directed works learning means that the learner directs the learning, what is learned, how, and when. Who controls the learning process is the learner. Creativity, feeling, continuity, and reflexivity are vital qualities of learning as a way of being (Vaill,1996).

“Making teamwork is an essential part of the workplace, especially when structured in the form of self-directed work teams (SDWT), represents a sophisticated and advanced form of organizational innovation. A considerable amount of savvy (intellectual and strategic) will be required to introduced and sustain team-based performance” (Fear, 1998:9).

Essential to client accountability, decentralization, gender sensitivity, participation, and therefore sustainability, is a different mode of involvement in development. It is a mode in which the outsider′s assumptions that they know best what insiders need are replaced by a new type of genuine collaboration among insiders and outsiders. It is also a mode in which specialized professionals from any one field or discipline acknowledge that they need to work with and support specialized professionals from other fields. A different style of relationship more efficient, more effective, and more appropriate is the collaborative mode. An organizational structure for NARSs should facilitate cross-disciplinary cooperation, coordination, and communication among researchers from different scholars and stakeholders for maximum effectiveness. A major challenge to NARSs is how to reorganize for collaboration (Axinn and Axinn, 1997).

2.1.9 Sustainability

It is increasingly recognized that the natural resources are not unlimited, and there are no more new frontiers to explore. The international cooperation efforts focused on agriculture development are led to consider sustainability in planning and implementing activities.

Sustainability is a temporal, holistic concept. The challenge for agricultural research is to contribute for human progress meeting today's needs, without compromising the consequences for future generations.

In agriculture there are sustainability constraints in over-use of agrochemical and irrigation in intensive large-scale commercial systems, and high pressure on the carrying capacity of the fragile ecosystems in marginal areas (Axinn, 1995).

The desirable change has to be sustainable over time. Evaluation of projects should be considering the long-term, taking into account sustainability (with some follow up during the first years).

The long-term sustainability of agriculture requires commitment to evaluate objectively as complete a range of practices and systems as possible and to communicate effectively the findings to the agricultural community (Edens, 1985).

The Evolution of the World Concern on the Environment

Since 1960 there has been a growing understanding of the adverse ecological impacts of development. A relevant conference held at Virginia (1968), and other meetings were organized by conservation organizations and development agencies (Adams, 1994).

Chronologically, environmental issues can be associated with the UN Conference in Stockholm, Sweden (1972), where two opposite positions were established: continuing development even with contamination, and in contrast, stopping contamination to improve quality of life. After that, a remarkable evolution of the latter approach was evident.

In the UN Conference on Environment in Rio de Janeiro, Brazil (1992) the importance and urgency for addressing sustainable development and environmental protection, as well as the concern about the future world's ability to feed itself, was featured (UNCED, 1992). As a consequence of the Conference, ISOs 14000 Norms started to be developed in March, 1993. Hence, public sector, mass communication, consumers and transnational companies are contributing to globalization, bringing environmental management.

According to Ruttan (1996) for the third time since World War II, there is a social concern about the availability of our natural resources and the quality of our environment. The focus was primarily on how the scarcity of resources would limit economic growth

(1940s), later about the pollution generated by growth associated with technologies such as pesticides and fertilizers (1960s), and now, on environmental changes that are occurring on a transnational scale -issues such as global warning, ozone depletion, and acid rain- and their effects on environmental quality, food production and human health.

The Increasing Involvement of Consumers

The increasing concern of the final consumers for both health and environmental conditions, represents an opportunity for export-oriented countries, like Uruguay, if they take into account marketing strategies and research, with an ecological approach committed to the development of its own agricultural resources.

It requires more than a product free of potential toxic residuals. The system of production has to be based on a profound knowledge of nature, in harmony with natural cycles (minimum use of hormones, antibiotics, agrochemicals and other materials harmful to human health or the environment). The process has to be clean and sustainable, and aimed to accomplish a proper flow of energy and nutrients, with a minimum use of inputs, and also has to meet an acceptable environment and natural resources cost.

For the past years, the public sector was in charge of the environmental control; presently the NGOs are also participating and, in the future, consumers are expected to be integrated with them. Consumers will make pressure on organizations for environmental management reconversion, particularly on the agricultural systems of production (ecolabels).

A Paradigm Focused on Productivity

The agricultural research-extension systems, in the past, have worked to optimize, and even maximize yields, without regarding as a main concern the effects on sustainability and environmental conditions.

High productivity is a goal of all agricultural systems, as it has been in the past and will certainly be in the future. This means efficient use of resources for optimal output to serve personal, social and economic needs. However, all of this must be done with socially and politically acceptable environmental disruption. All agriculture, by definition, creates environmental disturbance in the natural systems, in an ecological sense, through human intervention. Potential yields imply achieving high flow of nutrients from soil to crops, and, through animals back to soil. Losses in the surrounding environment must be minimized. In the last three decades, development in the expansion for efficiency was characterized by inputs domination, capital investment in machinery and chemicals, replacing labor, and were criticized for their adverse environmental and social impacts (Hardwood, 1994).

The yield increase does not come without costs. The US EPA, has identified agriculture as the largest non point source of surface water pollution. Pesticides and nitrate from fertilizers are detected in the groundwater, soil erosion remains a concern, pest resistance to pesticides continues to grow, pesticide residues in food has yet to be resolved, inputs have become a significant part of total operating costs (NRC, 1989).

Today's conventional agricultural systems have serious shortcomings. Environmental problems are caused by generations achieving goals by themselves. This economic stability achievable is politically attractive. The criteria for evaluating short-term performance (labor productivity and yield per unit of land area) has caused an increment in agricultural productivity, but has led to a capital- and an energy-intense activity. The available resources, without a real technological shift, will not be enough to satisfy current and expanded needs. Consequently, the agricultural production system will be unsustainable. To adopt just these economic criteria without evaluating the impact of the innovations on the agricultural system as a whole, may have negative impact on the sustainability of the system in the long term. Hence, the importance of a system criteria for choosing priorities in agricultural research (Edens et al, 1985).

During the 1960s, the "Green Revolution" package promoted technical change in order to modernize agriculture in the developing world by the International Research Centers (introducing and expanding high productivity technologies based on high levels of inputs and efficiency). This model had different impacts in the world. Despite the success in increasing agricultural outputs, some valid concerns have arisen: indigenous knowledge systems were ignored and replaced by foreign concepts, increased dependence upon purchased inputs, increased use of fertilizers, pesticides and herbicides has led to pollution and detrimental ecological impacts, increase in the demand for energy in the agricultural sector, and affected the narrow genetic base (World Bank, 1992).

The National Research Council Report (1989) describes the human and environmental costs of high-input production methods in USA as: soil erosion and other forms of degradation, deforestation, desertification, declining water quality and availability, nonpoint source water pollution, groundwater contamination, salinization, disruption of hydrogeological cycles, aquifer depletion, loss of biological diversity, resistance to pesticides, human health associated with pesticide application and residues.

The main elements of "Green Revolution" concepts are still used in International and National Centers in order to prioritize research and extension policies, and this is the case of INIA. The long-term effects of the application of these policies became more evident in the 1990s. However, a strong resistance against change is shown (Chambers, 1993).

A New Paradigm Emerging on Sustainability

Sustainable agriculture and natural resources are at this moment central issues in public and policymakers agendas taking into account the real concern about environmental protection, natural resources responsibility, and the world's ability to feed ever-growing populations.

The quality of human life and of the environment are truly linked. The issues transcend science and national boundaries, involving critical considerations of intergenerational responsibilities and equity. The awareness of the interdependence of agriculture, the environment, and socioeconomic conditions affect the sustainability of current agricultural production systems.

There are systems of production adopting alternative practices (crop rotation, integrated pest management, and increased use of on-farm nutrient sources) that preserve the natural resources base and the environment. As the availability of new arable lands decreases, sustainability will require enhancement and improved management of soil and water resources and the protection of biodiversity in the system (NRC, 1991).

These interrelated factors can derive from losses in agricultural productivity at local and regional levels, raising concerns about food security, food quality, public health, and other long-term development issues, both environmental quality and economic development.

Agricultural research institutions, then, must focus more on technologies and practices that are less dependent on energy and agrochemicals, and more friendly to the environment, than those now in common use.

The Concept of Sustainability

Sustainability has been defined as: "development that meets the needs and aspirations of the present without compromising the ability of future generations to meet their own needs" (Bruntland Commission Report, WCED, 1987); "the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources" (TAC/CGIAR, 1989); and "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to assure the attainment and continued satisfaction of human needs for present and future generations" (FAO, 1991).

The common view is that sustainability is a stated goal which particularly implies value options; meeting the essential needs of today's population without compromising the ability of future generations to meet theirs, living on the planet without depleting nature's capital; and managing natural, human and financial resources in order to increase long-term wealth and well-being. The definitions, however, do not say how sustainability may be achieved, what are legitimate needs of future generations and who judges them. The emergent debate will bring different perspectives because our needs would be defined in relation to what we are accustomed to and what we hope for.

Sustainability is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainability as an agronomic concept refers to the ability of land to maintain productivity on the long run (EPSD, 1990).

Sustainable Agriculture

Sustainable agriculture is a recent response to these environmental and economic concerns. The intensification for high productivity stressed the importance of the renewal capacity of agricultural ecosystems and claimed that many conventional agricultural practices were detrimental. Now, an emerging approach to agriculture incorporates the principles of ecology by emphasizing interactions among and within all the components (physical, biological, socio-economic) of agroecosystems.

As the need for environmentally, socially, and economically compatible adjustments to conventional agriculture is recognized, sustainable agriculture provides for the needs of current and future generations while conserving natural resources. Thus, it implies values dealing with equity among people presently and among this generation and future ones.

Agricultural production and environmental management share common, rather than competing goals (agriculture and all its interactions with society and the greater environment). It implies long-term maintenance of natural resources and agricultural productivity, minimal adverse environmental impacts, adequate economic returns to farmers, optimal crop production with minimized chemical inputs, satisfaction for human needs for food and income, and provision for the social needs of farm families and communities, to ensure flexibility within ecosystems to respond to stress (NRC, 1991). Therefore, sustainable agriculture is the product of two agendas in conflict: socio-economic and environmental. The idea, thus, is an intermediate pathway that harmonizes them. (Ruttan, 1996). It has three dimensions: physical (most common use to mean that an activity can be kept going for a long time without running out of non-renewable resources, and without generating negative feedback); biological (ecosystems); and socio-economic implications (responsible, acceptable, desirable or morally right).

It is necessary now to make improved environmental quality part of the research objectives, developing more environmentally sound technology and advice on prevention of natural resources depletion and contamination.

Agricultural sustainability is viewed from different perspectives (productivity, stewardship and community schools). The position should be responsible agriculture, in favor of economically viable, ecologically sound and socially just agricultural systems (Douglas, 1985).

Sustainable agriculture systems should be stable (reduce risk and lead to continuity in income and food supply for the short-term needs of farmers without long-term environmental costs), resilient (adaptation to changes in the physical, biological, and socioeconomic environments), environmentally acceptable (avoid erosion, pollution, and contamination, minimize adverse impacts on adjacent environments, and reduce the threats to biodiversity), economically viable (in both short and long term), and socially compatible (with local people and political economies) (NRC, 1991).

Efficient and Sustainable Use of Resources

Economics is about the efficient use of resources. Economic sustainability depends upon the sustainable use of resources, except that one resource can substitute for another. All processes should be sustainable, in the sense that it can be continued in the future, without the resources needed running out. There is a difference between using a resource and using it up. The rate and the purposes to be used and by whom have to be strongly justified.

The systems of production have to assume that the required inputs (energy, fertilizer, water, foodstuffs) will not always be readily available, and that the non-product outputs (excreta, effluent, nitrates, methane) might contribute to unacceptable levels of pollution.

Sustainable agriculture includes: preservation of natural resources, improving the environment and productivity of the factors of production and quality of products. Therefore, the productivity of the factors of production (land, capital and labor) are essential components of sustainability.

Natural resources include exhaustible (oil, coal, minerals, ground water, natural gas), its supply cannot be increased or replenished, and renewable (wildlife, rivers, trees), biologically determined and need not be depleted if properly managed. The debate over who has the right to extract natural resources and how to weigh the well being of current versus future generations has no immediate answer (Robison and Schmid, 1996).

A sustainable agricultural system can indefinitely meet demands for food and fiber at socially acceptable economic and environmental costs. It implies a temporal dimension – a sense of intergenerational obligation; a spatial dimension –the world as a whole; a quantitative dimension –increasing demands for the system's output; and a normative dimension –meeting demands over time at economic and environmental acceptable costs for society. The agricultural system in the future will depend on the ability to mobilize the resources –the social capital- necessary to sustain the production increase.

Alternative agriculture integrates innovative practices with conventional farming, taking advantage of naturally occurring beneficial interactions. It pursues the following goals: more incorporation of natural resources; reduction in the use of off-farm inputs; greater productive use of the biological and genetic potential of plant and animal species; improvement of the match between cropping patterns and the productive potential and physical limitations of agricultural lands to ensure long-term sustainability of production levels; profitable and efficient production and conservation of soil, water, energy, and biological resources. It is an umbrella which includes a spectrum of farming systems, ranging from organic systems (to use no purchased synthetic chemical inputs) to those involving the prudent use of pesticides or antibiotics to control specific pests or diseases (NRC, 1989).

The essential principles associated with sustainable agriculture are implied in the concept of organic agriculture, which is not possible if it is not sustainable in a broader sense. If organic farming is farming without chemicals, it can be considered as sustainable, biological, regenerative, and even biodynamic agriculture, with common principles and practices, according to the IFOAM standards (Lampkin, 1992).

The central ideas referred to as sustainable, alternative, low-input, ecological and reduced- chemical agriculture, are interchangeable labels. The major goals include: conservation of natural resources, protection of the environment, enhanced social and economic well-being of rural communities and improved food quality. How to achieve these goals with the reduction or elimination of pesticides and fertilizers; sometimes this strategy is generalized to a decreased use of all purchased inputs (Lockeretz and Anderson, 1993).

Sustainable management tends to optimize soil quality. Soil conservation (preventing soil loss by crop cover, tillage systems, contouring and terracing) has been emphasized, but this is not enough. The maintenance of soil quality and productivity is more a social, political, and economic issue than a technical issue. In developed countries the balances shown an overuse of NPK, in contrast, developing regions have overextraction of nutrients, soil and genetic erosion, affecting the potential productivity, not always perceived as the environment costs (Harwood, 1995).

This challenge is a typical case that offer threats and opportunities. The Green Revolution orientation based on intensive use of inputs considers the biological and economic productivity in the short-term horizon, but sustainable agriculture based on the knowledge and rational management of natural resources will represent a long-term strategy for better and competitively positioning in the world market (Spedding, 1995).

Public Responsibility

Market failures include distortions due to externalities, caused by spill over effects of individual production or consumption on others; not compensated by market, with negative (underground water contamination) or positive (free use of research results) consequences. Public intervention is required in order to balance the generation of technologies, considering profitability and, at the same time, environmental effects. The investment in research and development to reduce negative externalities to environment, through natural resources stock consumption, which are free or subevaluated, should be a priority for the private sector , and to internalize externalities. (Alston and Pardey, 1995).

Most of the agricultural policies are designed as though economic agents act independently and selfishly. Based on this, farmers can be motivated to modify the use of potentially harmful herbicides, pesticides, and hormone growth stimulators or other activities that may increase or impose costs on others only by threat of litigation or income incentives. However, social capital theory suggests other important motives to which farmers respond, leading to socially desirable behavior without any external threats or subsidies, leading them to act responsibly about resources without outside intervention (Robison and Schmid, 1996).

Countries have sought to deal with environmental consequences of economic activity by regulatory approaches, but this improvement will be increasingly costly. Now, some developed countries are experimenting with market-like approaches to achieve environmental improvement. Private firms have better knowledge of what it takes to reduce their polluting effluents than government regulators, and that provision of market-*like* incentives to the firms will induce them to bring that knowledge to bear (Crosson, 1996).

The challenge is to design institutions whereby people and organizations find it advantageous to act in ways that help achieve overall goals of society (quality and quantity of food, quality of the environment, and health) (Ruttan, 1996).

2.2 The Framework for Agricultural Research Organizations

The World Bank (1992) reports about the profound changes in the world economy. and how globalization is affecting international development in different functions (production, marketing, research and development), as well as the economical, social, environmental implications on agricultural research agenda. Better information and participation of farmers contribute to improve priority-setting, decision-making and policy design regarding to sustainability.

The high turbulence environment requires anticipation. It implies to move from the old style of problem-solving (reactive mode), when real problems have occurred and they have to be solved, to the new style of anticipating new problems before they happen (problem avoidance and opportunity identification). That is a proactive approach (Drucker, 1980; Barker, 1992).

Many systems are suffering a crisis of management with top heavy bureaucracy, centralization of decision making and lack of incentives for the innovation process, critical for research. Well articulated research systems require innovative institutional models that encourage participation and exploiting complementarities. Main elements of the emerging concept of NARSs are: pluralistic institutional structure, diversification of funding, private-public sector collaboration, institutional autonomy, involvement of stakeholders, and new models for technology transfer (Byerlee and Alex, 1998).

A successful national agricultural research system requires many resources. First, it must have the needed experiment station infrastructure (qualified scientists and support staff, field and laboratory facilities, stable budget). Second, it must have the organization, structure, and planning mechanisms to use these resources effectively, to benefit stakeholders. Organization and structure help to create the potential for a NARS to be effective. Once we have created this potential for effectiveness, we can build on it the additional dimension of efficiency. We can do this by giving it the management techniques and tools which the NARS leaders and the professional staff can use in the course of their work. Some national agricultural research systems, both in the developed and developing countries, are quite effective, but they are not particularly efficient in the use of their resources. Conversely, there are NARS which may have an efficient management but fail to achieve much because of structural weaknesses. Social scientists define organizations as the instruments by which public policy is implemented. In the context of NARSs, organization may be defined as the institutional framework and entities created to generate technological support for the country's agriculture. The relationships and linkages of the different entities and actors and their reporting and decision making processes as part of the governance mechanisms help to define the structure of the system (Jain, 1989).

To understand processes of organizational change, organizations should be examined as social system transformation processes, contrived by people, characterized by inputs, outputs and functioning in an environment, with structure, technology and tasks, information and control systems, and culture (Griffin and Moorhead, 1986).

Previous studies show that main ideas for putting together an effective institutional development strategy are: get stakeholder participation (the most sustainable institutions have great involvement of staff, beneficiaries and other stakeholders; when power is shared, stakeholders take ownership of undertakings and help design them for their needs, resulting in improved and prolonged performance) and offer long-term formal education and training; for technical institutions the formation of a critical mass of trained personnel is essential, it provides the bedrock for a high-performance organizational culture (Goldsmith, 1991).

Korten and Klaus (1984) pointed out that the dominant logic of the industrial era created great bureaucracies that organized society into efficient production units-centrally controlled and functionally defined. They emphasize legal charters, formal authority, control structures, and budgetary processes. The post –industrial era faces conditions quite different, and presents potential to enhance human growth (the central concerns of people-centered development). The self-organizing learning systems of people-centered development complement the formal structures with a variety of organizational technologies that are less formal and more rapidly adaptive. Important among them are informal networks built around people, values, and information flows in response to particular interests and needs as circumstances dictate.

He considered that this need for change becomes increasingly evident, and criticized the obsolete vision of the global reality and the nature of human progress, which equates human progress with growth in the market value of economic output and subordinates both human and environmental considerations to that goal. The result has been the extravagant consumption of the world's resources with little recognition of the social and environmental costs. The critical development issue for the 1990s is not growth (not growth-centered vision). It is transformation institutions, technology, values and behavior consistent with the ecological and social realities, addressing basic needs of the global society (justice, sustainability and inclusiveness). It is a people-centered development vision that embraces the transformation agenda (Korten, 1990).

Interventions are focused on obvious symptoms, which produce short-term benefit, but systems thinking, with the reciprocal feedback process required to analyze the loop of cause-effect. He thinks that because of inadequacies of prevailing ways of managing, thoughtful people are engaged in building new types of organizations - decentralized, nonhierarchical organizations dedicated to the well-being and growth of employees as well as to success. Some crafted radical corporate philosophies based on core values of freedom and responsibility. Others have developed innovative organizational designs. All shared a commitment and a capacity to innovate that was lacking in the public sector (Senge, 1990).

Thus, the need for a new science and praxis which considers the problematic relationships between agriculture and environments is emerging. System thinking (including system analysis, cybernetics, ecosystem biology) and practices are fundamental (trying to design new, productive, stable, equitable, and sustainable agro-ecosystems). The complexity, dynamics, and chaos of contemporary agriculture, require movement from classical agricultural research, from the biological and physical sciences to a new transdisciplinary science of agriculture. Systemic thinking can pose a considerable threat to the experimental scientist, who controls the environment in the interest of reduced variation. In farming-systems research, the development of relevant and viable technology must be grounded in a full knowledge of the existing farming system, and that technology should be evaluated not solely in terms of its technical performance but in terms of its conformity to the goals, needs, and socioeconomic circumstances of the targeted small-farm system as well.

From an ethics perspective, it is generally not recognized that values are not peripheral to science and technology but constitute their very basis and driving force (Bawden, 1991).

Consequently, following Kuhn (1970) a paradigm shift in organizational development management occurred, with a new one emerging: the learning paradigm. It includes a change in social organization, moving from hierarchies to networks

However, this ideal tendency should be considered as a target in the long horizon. In the meanwhile, traditional management can be improved by replacing by a proactive, innovative, and shared leadership based on the mission, and oriented by the vision, moving toward the direction of a learning organization approach.

"To practice a discipline is to be a lifelong learner. You never arrive; you spend your life mastering disciplines. You can never say, we are a learning organization, any more than you can say, I am an enlightened person. The more you learn, the more acutely aware you become of your ignorance. Thus, a corporation cannot be excellent in the sense of having arrived at a permanent excellence; it is always in the state of practicing the disciplines of learning, of becoming better or worse" (Senge, 1990:11).

2.2.1 Total Quality Management (TQM)

According to Dean and Evans the term Total Quality Management (TQM) "conveys a total, company-wide effort that includes all employees, suppliers, and customers, and that seeks continuously to improve the quality of the products and processes to meet the needs and expectations of customers. TQM has become the basic business strategy for firms that aspire to meet the needs of their customers" (1994:12).

They consider that there are many different approaches to TQM, and although any one is not ideal, successful programs share these basic attributes: a) customer focus (the customer, external and internal, is the judge of quality), b) strategic planning and leadership (long-term strategy), c) continuous improvement (quality must be measured), and d) empowerment and teamwork (vertical, horizontal and interorganizational partnerships).

The philosophies of Demming, Juran, and Crosby provide fundamental principles on which TQM is based (Dean and Evans, 1994). A comprehensive framework for how to implement TQM within an organization and a means of assessing, the prominent role is played by awards (the Malcolm Baldrige National Quality Award), and certification procedures (ISO 9000 and 14000 registration). There are specific tools for quality planning (quality function deployment, the seven management and planning tools), and for continuous improvement (the spiral of Demming Cycle, tools for data collection and analysis, benchmarking).

Blackbum and Rosen, analyzing lessons learned from Baldrige Award-winning companies, indicate that moving to a TQM culture demands much from an organization, and aligning human resource practices with quality initiatives requires revolutionary changes in the way organizations train, empower, evaluate, and reward individuals and teams. They said that "however, the revolution is far for over. Even among organizations recognized for their TQM achievements, there is still a need for continuous improvement with respect to human resources practices governing the selection, promotion, and development of future leaders"(1993:3).

Spencer (1994) examines TQM in relation to the mechanistic, organismic, and cultural models of organization in an effort to bridge the gap between TQM practice and management theory. She suggests that research on TQM practice has potential to expand the understanding of these management models. "Quality revolution" has been described as a new way of thinking about management of organizations; a comprehensive way to improve total organization performance and quality; an alternative to "management by control" and ultimately a paradigm shift. The new paradigm: customer –oriented organizations that are organized around processes, run by teams, and conducted more like ballets. Some corporate managers have invested, others have waited for hard evidence that it works. She conceptualizes TQM not as a new paradigm, but as a comprehensive management practice that captures signal from established models of organization and amplifies them by providing a methodology for use.

TQM is a systematic approach to the practice of management, requiring changes in organizational processes, strategic priorities, individual beliefs, individual attitudes, and individual behaviors (mechanistic organizations focusing on performance; productivity, effectiveness and efficiency are primary concerns). The role and nature of environment is also important: a mechanistic model employs closed-system assumptions about organizations, and TQM has an open-system view. TQM recognizes the environment as a vital source of resources and constraints (boundaryless organizations), which has permeated TQM literature, connotes the more open posture of this perspective. In the Deming flow diagram customers and suppliers are viewed as part of organizational processes.

In relation to the role of management, the classical management theorists define management's role according to principles: managers plan, organize, direct, and control. However, TQM suggests that managers lead rather than plan, empower rather than direct, partner rather than organize, and asses rather than control. Their roles are redefined from directors who give orders to designers who create visions and establish systems.

Dean and Bowen (1994) analyze principles, practices and techniques in relation to customer focus, continuous improvements, and teamwork, and remark that TQM is not simply slogans and tools; it is a set of mutually reinforcing principles, each of which is supported by a set of practices and techniques, and all of which are ultimately based on fulfilling customers'needs.

They argue that there is considerable conceptual overlap between TQM and management theory. Management theory is a multidisciplinary academic field. Perhaps the fundamental difference between TQM and management theory is in their audiences. Whereas TQM is aimed at managers, management theory is directed at researchers. Therefore, the language used in the two literatures differs substantially. The difference in audiences results in two other differences: a) TQM is inherently cross-functional. (marketing, product design, operations, human resources management), and management theory as a field is multidisciplinary, but individual theories tend to be discipline; and b) given its mission to improve organizational performance, TQM is almost completely prescriptive in orientation (i.e. Deming 14 points, are imperative statements), management theory in contrast is concerned with understanding, not just improving organizations. Some management theories are prescriptive, others simply describe relationships among organizational characteristics. When management theory is prescriptive, its prescriptions tend to be contingent (i.e. sensitive to variation in the organizational context). The two systems of thought can be compared on the basis of their area of overlap: recommendations for organizational effectiveness.

2.2.2 Trans-Frame Analysis

Kouzes and Posner (1988) affirm that the old ways of doing things do not work any more. Leaders do not wait for a disaster. Instead, they build community through shared values, create consensus, and rely upon those to resolve conflicts; build commitment to these values and get people to perceive themselves as part of a larger whole and to become involved in collective action and shared successes. The engine of renewal is fueled by learning (unlearning and then learning anew). That implies talented people who embrace the organizational values.

Covey (1989) suggests that to move up on the upward spiral of growth and change, requires learning, commitment and doing on increasingly higher planes. It requires to be proactive, taking time regularly for reflecting ("sharpen the saw").

Organizations are complex, ambiguous and paradoxical (Morgan, 1990), complex, surprising, deceptive, and ambiguous (Bolman and Deal, 1991).

The real challenge is to learn to deal with these characteristics, with our capacity for critical thinking. The critical challenge is to confront and manage contradiction and paradox. Managers often favor rational and structural ways of thinking, looking for one right way to handle their responsibilities, simple answers to organizational dilemmas, and by people-blaming, blaming the bureaucracy and the quest for power (Bolman and Deal, 1991).

They emphasize that behind every effort to improve organizations lies a set of assumptions (theories), about how organizations work and what might make them work better.

Morgan (1990), and Bolman and Deal (1991), do a prominent organizational analysis, through frames and metaphors, based on the evolution of the main schools of thought. These are the ways of understanding and thinking about and then acting toward organization development. Leaders should apply the most appropriate frame (s)/metaphor(s) in a flexible manner, through learning different ways of thinking. There are commonalitites among them. No single way of thinking about organizations is right, best, or appropriate.

Fear (1994) emphasizes the need for developing analytical capability and trans-frame thinking (connecting across the frames). The processes of organizational development start with the current situation and by applying a dynamic, complex, and integrated set of strategies and tactics, people move from where they are to where they will be. This process takes courage, experimentation, and requires high levels of trust, but is the way that organizations and the people begin to feel fundamental change.

Busch and Bingen (1994) analyzing the ISNAR's (International Service for National Agricultural Research) experience in 40 countries over 12 years, suggest that structural change on its own not necessarily is the best approach for achieving the goal for building more effective agricultural research organizations. Change is more likely to be effective if it embraces a multiframe approach that involves a combination of structural, human resource, and political perspectives. Effective management requires this to be done through a skillful combination of strategies involving human resources development, stakeholder participation and institutional reorganization.

ISNAR (1997) in relation to governance and management of institutional change establishes that NARS are under increasing pressure to respond to stakeholder demands for accountability, to undergo evaluations according to the standards of the semi-private sector, and to redefine their roles in the public sector. Under governance, therefore, it will focus on 3 issues: development of improved mechanisms to allow stakeholders, particularly women, to influence the research system; design of appropriate feedback mechanisms to stakeholders; and analysis of effective mechanisms for internal governance within the research system itself. Alternative governance mechanisms should ensure that gender issues are addressed. They might include user-based boards of trustees, competitive grant schemes, and participatory planning approaches (examples of mechanisms of accountability are auditing, impact assessment, and external program evaluations). Change, in itself, is a challenge to existing organizations, both public and private. ISNAR will facilitate institutional change and development. The institutional strengthening, will be within a CGIAR system-wide initiative on governance and management of change, particularly directed towards institutional performance, and market orientation.

The proposed multiple-frame model for re-thinking the national agricultural research organization in this study, drawn from the literature cited (Morgan, 1990; and Bolman and Deal, 1991), is based on:

- Just capturing the essence of structure, organizational effectiveness and efficiency of the structural frame/machine metaphor, drawn from the foundational rational systems theory, relating to organizational goals, roles and technology (structures that best fit organizational purposes). The driving force of goal orientation, rationality, order and predictability, and the concept of functions are the important contributions. But, crucial limitations for agricultural research organizations are: a) it doesn't address a proactive leadership, just driven by management and focusing in administration, b) the inward looking of this frame (close systems), particularly in organizations with the external environment and context are unstable, uncertain, unpredictable, rapidly changing and turbulent, requiring decentralization for high levels of adaptability and flexibility to cope, c) tend to limit rather than mobilize the development of human resources, molding human resources to mechanistic requirements instead of building strengths and capabilities, d) pay little attention to organizational culture, e) segmentation and compartimentalization are created by mechanistic divisions, vertically and laterally creating lack of coordination, and f) difficult organizations have to be creative, innovative, risk-taking, adaptive and responsive. As a consequence and reaction of these fundamental restrictions associated with the structural frame, the emphasis will be on the following approaches:

- the organismic metaphor/systems frame to give adaptation, to open systems that understand their environment to achieve appropriate organization-environment relationships, and to improve organizational effectiveness. And, even more, co-evolving the organization and its environment, creating partnerships and collaboration, influencing the environment, as organizational ecology.

- the human resource frame, based on the assumption that people are the most important organizational resource, and looking for a high degrees-of-fit and synergistic link between human and organizational needs, because both require each other. Organizational development can be one proactive strategy for addressing this appropriateness, improving the organization in all dimensions.

- the cybernetic frame/organizational learning, giving the capacity to anticipate external and internal environment changes (generative rather than adaptive), looking for continuous improvement by scanning and exchanging information to constantly adjust (double-loop), the ability for organization learning how to learn (self-governing behavior).

- Also the influence of other frames have to be taken into account, mainly cultural (ethos, history, and regular patterns), symbolic (perceptions), psychoanalytic (emotional and personal dimensions), political (exercise of power and conflicts).

2.3 Collaborative Action Research (CAR)

The definition of CAR for the research protocol in this study was adapted from literature emphasizing key words and concepts (Chapter IV).

2.3.1 Components of Collaborative Action Research

Action-based research presents multiple approaches within one framework. According to Rapoport, Action Research (AR) emphasizes the science-practice link, and its collaborative nature, as researchers and clients, together, engage in a mutually beneficial process, describing the responsibilities and limitations for each of the parties involved.. "AR aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework" (1970:499).

Liu (1992) proposes the combination of the following elements: (a) the convergence of a desire for change and a research intention; (b) the dual nature of the objective to solve a problem and develop fundamental knowledge; (c) an ongoing long-term joint project between researchers and users; and (d) a common ethical framework negotiated and accepted by all.

Benne et al define AR as "an application of scientific methodology in the clarification and solution of practical problems. It is a process of planned personal and social change....It is a process of learning in which attention is given to the quality of collaboration in planning action and evaluating results" (1964:22).

Whyte (1991a) considers AR when some of the people in the organization under study participate actively with the professional researcher throughout the research process from the initial design to the final presentation of results and discussion of their action implications. It is primarily oriented towards helping organizations and community groups to improve their performances and achieve desired change.

All definitions emphasize the researcher's role in extracting relevant information and creating knowledge for the solution of practical problems in a planned effort to bring about the change.

Parts of the process attempted to change a problematic situation include: a) solution to problems (oriented to problem-solving, practical problems), b) creation of additional knowledge (by using the scientific method for the generation of knowledge in behavioral science), and c) learning process (skills are learned in the process of fact-finding, working to change the situation, and evaluating results).

"An AR project is an on-going, cyclical process of problem identification, data gathering, feedback to the client group, discussion of the data, action planning, action taking, and evaluation" (Selener, 1997:63).

A collaborative relationship among the participants, the researcher and the people affected by the change is essential. Both have knowledge and experiences that contribute to solving problems. The relationship must be grounded in a common view and mutual agreements to goals.

AR is designed to achieve simultaneously 3 goals: a) problem-solving, b) adding to the body of scientific knowledge, and c) participant learning.

By the late 1970's two distinct "schools" AR (action research) and PR (participatory research) had emerged. Although similar in most respects, Brown and Tandon (1983) differentiate between the ideological basis of these two approaches, and their orientation to how change is undertaken.

In AR, a product of westernized countries, consensual ideologies are dominant in how problems are defined and in the development strategies selected. All parties are assumed to have a common interest in the research, and collaborative strategies are encouraged with the understanding that greater efficiency and effectiveness will be of benefit to everyone. Thus AR relies on legitimate authority and an acceptance of the existing distribution of resources. PR, on the other hand, comes from the traditions of oppressed people in the Third World countries (mainly Latin America and Asia), assuming that groups have conflicting interest. Cooperation is not expected, and those opposing the parties involved in PR will actively resist suggested change. Some similarities are the reliance on the involvement of parties who will be affected by the research; the commitment to mobilizing people for their collective decisions and actions that will enable them to become more aware of themselves and their own realities; the importance of learning through involvement; the research process itself as an integral part of the organizational development; and the common values and standards that link researchers and clients.

Brown (1993) discusses differences in terms of "Northern" vs. "Southern" forms of PAR. The "Southern" tradition is committed to community transformation through empowering disenfranchised groups; the "Northern" tradition is concerned with reforming organizations (and communities) through problem-solving.

The addition of the word "participatory" seems to enhance the active nature of the process. The PAR label seems to be more commonly accepted as single reference for what had been called AR or P R. Consequently, in the future, PAR may become the dominant label with perhaps, as Brown suggests, "Northern" and" Southern" traditions attached to it (Fear, 1996b).

A major convergence between PAR and AR can be noted as far as the principles are concerned. In both cases the intention is to solve problems and confidence in the ability of users to produce and analyze information. The research objectives are identical, which is to take into consideration without exception the social and institutional dimensions of the project for change as expressed by the users. When applied to agrarian systems, it is necessary to involve different groups of actors, such as farmers, extensionists, policy-makers, industrialists, suppliers (Farrington and Martin, 1988).

A third approach is that of *Action Science* (AS), which deals with organizations through an AR perspective and is particularly linked to scholar-practitioner action (Argyris, 1985).

In the area of international development, another rapidly growing body of work is that of Participatory Rural Appraisal (PRA), essentially a self-help, AR-driven approach, minus the last two steps (implementation of the planned action and interactions of reflection and change) (Chambers, 1993).

2.3.2 Participatory Action Research Modes and Social Learning

AR and PR are modes of inquiry which share many values (common rejection of the irrelevant aspects of traditional conceptions of social science; the intended outcomes of research are to produce developmental change as a consequence of the inquiry, and a view that problem-solving is as important as advancing the knowledge base).

Vandenberg and Fear (1983) view the 2 modes as related but distinct kinds of inquiries, which they refer to as Utilitarian and Radical. The Utilitarian mode (AR) is essentially a pragmatic orientation to problem-solving and pursues a strategy of social reform, in contrast with PR strategy, which attempts to get awareness of oppressive and radical social transformation by confronting these structures.

While AR and PR agree in many aspects of traditional positivism, and share a comparable set of value assumptions, their political economies/ideologies are very distinctive. AR is for the research to work with the system; but PR is against it. Action researchers define the problem in collaboration with the client system, the benefits are provided to the whole system, and the resources and approval is obtained from system leaders. AR practitioners are utilitarian reformers and the PR practitioners are radical reformers (Brown and Tandon, 1983).

The two modes of inquiry can be distinguished as separate types, but both can be conceivable manifestation of the social learning paradigm. The end to which both inquiry modes strive is, generally, social change. Their divergence is based mostly on the different means of achieving the social transformation that each advocates: pragmatic problem-solving reform for AR and radical problem-solving reform for PR. The evolution of AR and PR epistemological modes is toward a holistic synthesis, to be referred to as Participatory Action Research (PAR) (Dickinson, 1988).

2.3.3 Experiences with Action Research

For 50 years since the term AR was coined by Lewin (1946), in his pioneering work in the field of psychology, with the goal of making the social sciences more relevant to practical problem-solving, a fair number of projects have been carried out in different countries involving several disciplines (educational research, sociology and hospitals) and at the present time, diverse proposals are in existence. The term has grown under a multitude of different labels, reflecting concerns over the twin goals of research relevancy and social change (participatory approaches).

Lewin proposed learning about social systems by trying to change them through AR. He indicated the need to consider the principles of action, research, and education, as the corners of a triangle and core elements in any definition of a scholarly-practitioner.

Since the starting point AR was proposed as cycles of analysis, related to planning, implementation and evaluation to simultaneously solve problems and generate new knowledge.

During this same period (World War II), two other European research teams, using different methods, reached the same conclusion concerning AR as a research approach (Liu, 1992).

The Curle team in the UK (Tavistock Clinic) pointed out the role of research in encouraging users to learn about their capacity to transform aspects considered unsatisfactory by the organization (Vallerand, 1994).

AR was developed by social scientists and practitioners, concerned with the generation of scientific knowledge but also with its usefulness in solving practical problems, closing the gap between theory and practice.

From a researcher's perspective, the challenge is to define and meet standards of appropriate rigor without sacrificing relevance, a fundamental dilemma solved by participatory research (Argyris and Schon, 1989).

The AR approach has a long history of use within organizations to help members improve their effectiveness and efficiency in achieving their shared goals, and to outreach and service-providing organizations, in being more responsive to the needs of their client groups. It can be seen as a vehicle for facilitating organizational transformation and its continued use as a learning organization (Senge, 1990).

Farmer participatory research is widely adopted, aiming to achieve outputs, such as to develop improved agricultural technologies in response to farmers´needs; the human resources or the institutional capacity of farmers´groups and collaborating organizations (Farrington and Nelson, 1997).

Examples of participatory research approaches in the Natural Resources Systems Programme, U.K., can be identified in research projects on crop protection, post-harvest, plant sciences and livestock production (Martin and Sherington, 1996).

This approach provides adequate collaboration, democratic decision-making, and effective communication between the participants. Therefore, it is increasingly being used and recognized as valuable for addressing issues that arise in environmental and natural resources management, where multiple, strongly-held and opposing points of view are present (Fear, 1996b).

2.3.4 Characteristics of Action Research in Organizations

A basic feature of AR in organizations is the close relationship between the generation of knowledge and actions taken to improve organizational performance. AR is consistent with a collaborative change effort since it involves participants in both research and change processes (those affected by the problem). AR integrates research and action in an on-going, participatory process.

Selener (1997) summarizes AR in the following set of components and characteristics: (1) focuses on practical problems in order to solve them, and in the process, leads to the development of practical knowledge; (2) follows the scientific method and generates scientific knowledge; (3) generates data which will guide organizational change; (4) is collaborative and participatory; (5) the researcher is a change agent who becomes involved in the organization; (6) it is an on-going, cyclical process in 2 ways; (7) is flexible a process; (8) brings about organizational change; (9) aims at the development of the whole organizational system.

2.3.5 Relation to Accountability in NARS

This approach may contribute to accountability of NARS, through participation in the responsibility of the organization to report for the proper use of resources and activities, and mainly for more and better evidence of the results and impact of agricultural research. Moreover, it improves decision making through the management cycle. Strengthening an agricultural research organizations' accountability to farm and industry groups generally stimulates more effective PM&E with a direct impact on management decision making.

Information generated from this methodology tends to be valid, credible and feasible, supporting organizational transparency and marketing. It is required to satisfy the relevancy to the client system, while at the same time generating data with sufficient scientific rigor to also satisfy the research community (Rapoport, 1970).

To answer stakeholders′ questions in the planning and evaluation process is critical to NARS′ accountability. Therefore, the first step in the utilization-focused evaluation is identifying the primary intended users, including their presence as the personal factor.

In agriculture, a major concern is to reduce the gap between scientific knowledge availability and the application by farmers. In the past, researchers did not feel responsible for the utilization of their findings. Technical quality and methodological rigor were the primary concerns of researchers. However, implementation of a utility-focused approach to evaluation requires situational responsiveness, methodological flexibility, multiple evaluator roles, political sophistication, and substantial doses of creativity (Patton, 1986).

This approach typically involves case study work, and an important consequence is that the process evaluation results have high research utilization rates.

Agricultural research is oriented towards farmers and it is important to emphasize that researchers are not external to the system under study (principle of third party) and that farmers take part in the research.

Participatory research has the characteristic of being client-driven. This means that farmer's criteria, indigenous knowledge, and subjective preferences have weight in decisions about technical innovation. It implies that farmers are actively involved in decision-making about what kinds of innovations are introduced, according to specific needs and their own agronomic and socioeconomic situations.

Addressing client needs means that the technology development process itself must be sufficiently decentralized to meet diverse goals, contrasting with applied agricultural science, which is primarily concerned with discovering general principles that permit technology to function in a wide range of circumstances. In applied research, decentralization requires that the transfer of technology model give way to a highly interactive relationship between technology designers and clients.

Local participation in the research process affects the utilization of research by potential users by insuring that user interest and needs are taken into consideration; increasing commitment to what is being undertaken; contributing to self-reliance, and providing legitimate reasons for conducting the research.

The particular focus of participatory methodologies is the active participation and decision making of farmers and technology users throughout the technology development process.

Arguments in favor of this approach are particularly related to accountability: enabling a better technology fit with the farming system and farmer´s constraints; adjusting technology to particular environmental conditions; allowing more rapid testing, evaluation and adoption of technology; and promoting a channel for farmers to influence research priority setting. Also, technology development and assessment takes place more easily, through building on indigenous technical knowledge and on farmer experimentation and problem solving, emphasizing research with practical application and impact.

These are the reasons why the number of NARS applying participatory approaches involving farmers and technology users in research is increasing (Martin and Sherington, 1996).

2.3.6 The Rationale for this Approach

As mentioned previously, the rationale for this approach is based on integrating research and practice in an mutually influential way, by incorporating the end-users in the knowledge generation process, and not just applying the results. For this reason it can be simply considered as an integrated form of basic and applied research. However, Fear, (1996a) points out that action research is fundamentally different. It is different in philosophy and politics, in procedures, and in desired outcomes. Action research and what is becoming to be known as action science, is a part of an emerging practice-driven discipline that transcends fields (international development, urban planning, social work, nursing, rural development, public administration). It applies to any work that seeks to improve the human condition by linking knowledge with action and, of course, scholarship with practice. This approach integrates the actors engaged in a research-practice episode. Scientists bring knowledge of research methods and subject-matter, and end-users the knowledge of the context and interest in solving the problem, making a research team, framed in a collaborative relationship. The knowledge is co-generated by the parties.

Non-professionals are expected to actively participate and learn research skills in this collaboration with researchers, who are viewed as a medium for change, not as objective observers, in contrast with the conventional in which some are doers, others are contemplators.

In this approach, members of the organization are actively engaged in the quest for information and ideas to guide their future actions, contrasting with the conventional and elitist model of pure and applied research, in which they are treated as passive subjects receiving the results, and researchers serve as professional experts.

In science the greatest conceptual and methodological challenges come from engagement with the world. Research and action are compatible and need to be together.

Any scholarly field has to consider the main stakeholders, its clients and the field itself. Practitioners try to identify the needs and solve the real world problems and researchers try to expand the knowledge base. A tighter link can enhance their effectiveness simultaneously (Fear and Lichty, 1990).

Experience suggests that participatory research as an applied research strategy process can achieve results of current benefit to the organizations and also can lead to rethinking how organizations work and learn and on the impact of the process in the future. The process begins working with the members of the organization diagnosing the problems they are currently facing, instead of the conventional review of the literature (Whyte, 1991a).

This approach is as a reflective process related to double -loop learning which is concerned with the large picture of understanding about problem-solving, and how to carry-out successful interventions (Argyris and Schon, 1989).

A significant distinction of participatory research is that in carrying-out the interventions the traditional notion of research subjects is changing, and the research subjects (client groups), are thought of as knowledgeable and vital contributors, and are brought into the research/change process as co-investigators. By allowing the different stakeholders to participate and assume ownership of the research/change process, the problems of relevancy, and interpretation of the findings are dealt within the course of the intervention through the process of consensual agreement and understanding.

This approach is unique in the attention it gives to the relationship and understanding between the researcher and user of results. Emphasis is placed on the common values and standards that are needed to link the two parties. When they are involved throughout all aspects of the research process (by collaboration), a sense of ownership arises, which creates a certain responsibility for seeing to it that some decision and/or action follows.

People who are actively involved learn to appreciate the value of sound research, and also benefit from the assurance that salient issues will be included in the study. This approach also includes the opportunity for stakeholders to participate in various development roles (beginning with the planning, on going through implementation, and evaluation phases) (Ryan, 1987).

Farmer participation, on a regular basis in the design and evaluation of technical innovations in agriculture research and development is now widely promoted as a vital feature of sustainability.

Farmers participate early on in the design as well as testing and validation of new technologies, not just at the very late point in time when adoption or rejection occurs, but starting in the research process when a particular technological theme is chosen and design features are being determined. NARSs need to facilitate decentralized testing, a menu of potentially useful technologies by putting farmers in contact with researchers in the experimental stations, prescreening the options for localized, adaptive testing. By testing different menus adapted to preference and localities, farmers take the lead in identifying and transmitting local recommendations.

Participatory research encourages integrative and interdisciplinary social science in an ongoing learning process involving continual management and change. Participation improves the quality of the research. It forces a researcher to go through a rigorous process of checking with firsthand knowledge before reports are written (Greenwood et al, 1993).

The farmers must have the right to participate in setting priorities on the research projects through their control over resources allocated, tending to develop an impact-oriented agenda. They also have key roles in evaluating the performance of research programs to ensure accountability. With rights go responsibilities, which implies that farmers share in implementation and undertake some cost sharing, which makes decentralization possible.

Thus, participatory research actively involves farmers in decision-making about agriculture innovation, requiring decentralized technology development, with institutions capable of receiving and acting upon feedback from them. Devolution of major responsibilities to farmers for adaptive testing and for identifying and transmitting local recommendations is an integral feature of this approach.

Decentralization and devolution also require cost sharing, in order to ensure greater accountability and responsiveness to farmer's research agendas (Ashby, 1993).

A related issue is that the effectiveness of the consecutive spirals of action and reflection is facilitated by each participant's ability to identify problems and shortcomings, and to take the risk of error, as a vital tool of self-evaluation, critical_for organizations engaging in the learning process.

This approach can be related to the concept of learning by doing, and as the social sciences evolved, it increasingly recognized the need to accomplish both real world relevance and credibility in the scientific community (Fear and Lichty, 1990). It is the application of the scientific method involving the collaboration and cooperation of scientists, practitioners, and laypersons. The desired outcomes are solutions to the immediate problems and a contribution to scientific knowledge and theory. It results in encouraging reorganization, thus increasing the system's capacity to adapt to change (sustainability). Based on the above mentioned, this approach represents an alternative paradigm for the social sciences (Fear, 1996a).

2.3.7 Assumptions of Action Research in Organizations

According to Selener (1997):

1) AR works within the context of System theory in organizations. These external forces are inputs, which are used rationally to produce outputs (goods or products and services), with certain constraints imposed by the environment. To successfully transform inputs into outputs, organizations depend upon on-going feedback concerning their performance. AR is a tool used to provide that information in order to improve the organizational system. Organizations are systems looking for balance, regularity and equilibrium.
2) AR is based on humanistic values and designed to further the development of human potential. The unique and complex need of individuals is a characteristic of AR, OD, and the HHRR framework. Through the application of AR, the workplace can become positive, exciting, productive, and rewarding environment. AR bases assumptions on humanistic and democratic values.
3) Epistemological Assumptions
    - AR is generally based on a logical positivism position. It is a scientific method of inquiry based on logical positivism. Consequently, it is used to test hypotheses and assumptions about organizational factors and to generate knowledge in an objective way. The research process is rational (logical), empirical (data based),

and objective (controlled). Participants implement a plan of action intended to solve the problem and then evaluate the results to determine whether this has, in fact, occur.

2.3.8 Role of the Researcher in Action Research

The role of researcher in AR is to assist an organization in problem-posing and problem-solving processes. AR process involves collaboration and action, it is more time-consuming than traditional approaches and thus, it requires a long-term commitment to a project. He should participate in both: the research and the search for an implementation of solutions (Argyris, 1985).

Action researchers generate useful knowledge and applies scientific knowledge to action, beyond the limits of academic disciplines to understand practical problems from an organization's perspective (Cummings and Mohrman, 1971).

The action researcher is a person who performs many tasks and assumes multiple roles in the course of the research process: educator, at the beginning introducing members of the organization to the philosophy and methods of research so that they can engage in a more meaningful way, generating research questions, designing relevant methods, and collecting and analyzing data, this role in designing and implementing an AR helps to establish legitimacy within an organization. He works with clients in problem identification, selection of alternative actions, and evaluation of outcomes. This is a collaborative process in which both parties have valuable inputs to share. He contributes with theoretical knowledge and practical experience, while clients offer practical knowledge and experience of the specific problematic situation. He is acting as a partner in the process.

2.3.9 Methodological Guidelines for Conducting Action Research

Planned change based on AR models is a cyclical process in which both members and action researchers collaborate.

Implementation of action is carefully planned, according to results emerging from the research process.

Major phases according to Selener (1997) are: entry, formation and training of the AR team, problem definition, data collection, data analysis, data feedback, problem diagnosis, action planning, action implementation, and evaluation.

The AR process is designed to lead to improvements in the ability of the organization to accomplish its mission, the quality of working life, the development of the capacity to learn on their own about the organization, and the generation of a new knowledge, practical and scientific, applied to bringing about change in the organization. Improvements in these areas will lead to greater organizational effectiveness.

Chapter III

DESCRIPTION OF THE CONTEXT

In this Chapter the context of this research at three levels is described:

3.1 The main features of Uruguay

3.2 The particular characteristics of the agricultural sector

3.3 The specific case study of INIA

3.1 Features of Uruguay

In order to provide a framework for this study, the principal features of Uruguay are briefly presented. An overview of the country can be characterized by relevant geographic, climate, socio-demographic, economic, and political parameters.

3.1.1 Geographic and Climatic Conditions

Uruguay has an area of 176,215 square kilometers (68,037 square miles), being one of the smallest of the South American countries. It is located in the subtropical zone in the Western Hemisphere, between 30 and 35 degrees latitude South and 53 and 58 longitude. It is surrounded by Argentina, Brazil and the Atlantic Ocean. It is divided into 19 States.

The country is characterized by rolling hills, with an average altitude of 117 meters (384 feet) and a highest point of 514 meters (1686 feet) above sea level.

Agricultural land is the principal resource. There are not enough mineral resources to be economically extracted.

The country can be classified as Humid Subtropical and its predominant vegetation is natural grassland plains, range conditions based on summer perennial grasses (suitable for crops and livestock production); and herbaceous (natural forest cover just 3%). The hydrography is reasonable and provides water for animal requirements most of the year. The entire territory is habitable.

The climate is defined as humid mesothermic, a truly temperate climate with high sunshine, varying daylight from 10 hours in winter to 14 hours in summer. The temperature varies between 11° C in winter and 27° in summer, reaching minimum of -4°C and maximum of 40°C. There is a probability of an average of 30 frost days during winter, and few strong windy days. The average annual precipitation is 1000 mm in the South and 1300 mm in the North, with irregular climatic conditions, including rainfall, and unexpected occasional drought periods. These effects have been remarkable due to the global climatic condition changes, particularly by the "El Niño" effect.

3.1.2 Socio-demographic Data

While it is a country with a small economy, Uruguay has achieved some high social and economic indicators.

According to the last survey (INE, 1996) the total population is 3,163,763 (17.8 inhabitants per sq./km), with a population growth of only 0.6% per year, the lowest in Latin America (92% concentrated in cities). It is an urbanized country. The average age is 30.9 years. Because of immigration, most of the population is of Spanish and Italian descendent. Health coverage is broad (89.8%), and mainly private (55.6%).

Education has been substantially improved in the last ten years, with 49.0% completing Elementary School, 34.5% High School, and 12.6 % University level. But, for the Economically Active Population, indexes are 11.8%, 24.9%, and 63.3% respectively.

High rates of literacy (96.9%), life expectancy at birth (72.4 years), Gross National Product (GNP) per capita U$S 6,268 and low infant mortality rate (17.5/1000 live births), explain the Human Development Index (HDI) of 0.883, ranking 37 at the world level, one of the best in Latin America, according to the United Nations Development Program. In the gender-related development index, Uruguay is 31 in the ranking (UNDP, 1997).

Other social indicators are home comfort, such as ownership of refrigerators (89.0%), access to potable water (86.1%), and electric energy supply (98.5 % urban and 59.2 % rural). The consumption of food per capita is very high (i.e. 67 kg. of meat and 220 lt. of milk per capita, per year). In communications, Uruguay is leading in Latin America: telephone net digitalization (97%), basic telephone per inhabitant (26%), and increasing cellular phones per inhabitant (3.2%) (OPP, 1998).

3.1.3 Economic Data

Uruguay´s economy fundamentally depends on the agricultural sector, contributing substantially to export through commodities and agro-industrial products. In the international market, the prices of these products are decreasing, and as Uruguay is a "price-taker", it is being strongly affected. After satisfying the internal needs of the population by the 1930s, the increases of production were destined for export. The domestic industry was supported by government to add value to commodities, to reduce dependence on external trade, and to increase the employment rate. There were increases in the inflation rate and external debts.

Even though the economy depends mainly on agriculture and livestock farming, only 8% of the people live in rural areas. In the last 15 years, investment away from the traditional agricultural sector was encouraged and the economy started to grow again. The tourism sector now represents an increasing proportion of the income.

The increase of agricultural sector productivity is oriented to the international market because the internal population's food needs are satisfied. A main priority at the national level is to increase production and exports as a long-term objective to support economic growth accompanied by reduction of inflation and improvement of the country's competitiveness. The global external exchange trade, in the context of an open economy, has increased four times since 1995. The Gross National Product (GNP) has increased by 62%, since 1983. Uruguay had 3.29% economic growth from 1935 to 1954, a long stagnant period of 1.05% for 30 years, from 1955 to 1984, and after that a consolidation in the economic activity growth of 3.75% (1985/97). This was a period of sustained growth, with an annual average of 3.6%, and increased the GNP per capita four times in the last twelve years (BCU, 1992).

The Agricultural Sector participation (AGNP) in the GNP is 12.2%. However, participation in agro-industrial export is relevant at more than 70% (OPYPA, 1998).

The External Debt has significantly decreased as a percentage of the GNP, from 44.7% in 1985 to 14.6% in 1997. In relation to prices and exchange, a gradual process reduced inflation, from 73.2 in 1985 to 15.1 in 1997, with consumer prices at 15.2. In September of 1998, the inflation rate reduced to less than 10%. The unemployment rate has fluctuated, varying around 11.6 in 1997. The general trend to economic stability can explain increasing investment, promoting and encouraging technological change and innovation in the systems of production. (OPP, 1998).

3.1.4 Political Context

Uruguay has a long traditional history of democracy, which promotes people's participation in decision-making. This institutional interest for such participation is found as early as in the first Constitution in 1825, and ratified presently in the current Constitution, approved by vote in 1996. The country has, consequently, a democratic culture.

The Republic Democratic System of Government is based in three representative power bodies: Legislative, implemented by a General Assembly composed of the Chamber of Representatives and Senators; Executive, with the President of the Republic, a Vice-President, and the Cabinet of Ministers; and the Judicial, implemented by the Supreme Court and the Tribunals and District Courts.

Political parties have been present since the settlement of the Republic. Elections are each five years, and in addition, there are referenda for specific issues. Even more, in the Constitution of 1952, which lasted until 1966, the Executive Power was exercised by a National Council of Government (Consejo Nacional de Gobierno) formed by nine members elected directly by the people (six representing the majority party and three, for the following one). The same system was used in the 19 different States, showing its highest people participation during that period.

After an interruption from 1973 to 1984, political parties formed a consensus to reform the role of the public sector. This context particularly increased participation of farmers in agricultural issues, with INIA as an example.

3.1.5 Regional Integration (MERCOSUR)

The MERCOSUR Treaty for the integration of the Common Market of the Southern Cone, involving Argentina, Brazil, Paraguay, and Uruguay, was signed in March 1991. Implementation of this regional integration process started in January 1995. The purpose was to develop the economies, expand and harmonize the markets, and become more efficient and competitive.

MERCOSUR is a tool of open regionalism, reducing collective barriers to external trade and expanding the group to other countries.

It includes 12 million square kilometers (70% of South America), a population higher than 200 million, and GDP (Gross Domestic Product) that is fourth in the world (78% of the GDP of South America), with U$S 4,900 per inhabitant.

Uruguay is in a geographically strategic position, complemented by structural reforms and policies of openness in the last 20 years, transforming comparative advantages to competitive advantages. Uruguay appears to be the natural door of the MERCOSUR, since 85% of the GDP of the MERCOSUR is around Uruguay (MRREE, 1997).

In the 70s Uruguay started a process of deep economic liberalization, with a substantial reduction in trade barriers.

As a consequence of this integration, trade of Uruguay in the region is more dynamic, particularly with Argentina and Brazil. It was changed from 26.8% in 1985 to 44.8% in

1997. Consequently, the recent crisis in Brazil in January of 1999 had an immediate and major effect on Uruguay and the rest of the MERCOSUR countries.

3.1.6 Quality Culture Context

Currently, the country's society is increasing a general consensus on the importance of quality (in products, processes, and management) to develop specialized niches in international markets.

Uruguay has a National Quality Committee, promoting the efforts in private and public sectors. This Committee includes the Ministers of Agriculture, Economy, Industry and Tourism, Technological Laboratory of Uruguay (LATU), Uruguayan Industrial Chamber, and INIA. It is responsible for the National Quality Award, based on the Malcolm Baldrige Award, USA (CNC, 1999). An essential objective of the National Quality Program is to promote tools and mechanisms tending to consolidate quality, supporting the country's competitiveness at the international level. The progressive development of quality is part of the process of social transformation, as a guarantee of higher excellence in social organization, generating a highly qualified productive context.

It was established an Uruguayan System of Accreditation, Normalization, Certification, Calibration and Testing (SUANCE) in 1997, after a good experience in this area of Certification (ISO 9000 and ISO 14000 norms). INIA is actively participating in this System, and is even supporting its implementation financially.

This national political decision was based on the requirements of international trade, which will be guided by Quality Norms, in the short term. These refer to the total characteristics of products, services and processes, related to their capacity to satisfy explicit or implicit needs of all interested sectors (clients, users, employees, owners, suppliers and the society). This is a consequence of a broader diversification and knowledge of reliable products. The International Standard Organization (ISO) is the forum in which the international norms and guides are developed, including quality (ISO 9000) and environment (ISO 14000) management. The norm is the base for the dialog between clients and suppliers, and is a central tool for penetrating markets. Even though adoption is voluntary, it has an increasingly strategic importance in facilitating international trade, moving from a competitive advantage to a requirement, particularly regarding health, safety and environment. The State has a regulator role in the organization and in enabling institutions to expedite certification of quality inducing organizations to set clear quality specifications required for products and services.

3.2 Agricultural Sector

As pointed out in 3.1.3, the Uruguayan economy is based on agricultural production, which plays a strategic role in the national economy. The Agricultural Sector (AGNP) contribution to NGP has been about 12% in recent years, and only 12% of the working population were employed in agricultural exports, still accounted for over 70% of total exports, at different levels of processing through the agro-industrial chains (OPYPA, 1998). The sector provides almost all the food consumed by the population. Only 5% of food comes from imports. The industrial sector utilizes agricultural products as 60% of its raw material. Uruguay has traditionally been an exporter of agricultural products.

3.2.1 Main Agricultural Production Systems

In 1996, 9.8% of GNP (U$S 18,895,000,000) was related to the agricultural sector distributed as follows:

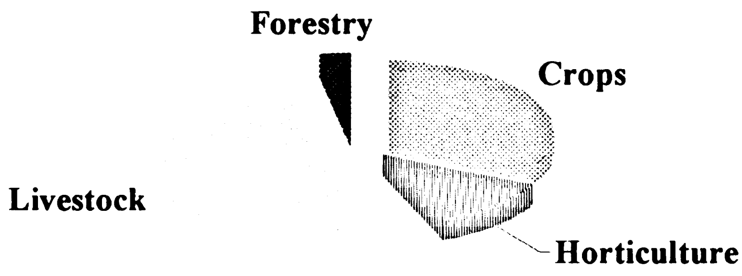


Figure 3.1 Distribution of the AGNP by the main areas of production in Uruguay. (OPYPA, 1998).

Approximately 65% of the AGNP come from animals (wool, meats and milk), and the remainder 35% from crops. Around 90% of the wool, 60% of meat, 30% of milk, 90% of rice, 80% of barley and citrus are exported. Most of the other crops produced are used internally. Some sub-sectors have shown significant productivity growth due to technical change (dairy, rice under irrigation, citrus, protected horticulture, and even livestock production under grazing conditions). The forestry area has a significant impact, increasing from 40,000 hectares in 1990 to 200,000 in 1998.

The number of farmers now (55,000) has declined 20% during the last decade, principally by loss of small-scale farms. Most of the land is privately owned, but leasing and partnerships also occur.

The use of agricultural land is as follow: livestock (87%), crops (8%), forestry (4%), and unproductive (1%). More than 80% of the total land is still under natural pasture.

Table 3.1 Types of farms, workers and hectares of the main agricultural production systems in Uruguay.

Production Systems	*Farms*	*Farm Workers*	*Total Hectares*	*Cultivated Hectares*
1. Extensive beef cattle and sheep systems	28,800	51,800	11,700,000	16,000
2. Extensive agriculture	5,400	12,300	1,800,000	334,000
3. Dairy	8,200	25,000	1,250,000	128,000
4. Irrigated rice	357	3,200	550,000	67,000
5. Citrus	280	2,000	58,000	18,000
6. Fruits	2,900	7,800	86,000	19,000
7. Horticulture	6,700	13,800	147,000	18,000
8. Others	2,363	24,600	409,000	28,000
Total	55,000	140,500	16,000,000	610,000

Source: DIEA 1994

Considering production specialization and scale, 126 different systems were identified and grouped into 11 major categories, as it is shown in Table 3.1 (DIEA, 1994). Mixed beef cattle and sheep grazing is the main activity (52% of farmers and 74% of the land).

3.2.2 The Role of Technology in Improving Competitiveness

There is a general agreement that technological changes are essential to increase productivity (yield/ha.), as well as quality in management, processes and products, to improve competitiveness in international markets (Ferreira, 1998).

The development of an effective system of agricultural research, with the capability to adapt and to generate technological packages suited to the different regions of the country, is an essential need.

The sector is oriented towards agricultural intensification and diversification. It is also concerned with commodity transformations, adding value through increasingly industrial participation, mainly for export.

As mentioned in 3.1.5, during the last decade, liberalization policies led to a more open economy and to a regional integration process, and to emergence of a new mega-market, the Southern Cone Country Common Market by December 1995 (MERCOSUR). In this context, competitiveness for agriculture is increasingly required, and the role of technological change is crucial in national economic growth.

The new economic policies related to the expansion of world trade liberalization, open markets for international exchange, and the consolidation of regional integration within MERCOSUR, imply a process of significant adjustments in the agricultural sector, promoting technological changes at the farm level.

The expanding interest mainly in the developed countries, of final consumers in "natural products", with minimum agro-chemicals, hormones and other inputs, represents an opportunity for Uruguay to produce high quality outputs. An example is meat production from grasslands, relatively efficient low input, with a rational utilization of the natural resources.

The State is clearly deregulating and lowering interventionism, setting a framework of more stable and predictable policies. As a consequence, the country stopped a long stagnant period (from 1961 to 1984 agriculture grew at 0.1% and the economy at 1.1%), and has shown a significant recovery during the period from 1985 to 1997 (the annual accumulated growth rate was of 4.0% for agriculture and 3.6% for the economy). Even more, agriculture had a 5.6% annual growth rate for the last five years (1992/96), helping to move the economy (4.1%).

Most of the sub-sectors show significant growth. However, the disappearance of relatively small farmers and the decreasing income of traditional systems of production, in the context of increasing competitiveness in the external and internal markets due to the process of open trade, introduced the issue of sustainability and equity of growth. New probable scenarios, under increasing globalization, require rapid incorporation of technological change to improve competitiveness of the products.

The traditional agricultural export commodities (meat and wool) were augmented with milk products, citrus, rice and barley. This development was explained by technological innovation. Milk (75%), wheat (30%) and rice (20%) increased in productivity (kg/ha); and even meat (20%), by increasing the area of improved pastures and supplementation. However, there still are gaps between the national average yields and the technological knowledge available.

Reconversion processes are going on, due to the reallocation of resources in response to the opened economy and regional integration. Quality is becoming a main concern in order to compete in sophisticated international markets. An example is represented by the wines, which were exposed to an uncertain future. Through a technological innovation of the genetic material and management of grapes, and a modernization of the industrial sector, wines are increasingly being exported to foreign markets (European and USA). The area under forestry production has been expanded during this decade, based on a Law promoting through incentives the plantations of eucalyptus and pines.

The technological paradigm moved from just productivity to sustainability of agriculture, with concern for quantity, but also quality and environmental impact. Technological restrictions are related to the need for increases of productivity, reduction of costs of production, differentiation of products and quality improvement, market access and better prices, as well as taking into account natural resources preservation. Leading farmers are using most of the available technology. Plant breeding programs are addressing the increasing quality levels required by the agro-industrial chain for export, and the resistance to diseases. Minimum mechanical tillage, mixed cropping/fattening systems, rotational schemes complementing crops and improved pastures (legumes and grasses), are being developed. Integrated pest management (IPM) and integrated nutrient management (INM) are also being developed to improve sustainability of production. New sustainable technology is being tested to prevent soil erosion and degradation, recycle nutrients, grain, water and soil contamination due mainly to agrochemicals and waste management.

New technological development requirements related to the era of open markets are also being examined. In the past, competitive advantages of countries were determined by natural resources and production factors, but presently, and in the future, technological innovation is becoming increasingly important. The development of a country will depend on the application of adapted knowledge generated by national research and experience at the farm level, to produce new materials, products, processes, systems or services, or to improve the existent ones substantially.

For technological progress, continuing feedback among generation, adaptation, validation, transfer and adoption of innovation, reducing the time cycle, overlapping some phases of the process, will be required. Adaptation of accumulated technical and organizational knowledge, as well as a learning capacity to keep a continuing and intensive flow of new knowledge is required. Diffusion becomes a continual innovation process within farms. Innovations result in an interactive process in which scientific, technological, sociological and empirical knowledge are involved.

Improvement of sectorial competitiveness is also important. Competitiveness is created through a continuing innovation process, with a solid scientific-technological base, highly qualified human resources, and permanent continuous improvement of quality, with fast and efficient activities. Competitiveness depends on the institutional capacity to supply a continuing scientific and technological base to make new technology available to farmers, so they can utilize resources more rationally. (Porter, 1998).

Besides competitiveness, research has to address other objectives, setting priorities on activities which consider environmental impact, sustainability of production, conserving natural resources, and developing suitable technologies for subsistence farming, to contribute to social equity.

3.2.3 The National System of Generation and Transfer of Agricultural Technology (NSGTAT)

The structure of NSGTAT includes a conglomeration of agents, institutions and norms of behavior of the society. Looking for the best performance of the system, efforts focused on sharing clear and comprehensive objectives, coordinating the links in the agro-industrial chain, and maximizing the potential scientific capacity and available factors of production.

There are two sub-systems: a) technology generation, and b) technology transfer.

a) The sub-system for generation of technology is fundamentally provided by INIA, representing approximately 90% of the national investment in agricultural research.

There are also two public institutions: (a) the University of the Republic, with a Faculty of Agronomy and Faculty of Veterinary Medicine (financed by public resources, dedicated to education and research); and (b) the Ministry of Agriculture, Livestock and Fisheries mainly through a Veterinary Laboratory Research Center (public funds). A non-profit private organization, SUL (Uruguayan Wool Secretariat), directed by farmers, is related to sheep research.

b) In the sub-system of extension and technology transfer, a transformation in the recent years is moving from the public sector to increasing utilization of private agents. The present sub-system is multi-institutional, formed by: a public non- governmental organization (Instituto Plan Agropecuario); a non-profit private organization (SUL); programs managed by the public sector with components of private technical assistance (PRONADEGA, PRONAPPA), programs conducted by the public sector with high participation of private sector (PROVA, PRENADER); agro-industrial organizations of input suppliers (CONAPROLE, cooperatives related to agriculture and livestock production, agro-industrial firms in milk, barley, rice, citrus); organizations supporting the development of the agricultural sector constituted by farmers (Federación Uruguaya de Centros Regionales de Experimentación Agropecuaria (FUCREA); Rural Societies; institutions of the public sector participating in technology transfer activities (Instituto Nacional de Colonización, State Governments); and professionals (agronomists and veterinarians) providing independent technical assistance to farmers.

The present government strategy is to transfer the financial responsibility of the extension activities to the private sector, except for small farmers, particularly related to horticulture and fruit production. The progressive tendency is clear, and some of these organizations are already functioning with a Board of Directors including representatives of the principal farmer associations.

Technical assistance to individual farmers, including farm management, is mainly through individual advisors. However, group technical assistance is increasing. The experience with this participative methodology is very positive, using adult learning, supporting farmers to help them to analyze problems and making decisions to solve them, exchanging ideas among peers in the groups and the technical advisor (agronomist). This methodology is a holistic approach, viewing the farm as a whole, encouraging a continuous education for the farmer to develop as a rural entrepeuner.

The increasing demands from globalization and more competitive markets, require creativity to develop new strategies for modernization of the NSGTAT, more innovation capabilities, better articulation to optimize organizational efforts, and to induce additional complementary resources from the private sector.

International cooperation has been supporting the system of generation and transfer of technology (MGAP, 1997).

3.2.4 Experimental Units for Validation and Demonstration

INIA has developed an agreement for 20 years with a rural association, the Sociedad Rural Río Negro, in an intensive cropping and livestock production region. The work has produced positive results in terms of validation of promising technologies at commercial level in systems of production, facilitating their transfer, and resulting in effective feedback to reorientation of analytical plot research.

This pilot experience was expanded in the last couple of years, with the signing of three agreements with Rural Associations of Tacuarembó, Durazno and Florida, to support regional development in extensive livestock production, co-working with farmers.

3.2.5 Agro-industrial Chain Approach

In order to compete successfully, quality, natural processes and opportunity to supply products in the market, are new attributes required besides productivity. The production of differentiated products requires better technologies of processing and packaging, commercialization modes, promotion, brands, origins, tracebility (vertical integration).

A strong and comprehensive articulation within the production-consumption chain is needed, integrating research and production of raw material and the industrial sector, and sensitive to market tendencies.

Infrastructure related to the agro-industrial sector is concentrated in INIA, LATU, University, SUL (wool), INAC (meat), INAVI (wines), and some private companies (dairy and other crops).

INIA is improving its relationship to the external environment: with other institutions also generating knowledge to solve relevant problems to which the system has to give responses, and with multiple institutions, working in the agricultural and agro-industrial sector which INIA has to consolidate an effective SNGTTA, to reach the potential of impact of the activities results.

This system has drawn on available international knowledge, incorporating and adapting it to the specific environment in Uruguay, as well as encouraging the generation of new processes and products at the national level. To accomplish these goals, higher formal education in human resources and incentives to innovate are promoted.

INIA's strength as a research institute will contribute to high quality technology, in response to real demands in the agro-industrial chain. This will help overcome technological disadvantage, and also enable participation with the most advanced countries in the globalized technological revolution in order to compete for accessing dynamic international markets.

3.2.6 Round Tables

In order to prioritize the demands for research from the continuous agro-industrial chain, round-tables (Mesas) were created in the last 5 years. They are like self-directed work groups, to identify relevant vertically integrated problems. They are composed of specialists from INIA, LATU, Faculty of Agronomy, and specific organizations related to the continuum, including the industrial sector at different levels and final consumers.

In Uruguay, at this time, there are round tables related to barley for beer (malt factories), wheat (mills, bread and cookies shops, pasta), rice (mills), forestry (paper factory, wood processing).

3.3 The National Agricultural Research Institute - Instituto Nacional de Investigación Agropecuaria (INIA)

The National Agricultural Research Institute is the result of a reorganization of an old organization.

3.3.1 Institutional Background

The Uruguayan Agricultural Research System was established in 1914, at La Estanzuela, Colonia, as the Plant Breeding and National Nursery Experiment Station. It was a pioneer agricultural research organization in South America. This was as a consequence of a political decision reflected in a national Law in 1911, creating a network of Experiment Stations through the country (Boerger, 1928).

The first Director, Dr. A. Boerger, a German plant breeder, working with a few other specialists, made a great impact on the agricultural sector. He imposed leadership based on a strong discipline, which still has some residual effect on the people working at the organization.

In 1961 the Institute was reorganized as Agricultural Research Center "Alberto Boerger" (CIAAB), strengthened by external technical and financial support from governments and international cooperation, principally IICA, FAO, and USAID. The number of researchers increased substantially, and post-graduate studies were substantially encouraged in order to develop a strong human resources and research capacity.

The responsibilities of the Institute expanded in the number of commodities (crops, pastures, dairy, beef cattle, sheep) and disciplines (plant breeding and protection, soils, agro-climetology, animal breeding and nutrition, statistics, economics), during the 1960s (Allegri and Grierson, 1982; MGAP, 1967).

Even though there was major improvement in this reorganization, enhancing a period of strong growth in agricultural research capacity, the Center remained as an executive Unit belonging to the Ministry of Agriculture. There was no formal participation by farmers, and there were restrictions in human and financial management and fluctuation of annual budget.

The result of this process was that the effectiveness of research programs and the ability of the Institute to respond to farmer's needs were limited.

Subsequently, there was a general consensus that a major re-structuring was required.

3.3.2 The National Law of INIA's Creation of 1989

In 1987, the Government sent a Proposal to the Congress, considering ideas drafted by some researchers, farmer organizations, professional associations, and also the scientific community

The Project was approved by unanimous decision of the Congress, and became national Law No. 16.065 on October 6, 1989, creating I.N.I.A. (Instituto Nacional de Investigación Agropecuaria) as a new organization (Delpiazzo, 1993:21).

This autonomous new legal entity and institutional framework (INIA) sought to remove the most important constraints identified in the diagnostics reviewed regarding agricultural research at that time. These limitations were in the objectives (weak articulation of research and national development programs, and lack of formal participation of clients), financial resources (scarce, and variable in amount and timing), human resources (high turn-over of qualified researchers, and poor management policies), operational efficiency (discontinuity), administrative norms (rigidity in procedures) and specific areas and services (planning and evaluation, technology transfer, library) (Delpiazzo, 1993; Diaz, 1985; Rabuffetti, 1989; Stagno and Allegri, 1985).

The scope of action was as an agricultural research organization linked to the existing network of public and private organizations of extension and technical assistance.

3.3.3 Implementation of INIA

The renewal process was supported in the planning and implementation by specific studies. Five documents were developed by researchers of CIAAB and specialists of ISNAR in fundamental areas: organizational structure, human resources, financial resources, research plans, and procedures (ISNAR, 1990 a, 1990 b, 1990 c, 1990 d, and 1990 e).

At the same time, INIA had the support of a loan granted by the Inter American Development Bank (IDB) to strengthen the institutional agriculture technological generation and transfer in Uruguay. This project INIA/IDB included physical infrastructure, field and laboratories equipment, post –graduate and short term training (INIA, 1997a) (Figure 3.2).

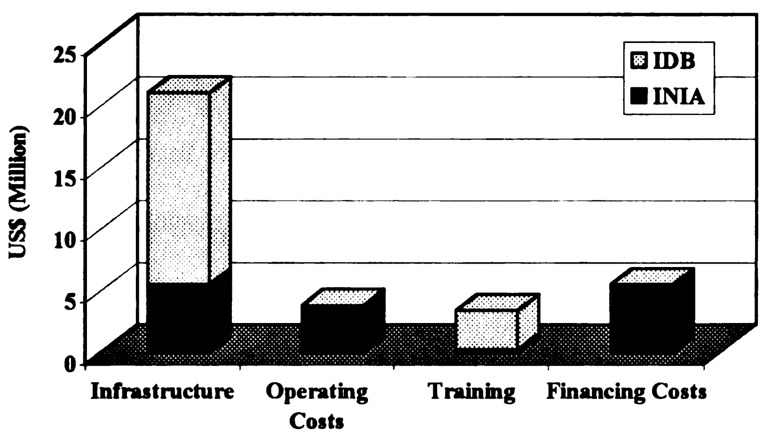


Figure 3.2 IDB/INIA project resource allocation (1989-96).
Source: INIA, Unidad de Administración y Finanzas (1997)

INIA began in May 1990, and the Board immediately transferred the human, physical and financial resources from the CIAAB to the new organization, after a careful selection process. In relation to personnel, INIA invited selected people who had the option to accept. (65% were transferred).

3.3.4 Structural Type of INIA

INIA is a decentralized institution. It is a public non-governmental agricultural research organization; a non-profit organization with many innovative features. It is characterized by a flexible administration of human, physical and financial resources; delegation of authority and distribution of power, for organizing, planning, budgeting, and implementing research activities, deciding on its own management procedures, signing contracts and agreements with private and public national and international entities. This is because it is a public enterprise, with co-funding by government, which is authorized to act under private administrative regulations or as a private organization.

It is linked through its Board of Directors to the Ministry of Agriculture, Livestock, and Fisheries.

The Law of INIA of 1989, also created an apex body, the Coordinating Council for Agricultural Technology (Consejo Coordinador de Tecnología Agropecuaria). It is composed of the Minister of Livestock, Agriculture and Fisheries (President), Minister of Industries and Energy, Minister of Education and Culture, Dean of Faculty of Agronomy, Dean of Faculty of Veterinary Medicine, and a representative of the Scientific Community (Agrupación Universitaria). It was established to coordinate the efforts in research and technology transfer, advise on research plans and programs and cooperate in the diffusion of results, articulating INIA to the system.

INIA is the main organization in the agricultural research system. It is assigned to generate improved production technology to provide support for the national programs of agricultural development. The University and some public and private organizations are also contributing in this matter. There are agreements with them and linkages in different ways. A principal strategic role in this partnership is played by a competitive grant, the Agriculture Technology Development Funds (Fondo de Promoción de Tecnología Agropecuaria, FPTA).

The objectives of the new organization are: a) to promote and to implement agriculture research activities in order to contribute to sustainable development of the agricultural sector, b) to advise the Government in relation to technological policy, c) to encourage the development of a NARS and to maximize the available international scientific and technological knowledge, d) to formulate and implement agricultural research projects and to adapt suitable technologies to the country's needs and the socio-economic conditions of agricultural production, e) to participate in the development of national scientific and technological knowledge in the agricultural area through its own activity or in efficient coordination with other agriculture research and technology transfer programs to be carried out at public and private level, and f) to articulate an effective transfer of technology, generated through technical assistance and extension organizations belonging to the public or private system. The control and inspection responsibilities of agricultural production are explicitly excluded from INIA's objectives.

3.3.5 Statutory Authority

The Statutory Authority of I.N.I.A. relies on these units:

- *Board of Directors* (Junta Directiva), - INIA's top authority
- *National Director* (including specialized Units),
- *Regional Directors* (Experiment Stations),
- *Regional Advisory Councils*, and
- *Working Groups*.

- *The Board of Directors*

The Board of Directors, is the highest authority of INIA, and its members are designated by the Government. Recognized background in agricultural technology is required for them. It is composed of four members:

- two government representatives proposed by the Ministry of Agriculture, Livestock and Fisheries, designated by the President of the country (Uruguay); one of whom serves as the President of INIA and the Board.
- two representatives appointed by farmers organizations, one proposed by Rural Association (Asociación Rural) and Rural Federation (Federación Rural) and the other proposed by Agriculture Federated Cooperatives (Cooperativas Agrarias Federadas), National Commission of Rural Promotion (Comisión Nacional de Fomento Rural), and Uruguayan Federation of Regional Centers of Agriculture Experimentation (Federación Uruguaya de Centros Regionales de Experimentación Agrícola).

These five farmer organizations cover practically all national agriculture, representing different types of farmers in terms of size, land tenure, commodities, and regions of the country. Members are elected for three years, and may be renewed just once. This separates then from the Government officers, who are elected each five years. The process of selecting Board members is one of extensive dialogue and consultation, where the relevant organizations and persons are consulted until consensus is achieved.

The Board guides the overall Institute, and the fundamental functions are related to the definition of policies and strategies. It works through weekly meetings, but the members are also involved in multiple internal and external activities.

- *National Director*

The National Director is in charge of implementing and executing the Board of Directors' decisions. It is also responsible for the preparation of proposals regarding internal resources management and external relationships.

The National Direction includes Specialized Units on Planning, Monitoring and Evaluation, Human Resources, Administration and Finances, and International Cooperation.

The National Coordinating Committee, created by INIA's Board of Directors, is a functional mechanism to improve internal coordination. It shares perspectives crossing the organizational structure, and is composed of the National and Regional Directors, Supervisor of Areas, Head of Programs, assisting the Head of Specialized Units of National Direction.

- *Regional Directors*

The Regional Directors have administrative responsibilities at the regional level. They are responsible for implementation of the projects approved by the Board, submitted through the National Director and based on proposals of Heads of Programs and Supervisors of Area. At the level of each Experiment Station there are Regional Coordinating Committees.

- *The Regional Advisory Councils (RAC)*

The Regional Advisory Councils were created in the Law to include stakeholders' opinions in the agricultural research activities at the regional level.

They were set by the Board in 1990, with the objectives of knowing the demands from the productive sector in the area of influence of each Experiment Station.

In each Regional Advisory Council, Working Groups related to commodities or systems of production analyze the principal technological limitations in depth.

The Regional Advisory Councils have the following duties: a) to support and advise the Regional Director in each Experiment Station, b) to propose bases for establishment of plans, programs and regional projects, c) to promote local actions related to technology generation and transfer, d) to look for additional resources to accomplish the regional research activities, and e) to do any other function recommended by the National Board

There are five Regional Advisory Councils, each with up to 15 members, who are local representatives of agricultural organizations in the region.

They work as "antennas" prospecting technological demands and at the same time, they inform others, assuring resonance of INIA's decisions and activities to sector needs, facilitating communication flow in both directions.

Regional Advisory Councils at each Experiment Station provide an important forum for regular exchange of views and close contacts between farmers and INIA staff. They are the places where actual exchanges and participation occur.

- *The Working Groups (WG)*

INIA Board created these WGs for each National Program in order to strengthen the role of farmers in guiding research.

In these WGs the INIA staff and farmer representatives discuss research plans and results for specific commodities and systems of production. They represent a very useful mechanism to formally incorporate inputs for research planning, monitoring and evaluation, and they have been generally successful.

There are 25 Working Groups, functioning at the level of the related Experiment Station, composed of about 10 permanent members, recognized farmers and professionals in the commodities and regions. But meetings are open to all farmers interested in attending.

The different WGs are attended by representatives of various target groups (farmers, extensionists, industrial sector, policymakers).

Each Working Group is represented in the Regional Advisory Council, facilitating the communication among them. Meeting minutes are recorded from each session of the Working Group, as well as, the Regional Advisory Council.

3.3.6 Physical Resources of Experiment Stations

INIA operations are based in five Experiment Stations located in different agro-ecological and socio-economic regions of the country. A total of over 5,000 hectares is devoted to experimental purposes.

The Experiment Stations are specialized according to the most economically important commodities produced in the respective region. Each is in at different stage of development, depending on when they were created, but these differences were minimized by the execution of INIA/IDB Project.

Each Experiment Station has a Regional Director, Regional Coordinating Committee, Regional Advisory Council, and Working Groups, demonstrating the functional and operative decentralization. The distance between the Experiment Stations ranges from 150 to 300 km. A research network covers the country, in order to include specific differences at regional level, including Experimental and Demonstration Units, with commercial farm sizes, and Experiment Areas, to carry out plot research. INIA's Board may establish, expand or modify them.

3.3.7 Financial Resources

In the new INIA, the farmers are involved in the institutional management and contributing to the budget with central funds.

INIA has 5 potential sources of funding: a) a 0.4% assessment on farmer sales, b) an amount at least equal to the assessment provided by the Government, c) self-generated funds (including royalties and joint ventures with private enterprises) d) voluntary contributions by farmers and other organizations, and e) grants and development loans.

INIA's budget is established by the Law, and farmers contribute significantly to it, matched by equal government funds. Farmers pay a levy of 0.4% of the value of most agricultural outputs at the first point of sale, which is earmarked for INIA. The government must allocate at least the same amount to this fund. The budget is complemented by income from sale of products and specialized services. The organization can generate resources for its own use.

INIA's core funds are considered to be the total collected from the assessment on farmers, plus the matching funds provided by the Government. Most of sales products in

Uruguay have a value-added-tax. In the case of the agricultural sector, all the products from farms have a direct-sales-tax (IMEBA), which includes an additional 0.4% for the use of INIA. The Public Treasury (Dirección General Impositiva) collects this tax for transfer to INIA. The amount collected is then matched by the Government providing its matching funds for INIA.

INIA's budget from these sources is determined once a year, and the budget allocation is made by quarters. INIA does not have to spend all of its allocation in one financial year, but it may carry over any surpluses into other years.

By this diversified way, INIA has been able to increase its financial sustainability significantly, and foster a demand-driven research system whereby farmers participate in priority setting and impact monitoring.

The structure of INIA's incomes is shown in Figure 3.3 (INIA, 1998a).

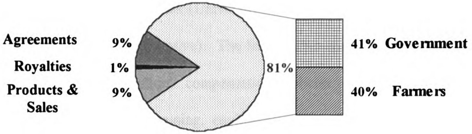


Figure 3.3 Sources of the income structure (%) of INIA, year 1998.
Source: INIA, Unidad de Administración y Finanzas (1998)

In the budget, the contribution of the farmers is significant, contributing a similar amount with government, and representing 40% of the total. It is increasing the income from sales of products and specialized services, and the royalties from new cultivars released, under protection of INIA.

INIA has a balance between income and expenditures. The distribution of the budget is carefully monitored to prevent excesses.

In relation to resources allocation, the distribution of the expenditures looks reasonable. The proportion assigned on human resources is controlled, in such a way that the availability of operating costs can satisfy the execution of activities.

3.3.8 Human Resources

INIA operates independently of the civil service regulations for human resources management, researchers and staff support.

Personnel management is regulated by a Statute, approved in 1990 by the Board, after discussing the main ideas with the personnel in the organization. It identifies three personnel groups: professionals (University level), specialized (technicians), and support staff (technical and administrative). The Statute also specifies recruitment, selection, and placement; work dedication; compensation policies; performance appraisal system; promotions and transfers; training; environmental conditions of workplace; travels; and disciplinary norms.

INIA personnel currently includes 137 researchers among 524 in the total staff. The ratio of researchers to support staff is around 1 to 3.

Regarding gender, 22% of the researchers are women, and two of them are project leaders (biotechnology and forestry). Although the proportion of women is increasing in recent years the percentage is lower in the total staff.

INIA had prioritized human resources essentially in the quality of searches (the new young researchers recruited are top ranking students) and in the highest level of post-graduate formation.

Most of the researchers have post-graduate degrees (58 % M.Sc., and 23% Ph.D., including those now studying, mainly in USA Universities). There are significant efforts to strengthen training at all levels of the staff, including formal and informal studies on a continuous education basis.

3.3.9 The Programmatic / Operative Matrix Model

In order to ensure a coherent integration of the working plans in the Experiment Stations, a matrix model was developed. The Areas and Programs (commodities and systems of production) conduct activities in the relevant Experiment Stations (regions).

The complexity in agricultural research requires effective coordination among the disciplines and support services. The leaders responsible for the research program, the Supervisors of Areas and Heads of Programs, are committed to promoting coordination among the disciplines within the projects.

The Areas and Programs established at the national level are shown in Table 3.2.

Table 3.2 Areas and Programs of INIA

Area	*Program*
Animal Production	Beef Cattle Dairy Sheep and Goats Farm (small) Animals Pastures
Horticulture	Horticulture Fruiticulture Citrus
Crop Production	Winter Crops Summer Crops Rice Evaluation of Cultivars
Forestry	Forestry

3.3.10 Priority Setting Process

The research objectives aim at developing suitable technological alternatives within systems of production at the farm level.

Careful attention is given to the relationship between priority setting and the organization's mission, process for resource allocation, program evaluation, budgeting and staff development.

In the priority setting process there is a formal scheme in which the more relevant problems are discussed. The externally-funded projects have to be in line with the institutional priorities, considering the internal effects that could unbalance the set priorities.

A Medium Term Operative Plan (MTOP) for five years, was established in 1992 (INIA, 1993). The Board defined priorities and procedures for its formulation, and then evaluated and approved proposed projects.

In the case of INIA, the farmer participation at different levels is a positive consequence derived from the reorganization process. Farmers are participating in INIA through the National Board of Directors, Regional Advisory Councils and Working Groups. Their demands can be directly met, and they also benefit from new technology. There are formal mechanisms for producers participation in the diagnosis, prioritization and planning of research activities.

Farmers are principally involved in the policy planning process, which is a central issue in agricultural research. This is related to institutional control. There is wide participation in problem identification and analysis. The concept of decentralization, strengthening local involvement, was also incorporated in the institution. Farmers are also taking responsibility to contribute to the budget.

INIA adopted basic guidelines from the Government in order to prioritize the generation of technology in defined areas, according to the volume of production, socio-economic importance, and the prospects to increase exports. At that time, these areas were: extensive livestock production (beef cattle and sheep mainly grazing natural pastures), horticulture (vegetables and fruits for exports), and forestry.

Based on this process, institutional strength was encouraged through human resources training and developing policy, as well as important investment in buildings and equipment, which fit the new priorities.

In general terms, the technology INIA offered helped to improve the agriculture sector export capacity under conditions of sustainability and more profitable systems of production. It was a programmatic approach articulated with the governmental policies of development, participation of farmers, and advances from the scientific-technological world.

New advanced technology, like biotechnology and information, were incorporated supporting research programs and services.

Technology transfer integrated with the experimental activities in the research projects is considered essential to achieve institutional aims.

3.3.11 The Planning System

Planning, as a basic tool to effectively accomplish institutional aims is the process that is designed to set up coherent objectives and priorities for INIA activities, to determine the appropriate means to attain these objectives, and to utilize those means effectively.

The planning system has provided tools to develop INIA's goals, priorities and strategies. Even though the Law gives INIA autonomy to administer its human, financial and physical resources, planning is required to maximize the limited resources available.

INIA has adopted three hierarchic levels, decreasing in complexity, defined as follows: a) Plan (institutional coherence of programs, according to the objectives and strategies established by INIA), b) Program (several projects designed to solve a more general problem), and c) Project (the basic unit of programming; all the organized activities to address a specific problem, including research and/or diffusion activities).

A dynamic cycling process, with continuous feedback is developing (planning - implementation - monitoring – evaluation).

Evaluation of the projects were conducted by scientific committees including external and internal professionals of recognized specialization in cereal and oil crops, vegetables, fruits, pastures, beef cattle, dairy, sheep and goats. The budget and the personnel required for the projects were also taken into account in the assessment.

The recommendations of these evaluation scientific committees were submitted to a critical review and reordering of the proposed projects by Supervisors of Areas and Heads of Programs.

The Board discussed and defined research priorities and resource allocation among the Programs for the Medium Term Plan.

This input came back to the scientific leaders to give a national, interdisciplinary and coherent conception in relation to the principal technological constraints identified in the different lines of work.

The Projects were presented and approved by the RACs at the level of Experiment Stations.

3.3.12 Resource Allocation

The current distribution of researcher's time allocations by Areas, Programs, and Experiment Stations, according to a time allocation survey, are shown in the following Figures 3.4, 3.5, and 3.6. There is a high congruency between the resource allocation in agricultural research and the production value of the commodities. There was a high correlation (r2= 0.89) between research time allocation distribution and total resources distribution. (INIA, 1998 d).

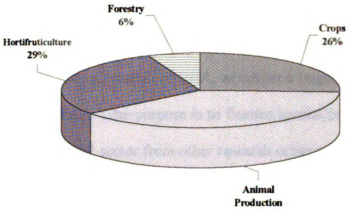


Figure 3.4 Distribution of the researcher time allocation by Areas

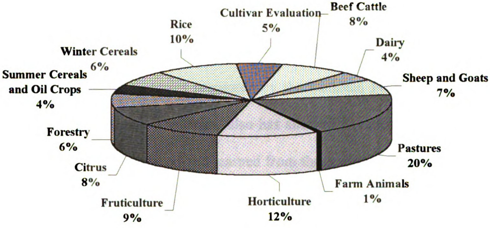


Figure 3.5 Distribution of the researcher time allocation by Programs

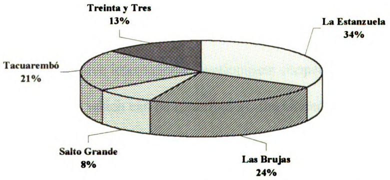


Figure 3.6 Distribution of the researcher time allocation by Experiment Stations

3.3.13 The Agricultural Technology Development Fund (F.P.T.A.)

The Agricultural Technology Development Fund (FPTA), was established in the 18th Article of the Law 16.065 of creation of INIA, which set a target amount of 10% of core funds devoted to this Fund. The purpose is to finance special projects of technological research for the agricultural sector from other research organizations. This Agricultural Technology Development Fund was for contract research, and was an INIA priority. The Board had decided that this Fund should be complementary to INIA´s work, used to form and strengthen strategic alliances, and that it should not alter the normal programming of research within INIA.

Thus, this Fund is financing projects, executed by other institutions or persons outside INIA, in response to topics requested by the National Programs of INIA, as a complement to INIA´s plans. The Board also has allowed having some flexibility, with 10% as an average. INIA analyzed and learned from these experiences. It has proven to be of help to establish strategic alliances, to coordinate the research efforts, and to achieve a multiplier to its own research efforts. INIA can rapidly contract to address specific problems, without waiting to build up its own physical and human capacity.

3.3.14 International Cooperation

INIA is involved in intensive international development cooperation with technical and financial assistance agencies, which can be classified as: the United Nations group (UNDP, FAO, UNESCO, IICA), the national government organizations (CIDA, IRDC, JICA, GTZ, SIDA, ODA, USAID), the national and state public research organizations (Agriculture Victoria Australia, Ag-Research New Zealand, INIA Spain, EMBRAPA Brazil, INTA

Argentina, INIA Chile), the international development banks (WB, IFAD, IDB), and international agricultural research organizations within CGIAR (CIMMYT, CIP, CIAT, IRRI, ISNAR, IFPRI).

INIA is actively participating in regional and international networks, mainly within the Cooperative Program for the Development of Agricultural Technology in Southern Cone (PROCISUR), a joint effort of the NARIs of Argentina, Brazil, Chile, Paraguay and Uruguay, and IICA, institutionalizing a permanent system of interchange of knowledge, cooperation, and integration of actions, related to the generation and transfer of agricultural and agro-industrial technology.

There is an increasing number of agreements with centers of excellence, mainly with universities and international centers of CGIAR (INIA, 1998b).

Chapter IV

METHODOLOGY

4.1 Operationalization of the Framework

This Chapter is a description and analysis of the research methodology and a description of the process which was used for two purposes: a) to integrate a new framework, for agricultural research organizations, and b) to operationalize Collaborative Action Research (CAR) for organizational development.

It summarizes what, where, when, how and why this work has been done.

4.2 Overview of Research Methodology

This research effort involved a case study of a National Agricultural Research Organization, INIA (Instituto Nacional de Investigación Agropecuaria) in Uruguay.

INIA is formulating and implementing an ongoing long-term collaborative process in order to transform itself into a sustainable development organization.

This research describes and analyzes an intervention in INIA´s organizational development process during the period October 1995 to December 1998. It includes a description of the scholar integration approach, the practical intervention, and analytical research about an organizational transformation. The author was engaged as both a scholar and as practitioner.

It is a narrative methodology, telling the story of what has been done, how the framework model was developed, and how it was applied in evolving an organizational transformation.

The type of research applied in this study, according to its orientation based on CAR, functions as a link between basic and applied research, focusing on practical problems that have theoretical relevance.

The goal is to generate highly useable knowledge and, at the same time, enhance the scholarly knowledge base. It involves the co-generation of knowledge by three partners: (1) the researcher (theoretical framework, scholarly perspective), (2) the internal staff, and (3) the external stakeholders (practical context, reality perspective). All three collaborate in the design and implementation of the research, and consequently in incorporating the results into the organizational development.

In this research the purpose is to link a proposed model for organizational development with the reality of a NARS, through a logical-empirical process of conducting research and connecting conceptualization with measurements.

The research is conducted and described step-by-step, systematically, in a logical way, explaining "what", "where", "when" and particularly "how" things have been done. The decision criteria adopted during this process are essential, justifying "why".

The methodology for this case study is based on the framework of a learning organization. Collaborative Action Research is the research strategy of this study (a synthesis of key features of collaborative, action and participatory research modes). It is a participatory action-oriented research effort involving the participation of INIA staff members working in collaboration with other stakeholders (members of the RACs and WGs), and the author.

The participative research effort was designed to help INIA staff and stakeholders gain critical understanding of the organization and their potential roles in facilitating the development of a sustainable organization.

The staff and stakeholders were oriented to these new concepts during the evaluation, planning and experiential learning processes, and this acculturalization is a long term on-going process.

For this research, a better understanding of the learning paradigm as a promising alternative for developing management in a NARS is essential.

The purpose of this descriptive research is to: assess evidence of an emergent learning paradigm in the practice of the case studied (INIA); to identify those forces that constrain or facilitate learning processes in the organization; and to explore the extent to which the CAR methodology applied is a useful framework for diagnosis and improving NARS (Chapter I).

The case study approach is particularly relevant for the description of an emergent paradigm and its manifestations in the practice of organizational development. The principles and techniques of the CAR methodology are used in this study to analyze the various components of the learning model, and the organizational factors that are limiting or reinforcing learning processes.

This should contribute to the efforts of INIA to carry out future improved research activities, in terms of performance (effectiveness and efficiency), quality (methodological rigor), and relevance, for technological agriculture transformation is the practical side of the research. At the same time, CAR methodology should contribute to the theory, as well as the practice, of learning organization approach (feed-back).

A holistic approach is applied to learn about the case by considering all relevant aspects of the whole.

4.2.1 The Research Protocol: Collaborative Action Research (CAR)

For this study, the definition of CAR was adapted from literature: an inquiry process in social research conducted with *Collaborative* efforts through participation of the researcher, external stakeholders and internal staff of the organization, for the common purpose of generating new knowledge *(Research)*. It is an attempt to respond to the felt needs and concerns of the client group (INIA, the organization) through practical problem-solving activities as well as identifying and anticipating future opportunities; and it simultaneously attempts to promote processes of social transformation *(Action)* whose goals and methods are defined by the parameters of a mutually acceptable ethical framework.

This form of scholarship provides a tool for organizational change and development, seeking more effective, efficient, and relevant action, through a consensus-oriented approach.

Collaborative Action Research is an appropriate label for this approach in order to emphasize the key words and concepts included in this methodology (Chapter II).

4.2.2 Case Study Research

The CAR approach typically involves case study work, and an important consequence is that the process evaluation results have high research utilization rates. Yin defines a case study as "an empirical inquiry that investigates a contemporary phenomenon, and the context are not clearly evident; and in which multiple sources of evidence are used" (1991:23).

He considers a case study approach as an appropriate selection when a "how" or "why" question is being asked about a contemporary set of events over which the investigator has little or no control. In a case study, the researcher draws from the knowledge base as a means of putting the case into perspective. Then, at the conclusion of the study, the researcher seeks to move to the knowledge base given the lesson learned/knowledge gained from the case study.

4.2.3 Data Collection

This study involved collaboration between the author (the researcher), the staff belonging to INIA, and the stakeholders related to the organization. This research team, collectively, was involved in designing the research methodology, as well as in collecting and analyzing the data. A series of planned activities and interactions with the people involved provided the primary data sources for this study. Secondary data available to the organization were also collected and analyzed.

In order to implement a valid, reliable, credible and feasible methodology, the following five data collection techniques were utilized: a) surveys of various types (different populations and different criteria of inclusion), b) different instruments (formal questionnaires, carefully planned and administrated and informal interviews), c) participant - observations and group discussion, d) direct observation, and e) secondary data, review of documents to corroborate and augment evidence (archival statistics, organizational records, letters, agendas, speeches, minutes, membership lists).

4.2.4 Data Analysis

This strategy depends on analyses based on valid description. This type of study, because it is social science research related to attitude, interest and opinion of the involved people, is often characterized by the use of qualitative data. However, this particular study also utilized the quantification of responses through the measurement of variables. This method allows description and analysis by scaling statistical indicators for variables. The structured instruments were designed with a common scale ranging from 1 to 7, in which 1 was very low, 2 (low), 3 (moderately low), 4 (neutral), 5 (moderately high), 6 (high), and 7 was identified as very high. A statistical package was applied for the analysis of the data.

Written forms were filled out anonymously by the respondents, in order to protect their confidentiality as participating partners. This was however, a limitation in analyzing the data. Even though some characteristics of the profile were included (researcher or support staff, age, sex, regional distribution), more information was not available, because of the attempt to prevent the identification of the individuals. Rich information is lost, and the potential cross-analysis association may be misleading.

Gathering, analyzing and interpreting data was used to explain the meaning of the evidence found. This study also used institutional documents, such as speeches, letters, internal memoranda and reports, which were important to corroborate and augment evidence from other multiple sources. Findings were also compared with literature.

4.2.5 Researcher's Potential Subjectivity

The fact that the researcher has been a member of the organization for a long time is indeed an advantage for knowing the organization in detail. However, personal bias is a potential factor that was recognized and minimized.

To assist in problem-posing, promoting the inquiry process, and in solving organizational problems, a proactive and critical partner participating in the research and in the implementation of solutions is required, to share learning with all levels in the organization.

Singleton et al (1992) describes this as intersubjective testability, which makes it possible to achieve. Scientists need to describe their research in detail and to outline their logic and methods of observation so that other scientists may duplicate their investigation; and so scientists can decide whether a researcher's subjectivity has distorted the conclusions. No one scientist engaged in this process is infallible, and each has his/her own peculiar intellectual or emotional bias.

Research methods are not mechanically applied in practice. Hoover and Donovan. describe science as the art of reality testing and research as a very creative process. That creativity takes place within the parameters of an accepted set of rules for knowing (science). This method draws upon our creative energies during the research process, and requires sharing with others the steps and rationale associated with that creative act. Science only informs us about reality. Science begins and also ends in uncertainty. They reflect "do we understand our values, and the influence of those values on our work in science?.The image of the value-free scientist is a myth....An interesting approach to these problems, and to some of the limitations of social scientific methodology, has been developed (termed participatory action research)" (1995:150).

Fear (1996a), however, points out that although is impossible for any human being to be objective about any aspect of reality, we can try to be objective as we engage in, and describe, the research process.

In the case of this particular research at INIA, in order to overcome and mitigate this personal bias, this participatory methodology tries to include a diversity of people with different perspectives and approaches. This participation was included in all stages of this study.

4.3 Description of the Process

INIA is engaging in a general process of transformation. The approach in this descriptive case study is to present collaborative activities developed in the planned cyclical process, chronologically and analytically. The purpose was to foster effective and sustainable organizational development.

The procedure for this participatory research featured three major aspects, as follows:

1) *Collaborative Evaluation Process* (CEP). This started in October 1995 (first step). It was an ex - post evaluation of the last five year (1992-1996) research plan (known as the Medium Term Operative Plan (MTOP)). This was a main input to the next plan (second step).

2) *Collaborative Strategic Planning Process* (CSPP). This was a proactive approach formulated for the future five years (1997-2001), called the Medium Term Indicative Plan (MTIP). This was accompanied by the development of a continuous improvement process (third step).

3) *Learning Process Teamwork for Continuous Improvement* (LPTCI). This was launched because of a felt need at the institutional level in order to support a cultural transformation to achieve sustainable organizational development.

The interaction of these three aspects of the process is depicted in Figure 4.1, below:

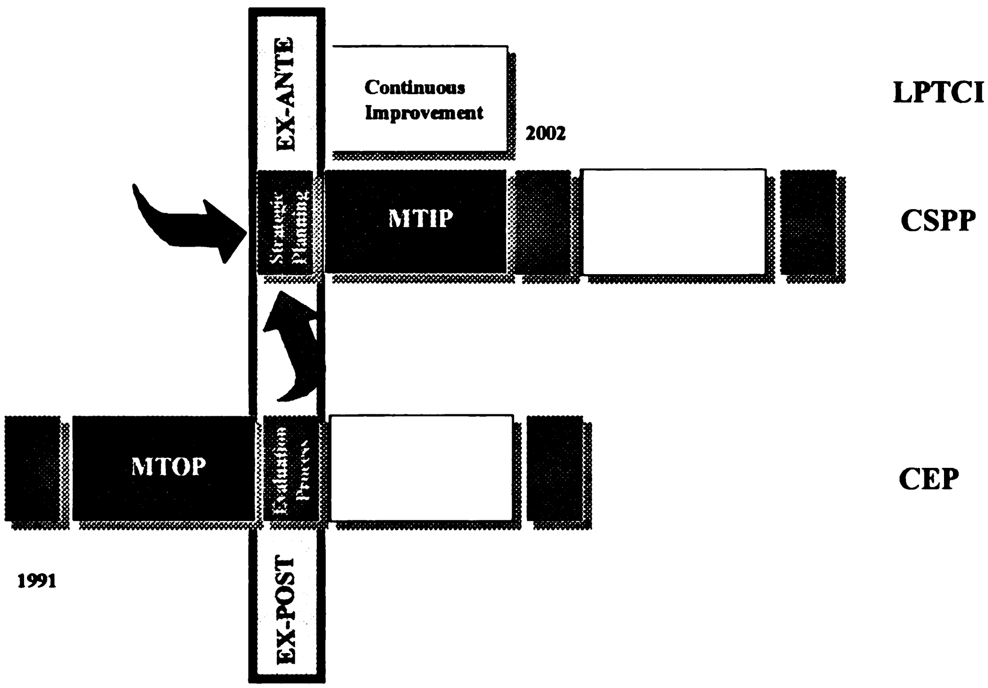


Figure 4.1 Description of the interrelated processes involved in INIA intervention.

4.3.1 Collaborative Evaluation Process (CEP)

The Collaborative Evaluation Process (CEP) was the initial step. The relationships with the other processes involved were shown in Figure 4.1.

It involved those researchers who were responsible for the Projects to be evaluated as well as stakeholders in the evaluation process. This is a way of enhancing the capacity for evaluation and for institutional learning by including researchers (self-evaluation), internal scientist leaders and managers, external scientists, and stakeholders in the evaluation process along with the author.

The chronological sequence and timing of the CEP followed the evaluation of the past Medium Term Operative Plan (MTOP) executed during the period 1992 – 1996. It started by a Board decision. Because of the lack of institutional background in this matter, a methodological development was required. The CEP gave essential information about current and past institutional performance, from the assessment of programmatic and functional organizational issues.

Starting Evaluation

In order to introduce monitoring and evaluation into the institution, the Board assigned the author to present a proposal.

In October 1995, the general conceptual approach, and a tentative design was submitted to INIA by the author. It recommended a collaborative and participative scheme, with the involvement of internal staff and external stakeholders.

Methodological Development

A proposal was developed based on the Context Input Process Product (CIPP) model (Chapter II).

Then, the proposal was discussed at the following meetings:

1) National Coordination Committee meeting

   The proposal was presented and discussed at the Experiment Station INIA Las Brujas. Since it was received positively, there was a recommendation to formulate it in depth.

2) Board of Directors meeting

   The reviewed proposal was presented, discussed and finally approved by the Board, in general terms.

3) Experiment Station meetings

   The proposed methodology and its implementation were presented and discussed with researchers and staff at the Experiment Stations level. The evaluation scheme, incorporating internal suggestions, was finally accepted.

Internal Workshop

An activity was organized in collaboration with Inter-American Institute for Agricultural Cooperation (I.I.C.A.), with the participation of Regional Directors, Supervisors of Areas and Head of Programs at the Experiment Station INIA La Estanzuela, during three days (December 1995). In this workshop a new Project profile, including Planning, Monitoring and Evaluation aspects, was developed for the future Medium Term Plan.

Progress Reports on Projects

The actual implementation started through a Memorandum dated February 28, 1996 to researchers explaining the initial stage of the evaluation of the Projects included in the past (Medium Term Operative Plan), and also related to the Document of Reference to be considered on the Internal Environment Analysis of the Thematic Areas of the Medium Term Indicative Plan.

The responsible researchers and the leaders of INIA were requested to make a summary progress report for each Project. Then, these were consolidated at the Thematic Unit and Program level, including the following content: i) initial situation (background and justification), ii) objectives (general and specifics), iii) expected results (related to specific objectives), iv) obtained results (indicators and means of verifications), and v) perspectives (finishing, reformulating or continuing).

Key Issues Addressed in the Research Evaluation

Issues were identified in a collaborative process involving all of the people mentioned above and the author.

These issues included analysis of the research activity (objectives, assumptions, processes, expected outputs, and possible weak points).

The most important sources of the issues were discussions with interested parties and an assessment of the purpose of the evaluation. Several individual and small groups meetings with samples of respondents were conducted and recorded by the author, in order to identify the most important issues.

The evaluation of INIA technical research activities was based on the performance of the projects executed in the last plan, including the following criteria:

1) Effectiveness

This was defined as to what extent the expected outputs have been achieved.

2) Efficiency

This was defined as effectiveness in relation to costs (resources assigned). The human resources cost estimated was based on percentage of time allocation.

Performance is mainly focused on the use of resources, and the timeliness of the activity (effectiveness and efficiency). It may be measured through monitoring and on-going evaluation, but in this case it was in the ex – post evaluation. The results are used to improve management procedures and increase productivity.

In the evaluation of effectiveness and efficiency the researcher responsible for self-evaluation, the Experiment Stations Directors, and the leaders of Areas and Programs have participated.

3) Scientific Quality

This was defined as adherence to accepted standards of scientific work and precision. In other words, to what extent did the methodology applied guarantee the accomplishment of planned results. Scientific rigor deals with such matters as validity and reliability of findings and is related to experienced scientific expertise, determined by the research leaders of Areas and Programs, and external specialists, scientific peers and expert reviews. At the beginning of the MTOP, in 1991 there was an External Scientific-Technological Committee that reviewed all the proposals, and made recommendations that were included to be accomplished with methodological requirements.

4) Relevance

INIA research is mission-oriented. It attempts to remove constraints and provide opportunities for national development. The expected results were considered according to their relative importance in relation to present needs, identified opportunities, and their potential impact in the long term. This involves relating each level of research objectives to the next higher level of objectives (project to program to area and to institutional level), which ultimately reflects national development objectives. This process relates to the results from the last Plan as well as the problems identified for focus in the next Strategic Plan.

The participants included in this aspect of the process were stakeholders who were involved in the Working Groups and Regional Advisory Committees.

This ex - post evaluation is related to the results obtained and their potential impact, but impact assessment (broad effects and to the long term of the research) is not included at this time because it requires adoption of the generated results, after at least five years (Figure 4.1).

5) Programmatic Consistency

This was defined as the extent to which there was coherence between the project's expected results and the higher levels of institutional objectives.

The proritization of strategic interventions during the planning process was based on the ends. Activities designed to achieve those ends required means. And, in turn, these ends became means to higher levels of ends, and finally contributed, through synergism, to the institutional mission and vision (Figure 4.2).

"Then, when evaluating, and seeking to understand the on-going development of the activities, the means/ends hierarchy is a highly useful tool" (Axinn and Axinn, 1998:136).

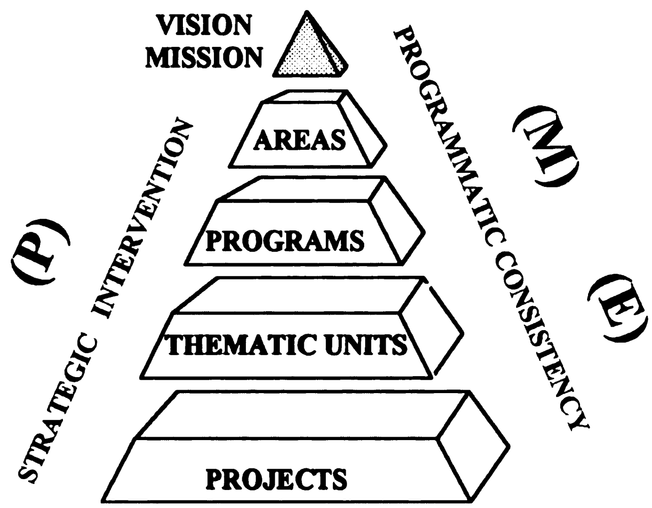


Figure 4.2 The means/ends hierarchies approach applied to INIA planning, monitoring and evaluation process.

Indicators, Expected Results and Means of Verification

Indicators were used to identify the evidence (explicit, measurable and objectively verified) of the expected results to demonstrate the level accomplished in each criteria. The expected results refer to the anticipated level in each technical-programmatic goal and the advance of knowledge.

Means of Verification refers to the specification of the source of data and the way in which each indicator is measured and verified. Sources refer to the type of respondents selected for this particular information.

Procedure for the Evaluation Process

Formal questionnaires were distributed through the National and Regional Directors at the level of Experiment Stations to leaders, researchers and stakeholders, to be completed by the different respondents from their perspectives. Each was asked to provide the required information, indicating the scale number, which according to their understanding was the best representation or meaning on the aspects selected.

The procedure for the evaluation was a follows:

1) Sample Test Forms

Different forms were used, according to the purpose and the respondents. Structured forms related to the evaluation of each Project were drafted and checked with researchers before they were distributed. The same was done with the forms for the leaders and for stakeholders in RACs and WGs.

2) Self – Evaluation by Researchers

The forms to evaluate the Projects by the responsible researchers, were then distributed and filled in by the responsible researchers (Appendix A).

The information collected from the researchers responsible for projects was about: stage of execution of the project; initiative of problem identification (demand); contributions during the programming process; modifications; accomplishment of the technical-programmatic goals (effectiveness); numbers of researchers involved; estimation of total time allocated by the researchers; total operative resources allocated; relation between effectiveness and the cost (efficiency); number of disciplines and commodities involved (multidisciplinary integration); factors limiting the execution of the proposed experimental activities (quality improvement); effective mechanisms for diffusion of the Project results; resources to be incremented to improve the Project; effects on the preservation of the natural resources; type of products generated; orientation of the objectives; determination of immediate users; present and future needs relationships; scope of the results; stage of the process of technological development; convenience of finishing, reformulating or continuing without modifications the Project (prospective analysis); and comments and suggestions on criteria for Monitoring and Evaluating to be introduced in the next Planning.

3) Evaluation by Leaders

Another type of form, including some similar and other different questions, was distributed to the Technical Leaders, Heads of Programs and Supervisors of Areas (Appendix B).

They assigned values to the following topics: expected results (outcomes or products) accomplished considering all the activities of the Project globally (effectiveness); effective mechanisms for diffusion of the Project results; relation between effectiveness and their costs (efficiency); size of the Project in terms of resources allocated taking into account the planned objectives; contribution of the results obtained by the Project to accomplish the objectives of the Thematic Area, as well as at the level of Thematic Area to the Program (programmatic consistency); relative importance within the Program given to the Project; grade of fit and internal structural consistency for the general methodology, data recollection, statistical analysis, conclusions, strategy, and scientific-technical information reviewed (scientific quality); quality value of the publications produced; grade of extrapolation of the results; determination of immediate users; stage of maturity of the process of technological development curve; convenience of finishing, reformulating or continuing the Project without modifications (prospective analysis); and comments and suggestions on criteria for Monitoring and Evaluating to be introduced in the next Planning.

4) Experiment Stations Feed-back and Analysis

The completed forms were collected and processed by the author, and then the data were presented and discussed in specific half-day meetings with the participation of all researchers at each one of the five Experiment Stations.

5) Relevance as seen by Regional Advisory Committees and Working Groups.

Specific forms were developed for the RACs and WGs to complete, both regarding the relevance of the obtained results and evaluating the process (Appendix C).

The Members of the Regional Advisory Committees and Working Groups provided information on: previous knowledge of the available information; usefulness of the obtained results and contribution to improve the decision making related to the principal systems of production for whom they are aimed or directed (relevance); effects of the application of the obtained results on productivity per hectare, capital or labor, quality of products, natural resources and environment; effective mechanisms for diffusion of the Project results; potential adoption of the technology or information; limitations or restrictions to adopt the available information or technology generated; magnitude of the adjustment to introduce the technology in the system of production; presentation of the information; convenience of finishing, reformulating or continuing the Project without modifications; and comments and suggestions on criteria for Monitoring and Evaluating to be introduced in the next Planning.

6) Final Document

All this information was consolidated at the level of Thematic Units and Programs, as an internal progress report, along with the processed data collected from the questionnaires. This information was a main input to the future Strategic Planning.

A summary of collaborative evaluation process, adapted from CIPP model (Stufflebeam, 1982; ISNAR, 1995) is presented in Figure 4.3.

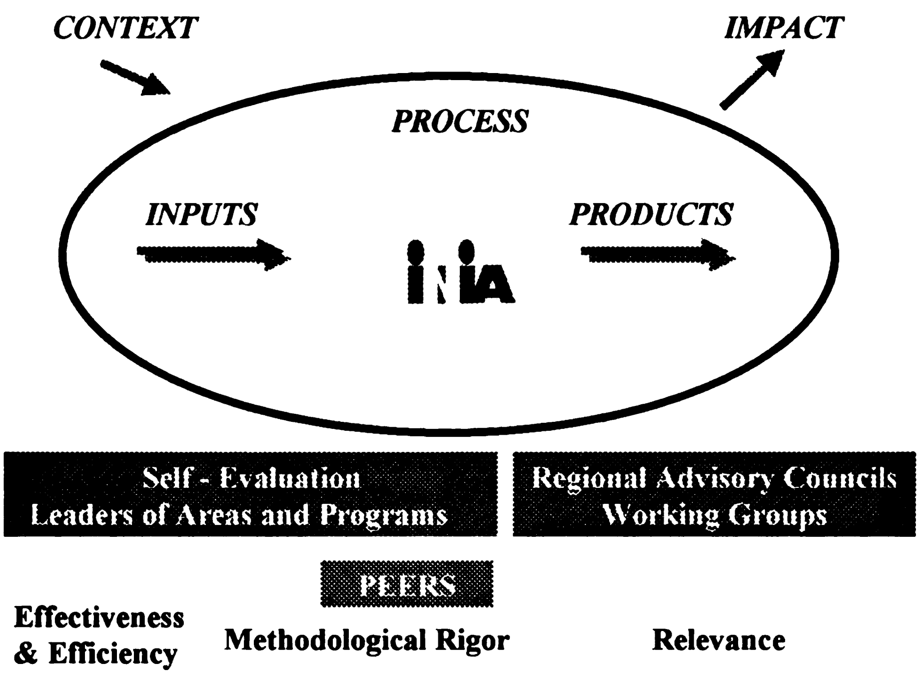


Figure 4.3 Collaborative Evaluation Process (CEP) developed ex-post evaluation of the Medium Term Operative Plan (MTOP). Adapted from CIPP model.

4.3.2 Collaborative Strategic Planning Process (CSPP)

This CSPP strategic planning process was a second aspect described in this process carried out by INIA. The relationships with the other processes involved were shown in Figure 4.1. This process becomes a comprehensive guide for organizational efforts to become more effective.

The internalization within INIA of the strategic thinking concept, based on careful analysis, is designed to identify and describe the values, mission, vision, and stakeholders, and to determine opportunities and threats (external environment) as well as strengths and weakness (internal environment) (Bryson, 1988).

This becomes an organization's way to define who we are, what, why and how we are doing; where and how we want to be in the future.

The collaborative Strategic Planning Process is a proactive, mission-based and vision-driven approach, which starts by scanning the environmental reality, and is vital to move to a sensitive stakeholder, committed staff and improved teamwork organization.

It is crucial to make decisions based on new future prospects and to avoid considering the future as just a prolongation of the past "to do more of the same". Stakeholder demands, organizational culture and resource availability are essential factors.

In brief, INIA's aim was to program activities and allocate resources in response to real demands from the agricultural sector, discovering and identifying relevant problems, and to contribute to solve them. The methodology adopted by INIA, based on strategic planning, is to identify the strategic issues and formulate strategies to manage them, as a frame of reference for the prioritization of problems to be tackled in the near future (Dias et al., 1995).

The chronological sequence and timing of the CSPP followed the steps described below. These are being implemented and executed during the period 1997 – 2001.

Starting Planning

There was an initial agreement for planning. INIA decided, in October 1995, to be engaged in a Medium Term Indicative Plan for the next 5 years, based on a Collaborative and Participatory Strategic methodology.

Orientation

A general presentation and discussion (sensitization and introduction) on the characteristics of strategic planning methodology, the timetable required and ways of participating in the process of developing the MTIP, was held at the levels of the Board, the National Coordination Committee and at the Experiment Station. In this stage, experts who had been in charge of this experience in EMBRAPA, the national agricultural research organization in Brazil, were involved in this sensitization.

The members of the National Coordination Committee, in agreement with the Board, identified responsibilities to start preparing drafts of documents to be presented and discussed with the internal staff and stakeholders, clearly communicating the institutional mandate.

External Environment Analysis

The assessment of the external environment was used to identify what opportunities and threats will affect the future alternative scenarios.

A team lead by two Regional Directors was in charge of this analysis, with the objectives of identifying the relevant components of the INIA ecosystem, and selecting their important factors. These factors and the implications for INIA were described and analyzed in terms of opportunities and threats. Based on that, they were assigned to construct alternative scenarios, and present proposals of objectives to assure the accomplishment of INIA´s mission, given the transformations estimated in each scenario. Then, the following four stages were implemented:

1) Ecosystem Description

At the beginning of the external environment analysis, a tentative ecosystem description of INIA was designed. It was discussed internally and externally, considering international and national, public and private forces that are operating and influencing INIA capacity.

2) Critical Factor Identification

By assessing the external environment, the key external critical factors related to INIA were identified. These were evaluated in order to identify elements that can contribute as opportunities, and elements that may be threats to the organization.

3) Relevant Critical Factor Analysis

Then, relevant critical factors for INIA were described and analyzed, in relation to the promoted and restricted forces determining the tendency of the factor, the alternative possible future evolution and the implication to INIA, in terms of opportunities and threats.

4) Construction of Alternative Future Scenarios

Based on these previous stages, the alternative future scenarios were analyzed from the perspective of relevant economic, social, political, cultural and technological factors.

The drafts of the external environment analysis documents were discussed in a two-day workshop, with all the members of the Board, the National Coordination Committee, and the Specialized Units of the National Direction participating. That took place at INIA Las Brujas, during the first week of December 1995.

Mission and Vision Proposals

Taking into account the organizational mandate, established law which created INIA, and the constructed future scenarios, proposals for drafting mission and vision statements were developed at the level of the Board and National Coordination Committee. However, it was a collective exercise for everybody involved in INIA. These first proposals were inputs to be discussed and shared with internal staff and stakeholders at the level of Experiment Stations, in December 1995.

The mission statement considered the INIA purpose, the reason to exist, the social importance, the philosophy and core values that will guide organizational decision, key stakeholder needs, how to anticipate to respond to problems, and the uniqueness.

The vision statement for the future considered INIA's hopes for positive outcomes of optimal effectiveness, a better future, transmitting enthusiasm, and looking for excellence.

Internal Environment Analysis

Simultaneously, an assessment of the Internal Environment started. This was an institutional diagnosis, attempting to identify strengths and weakness in relation to the mission and vision. The analysis considered inputs, processes and products that take advantage of opportunities and protect from threats (strengths) or vice versa (weakness). This information will be fundamental to formulate the strategy of action based on strengths and to overcome weaknesses.

It also considered INIA performance, organizational and functional conditions, and the changes needed to achieve the stated objectives.

The INIA internal environment analysis included three phases: 1) programmatic (characterizing past and current performance), 2) organizational and functional (identifying strengths and weaknesses), and 3) prognostic performance assessment (needs based on the new mission, objectives and policies).

The Collaborative Evaluation Process (CEP), which analyzed the Medium Term Operative Plan (1992-1996), became a key element in the process, supplying the required information about programmatic analysis (Figure 4.1).

A team led by two Area Supervisors was responsible for promoting an open discussion of the INIA internal environment analysis, focused on organizational and functional issues. It used a survey, with a questionnaire form. A list of factors were valued as very weak (ww), weak (w), strong (s), and very strong (ss), by all the researchers of INIA.

A draft summarizing the most relevant elements of the institutional internal environment became an input for a broad reflective analysis. Because this analysis was done by internal INIA personnel, it was different from the external diagnostic, in order to overcome potential problems of objectivity and credibility in the final proposal, there was a broad open internal discussion.

Workshop Follow-up

All members of the Board, the National Coordination Committee, and the Specialized Units of the National Direction participated in a workshop reviewing the strategic planning, advancing the discussion at the level of INIA, and setting the stages for the future. It took place at INIA Las Brujas, in February 1996.

Internal Validation of External and Internal Environment Analysis, Mission and Vision Proposals

An internal validation was conducted through daily workshops at the level of all of the researchers in each one of the 5 Experiment Stations, during February, March and April 1996. These included presentation and discussion of all of the components of the external and internal environment analysis, and the mission and vision proposals (Appendix D).

External Validation of External and Internal Environment Analysis, Mission and Vision Proposals

The drafts of documents of the external and internal environment analysis, and the proposal for mission and vision, were reviewed externally at two levels: a) Leaders of the Rural Associations represented on the Board of INIA ("Mandantes"), and policy-makers representing the Ministry of Livestock, Agriculture and Fisheries (in a workshop in May 1996), and b) Regional Advisory Committees at the Experiment Stations level (in workshops during July 1996).

In all meetings the drafts were presented and the external participants (stakeholders) were encouraged to discuss, to make critical analysis of the proposals and to introduce suggestions to improve them. After everyone had read the drafts of documents, critical comments and proposed modifications were presented in small groups. Suggestions related to all aspects of this work were organized into a timetable (Appendix E).

Prospective Studies by Areas

In the previous steps, the impact of global change on the agricultural sector and its influence on the institutional objectives was analyzed using the methodology of strategic planning. After that, strategic studies were developed on the four Areas of action for INIA. Future scenarios of the agricultural sector for each of them were constructed. These provided a specific framework for the research projects proposed for execution in the five - year period 1997-2001.

Terms of reference were developed with the support of expertise from INTA, the national agricultural research organization in Argentina, in order to conduct strategic analysis of the possible future scenarios at the level of the principal national agriculture system of production. These included the stages of production, transformation, and consumption (agro-industrial chain), as well as their implications for the areas of research of INIA.

Based on that, four Specialized Technical Committees were established. They were composed of three internal researchers (leaders of Areas and Programs), one of them as Coordinator, and three external professional consultants, selected by the Board (a technical /biologist with expertise in the area, an economist with experience on production systems, and a policy maker related to market tendencies of the production systems.

They started working on strategic studies for main areas of research, in April 1996. These prospective studies by Areas (Animal Production, Cereal and Oil Crops, Fruit-

Horticulture, and Forestry), were drafted, taking into account all earlier documents, and then they were internally and externally validated, and the strategic issues were identified.

a) Internal Validation of the Prospective Studies by Areas

The Specialized Technical Committees presented and discussed the draft documents with all researchers of INIA, and some technicians. Over 150 staff members attended meetings at the 5 Experiment Stations, in June and July 1996. Their suggestions were included in the draft documents that followed.

b) External Validation of the Prospective Studies by Areas

The draft documents were presented and discussed with the Regional Advisory Councils and expanded Working Groups, in groups, in 14 meetings, attended by 350 stakeholders at the 5 Experiment Stations, in July and August 1996.

Their suggestions and even new technological demands were incorporated into the draft documents. These began to form a tentative list of demands and definition of priorities.

c) Identification of the Strategic Issues

After considering all the internal and external suggestions, the Strategic Studies were reviewed, adjusted, and summarized by the Specialized Technical Committees, and became the framework for setting priorities for future Planning.

Strategic issues facing INIA were identified as a consequence of taking into account the opportunities and threats (external environment) and strengths and weaknesses (internal environment), as well as reaffirmation of the mission and vision, along this logical flow: a) which are the more probable scenarios for each principal Area of INIA (Animal Production, Cereal and Oil Crops, Fruit-Horticulture, and Forestry)?, b) which are the strategic areas of intervention (demand opportunities)?, c) which are the topics of strategic intervention of higher potential impact for INIA action (technological limitations within each demand opportunity)?, d) what projects address the principal technological limitations appropriately?, and e) which are the priority projects?

Topics of Prioritization

The prioritization of areas and themes of impact was discussed between the Board members with the Supervisors of each Area, and with representatives of the Rural Associations represented in INIA's Board and the Ministry of Livestock, Agriculture, and Fisheries.

Then the topics of prioritization were discussed among researchers and the Regional Advisory Committees and expanded Working Groups, in small groups, in 10 meetings, with 200 stakeholders attending, at the 5 Experiment Stations, in November and December, 1996.

Drafting Pre-Proposals

According to the prioritization of areas and themes, the researchers formed multidisciplinary teams, drafted proposals in relation to the main problems and opportunities identified, selecting mega-projects which have high potential impact.

Relevance of Pre-Proposals

The ideas for Projects drafted by these teams were submitted for discussion and adjustment to the Regional Advisory Councils and expanded Working Groups, at the 5 Experiment Stations, in March 1997 (Appendix F).

The list of ideas for projects, resulting from previous discussion, was subjected to a process of prioritization by scoring, open for adding new ideas if needed. These were utilized in formulating the program.

Formulating Policies and Strategies

As an organizational response, strategies dealing with the selected issues were developed. Policies, projects, actions and resource allocations were discussed with stakeholders and confirmed by the Board, consistent with the shared mission and vision adopted, to define what to do and why in the future. A set of proposals of mega-projects and a work plan were established for implementation in the future.

Final Review and Approval by Board of Directors

The new Board of Directors, in regular meetings and exchanges of ideas with the National and Regional Directors, Leaders and researchers, reviewed the proposals of mega-projects, at the 5 Experiment Stations, from May to September 1997. Feedback was given to the leaders and researchers.

Finally, the Board of Directors approved the Medium Term Indicative Plan for the next 5 years, with adjustments, in December 1997.

Communication and Feed-back.

The final approved Medium Term Indicative Plan was communicated to all internal and external participants in the process, and then it was evaluated by the participants (Appendix G).

Project ideas were documented as profiles of projects, with detailed objectives, teams to be involved, expected results and budgets required.

The implementation of these projects will be done with a philosophy of enhancing the organizational capacity through strategic alliances with national and international centers of excellence (universities and international centers of CGIAR).

This MTIP constitutes the framework for all the research Projects at the Institutional level. The FPTA, competitive funds with other institutions, and the IDB II Project, as strategic projects are within the priorities defined in the MTIP. Other competitive funds in the INIA/IDB II Project will be determined, based on the FPTA procedure.

4.3.3 Learning Process Teamwork for Continuous Improvement (LPTCI)

In order to establish and develop teamwork for continuous improvement, the basic idea was to constitute groups with the purpose of promoting understanding of prioritized problems, issues, and opportunities in organizational development, identified and prioritized by themselves.

These groups were considered very useful for constructive dialogue and efficient instruments for staff and institutional development. They helped individuals learn how to participate and lead others in collaborative, enriching ways, progressing and developing as a whole group, to achieve profound understanding and a broad systemic perspective.

This methodology is based on the premise that improvement comes from the application of knowledge. This idea is presented in the Deming cycle. This cycle is never ending (Deming, 1986).

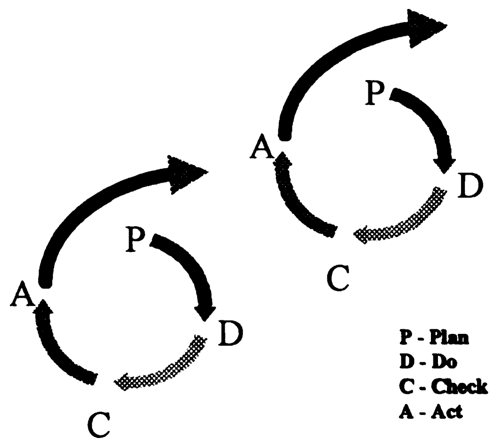


Figure 4.4 The spiral of continuous improvement. Adapted from Deming cycle.

Starting the Process

In order to complement the operationalization of the Planning, Monitoring and Evaluation (PM&E) Process, INIA decided to implement the Learning Process Teamwork for Continuous Improvement. The goal was to strengthen the conectiveness of the process, and to accomplish a sustainable and effective cultural transformation in the organization.

Orientation

INIA has developed an engaging introduction to this methodology through presentations by consultants in managerial workshops at the Board, high management and Experimental Station level, during the last decade.

The purpose was to internalize this approach through an overview of principles, practices and techniques involved in total quality management, as well as discussing the viability of applying it to organizational development in the case of INIA.

After this introductory period, and taking into account the experience working with these participatory planning and evaluation processes, the INIA Board of Directors decided to sponsor this process, through a Board Resolution dated 28/6/96.

Training of Upper Management

The top level of the organization received training on the process in order to have a strong commitment to leadership.

The Board, National and Regional Directors, Supervisors of Areas, Heads of Programs and Specialized Units participated in a Workshop, conducted by members of the National Organization for Quality and Excellence (AUECE), at INIA headquarters, once a week, on Monday morning (three hours), during three months (June, July and August, 1996).

The content of the Workshop to achieve improved understanding included philosophy and tools, according to the National Quality Award: client satisfaction, communication, teamwork, processes measurements, quality assessment (ISO 9000 and ISO 14000), leadership, mission and vision, problem solving, and action plan for continuous improvement. As an outcome of this seminar a tentative master plan was established.

The Guide Team

A multidisciplinary guide team, composed of a Director of the Board, a lawyer and a sociologist from the Human Resource Unit, a Regional Director (MBA), and the author, as coordinator, was established.

This team defined a tentative program of short term activities, expanding ideas through training, and appointing improvement teams in each Experiment Station (Facilitator Groups) in order to accomplish the implementation of this Plan. The members of this team have and will promote the inquiry process be proactive in supporting solving problems. Also, they set a long term target of obtaining cultural transformation and sustainable organizational development, adhering to learning organization principles, by the end of this Medium Term Indicative Plan.

Experiment Station Meetings

The President of the Board, the National Director, the Manager of AUECE, and the Guide Team traveled among the Experiment Stations to meet with all the staff from November through December 1996.

The purpose of this group was to communicate the main ideas directly and clearly, and at the same time to learn about the expectations of the staff. The program of those meetings was based on a presentation of the continuous improvement process. Then opinions on the most important ideas, the main obstacles, and restrictions that might interfere with the implementation of the process, emerging doubts, and related suggestions, were sought through a structured form completed individually (Appendix H).

After that, the personnel worked in groups (approximately 10 persons in each group), to discuss the individual answers, looking for a collaborative way to face the future actions.

These data were collected and analyzed by the Guide Team.

Reaffirmation by the Board

In May 1, 1997, the members of the Board finished their period established by the INIA Law of creation (3 years plus an optional renewal), and were replaced by new members.

In the inauguration speech, on May 2 of 1997, the new President reinforced the key importance of the continuous improvement process, recommending continuing in depth in this process.

Facilitator Teams

Each Experiment Station nominated a facilitator team, formed by the Regional Director, two researchers and three support staff (different levels of personnel). Members participated voluntarily, with a positive attitude to collaborate to create an environment of mutual cooperation and understanding.

Because of the concern about how they relate to the formal structure and hierarchies, a Director of the Board opened the meetings at different Experiment Station.

The training for these facilitator teams was as follows:

1) Training Facilitator Teams.

After the teams were established, they participated in an intensive workshop/seminar, with the same content as the first one addressed to the high management, conducted by the guide team with the purpose of bringing all individuals to the same level, during the third week of July 1997.

The program was based on presentations by the members of the Guide Team on the following topics: organizational models, communication, teamwork, problem solving, leadership and organizational change, Quality National Award and ISO 9000 and 14000 norms, mission and vision, and master plan for continuous improvement process.

At the end of the seminar/workshop, the participants, working in groups and based on the established concepts, defined statements of shared missions with the guide and facilitator teams.

This training was evaluated using specific instruments (Appendix I), which sought feedback information about the contribution of the principal ideas presented and discussed; the implementation of the continuous improvement process; and other suggestions, as well as comments on the organization, program and thematic content, methodology utilized, and level of participation.

After the meeting, the President of the Board sent a letter to each member of the Facilitator Teams to reinforce the importance of the continuous improvement process.

2) Training Trainers

An intensive course for the facilitator teams about adult learning, was conducted with the support by a psychologist expert, during the first week of September 1997.

The program was developed for adult education (new educational models, techniques for adult learning, use of audio visuals, case studies, role-play); teamwork management (types and roles); total quality and paradigm shift; client satisfaction; work processes (importance of measurements and tools to improve it); future training of Improvement Teams (specific materials elaborated for them); plan of actions to improve teams.

At the end, a strategy for future actions was discussed, and modules were assigned to different Experiment Station teams. They then drafted specific materials adapted to INIA.

3) Preparation of Documents

Based on general publications, each Experiment Station was in charge of developing specific materials on quality themes, adapted to the particular institutional mission and culture for internal training. This internal intermediate document, containing material adapted for training the rest of personnel, was distributed among them.

Training

Training is implemented through regular participation at different levels of the personnel at courses, seminars, and workshops, organized by other institutions in the country or in the region, related to these areas of continuous improvement. Some of them are in the same Experiment Stations.

Teamwork Groups for Continuous Improvement

Work groups were developed in relation to local emergent problems from each Experiment Stations survey, as well as institutional problems identified and prioritized at the national level (from the internal environmental analysis during the strategic planning).

Each facilitator team identified specific problems on which to work. Some of them also work on certain institutional problems at the national level.

At the regional level problems were prioritized. Among these were receptionists and internal communications (INIA National Direction-headquarters), toxicity from agrochemical products manipulation (INIA La Estanzuela and INIA Salto Grande), moving to new facilities (INIA Treinta y Tres), lunch facilities and functioning (INIA Tacuarembó), arrangements for staff transportation to work (INIA Las Brujas).

At the institutional national level the main problems prioritized were human resource reformulation, administrative procedures, communication (information network), and working safety.

Human Resource Teamwork

"Human resources" was identified as the most important problem to be considered under this methodology. It involved all staff, at different times, and was time consuming. A group, including personnel from different Experiment Stations and categories (researchers, technicians, administrative, labs and field workers), worked with the support of a consultant, to develop a draft proposal. After discussion with the National Coordination Committee, and the Board, a tentative proposal was introduced through the facilitator teams in a two-day workshop at INIA La Estanzuela. Then it was disseminated to the rest of the staff, so that feedback could be received. This was a clear sign that the most important issue in INIA at that moment was enriched through this methodology. It was guided by a structured questionnaire to obtain a systematization of the ideas and contributions. Even though the people were at an early stage of the process, and taking considerable challenge (risk of failing for lack of enough training), the Board gave strong support. There was a consensus among the teams to take on this responsibility. This process was evaluated by specific forms (Appendix J).

Other Teamwork

Other teamwork involved staff leading to change in problem areas to improve the quality of working life. In this way, INIA is creating the proper environment to learn about the organization in order to identify and to solve problems. This methodology of teamwork was applied to a new institutional challenge participating in the important annual national Agro-Industrial Active Exposition.

Administrative issues, the information technology system, communication and working safety, were also other institutional topics addressed by teamwork.

4.3.4 Results/Processes Interconnection

The interconnected components of the process were summarized in this Chapter.

In the next Chapter, findings from the operationalization of this process will be presented, along with some results and other consequences drawn as lessons from this organizational experience.

These outcomes will be the evidence found in this study in order to demonstrate to what extent this process is being useful for INIA future performance, and is contributing to developing an organizational change toward a sustainable cultural and financial transformation.

Chapter V

FINDINGS

This Chapter describes the most relevant findings obtained. These are most closely related to the objectives of this study, providing evidence directed to the research questions, and were drawn from the three major components of the process as described in Chapter IV.

As a consequence of the process described in earlier Chapters, the collaborative effort to formulate and implement a new approach resulted in fundamental changes in INIA.

INIA's Board of Directors took decisions to put the results of this participative exercise into practice. This evolving process was a cycling of continuous improvement, evaluating what has been done according to what has been planned, and then, applying what was learned from the reflective analysis of the experience.

Because of that, in order to integrate the results from the process, and to connect them in a logical way, they will be presented according to the main organizational aspects studied.

These include the actions conducted by INIA in relation to the diagnosis obtained from the Collaborative Evaluation Process (CEP), both the external and internal environment analyses and the conclusions reached in the Collaborative Strategic Planning Process (CSPP), and the evolving Learning Process Teamwork for Continuous Improvement (LPTCI).

5.1 External Environment Analysis

The prospective analysis of the context and the factors affecting how INIA will probably evolve in the future started by characterizing the ecosystem in which it works. Then the critical factors affecting INIA performance were studied in order to try to take strategic advantage of the eventual contribution of the opportunities, and also, to try to avoid the risk of the threats.

5.1.1 Ecosystem Description

A flow diagram shows the inter-organizational relationships influencing INIA capacity. It involves governmental institutions and the society, as well as the principal stakeholders (interest groups affected by the activities of INIA), at the national, regional, and worldwide level.

Figure 5.1 maps the set of organizations influencing or influenced by INIA, and assists understanding what will be possible, desirable and influenced in the future.

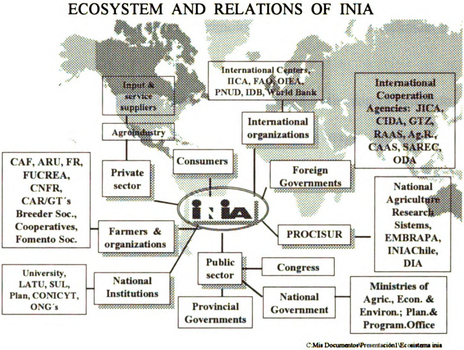


Figure 5.1 Ecosystem and INIA relationships

5.1.2 Relevant Critical Factor Identification and Analysis

From the External Environment Analysis, the following 12 critical factors were selected (Paolino and Silva, 1995). They are connected through a causal relationship to INIA performance: the social demands on agricultural research, the profile of the agricultural technology demand, financial sustainability of the institution, the agriculture suppliers (inputs, capital goods and services), the agro-industry-farmer relationship, the changes in the regional dynamic of agricultural production, the agriculture markets and regional integration, the emergent technological paradigms and their application in agriculture (biotechnology, information, chemical), agriculture technology and natural resources preservation, agriculture production and the primary factors of production, the relationships with other institutions of technology transfer, and the technical international cooperation.

Each factor was identified and described with regard to the forces acting to determine tendencies (promoting and restricting), future alternative stages, interaction with other factors, and the implications for INIA in terms of both opportunities and threats.

5.1.3 Construction of Alternative Future Scenarios

Re-positioning INIA in relation to a varied and turbulent context requires the use of alternative scenarios. The scenarios were constructed based on the anticipated future evolution of the relevant critical factors analyzed for INIA performance. They were defined considering models of development for the long-term in Uruguay. The four resulting scenarios, are the following: a) agro-industrial development with equity, b) concentrated agro-industrial development, c) development based on the services sector, and d) lack of structural changes and consolidation of defensive private strategies, oriented to the short term.

5.1.4 Common Premises and Implications for the Alternative Scenarios

The premises and implications were established in each one of the alternative constructed scenarios based on the analysis of the relevant critical factors selected.

They represent the fundamental base for the general objectives of INIA. They are the relationship with society; the increasing awareness and organization of consumers; the profile of demands for agricultural technology; the suppliers of inputs, products and services; the relationship between farmers and agro-industry; the territorial dynamic in the regionalization of production; new external influence on the Uruguayan economy; new emergent technological paradigms; concern of the society in relation to environmental impacts and the preservation of natural resources; the effects of technological progress on the participation of the factors of production in the sector; the relationship with other institutions, particularly those involved in technology development and human resources formation; and the agenda for international technical cooperation.

5.2 Internal Environment Analysis

The diagnosis of organizational capacity was obtained from different surveys conducted during the process.

5.2.1 Restrictions in the Execution of the Projects

In the ex-post evaluation of the MTOP, the opinions of researchers in the self-evaluation of the projects carried out in the previous MTOP were a fundamental input. According to them, the different factors considered as restrictions in the execution of the projects affecting the quality of the research activities, received low values (Table 5.1).

Table 5.1 Restrictions on the execution of the projects in the MTOP, according to the self-evaluation of responsible researchers. May 1996.

Factors	Mean	Standard Deviation
Support staff	3.55	1.92
Researchers	2.85	1.98
Bibliography	2.55	1.56
Equipment	2.43	1.62
Climate conditions	2.30	1.67
Materials	2.23	1.50
Specialized training	2.17	1.72
Physical infrastructure	2.14	1.58
Pest and diseases	1.96	1.58
Training in projects	1.88	1.48
Administrative support	1.55	1.05
Per diem	1.30	0.81
Vehicles	1.29	0.74
Gasoline and Diesel-oil	1.22	0.73

These results show that opinions on restrictions in the organizational capacity, in a scale from 1 (very low) to 7 (very high), had means ranging from 1.22 to 3.55. The physical infrastructure and the operative resources were not the main limitations in recent years at INIA. The operating costs also received the lowest values. These results contrast with the situation at the level of the experiment stations when INIA was first organized (Chapter III). But, when the major restrictions are satisfied, others come up as new ones. Because of that, the need for more personnel, both researchers and support staff was felt as the new most important restrictions on improving the quality of the research.

These judgements look reasonable as a consequence of: a) the IDB Project for institutional strengthening, which built new buildings, field and laboratory equipment (Chapter III), and at the same time b) the new INIA organizations, which with autonomous management of an increased budget, clearly improved the operative resources for work.

5.2.2 Opportunities to Improve Quality of the Projects

When researchers' opinions were asked about opportunities to improve quality in the projects, the traditional factors limiting execution of the projects in the past, such as physical and operating resources, were at the lowest level of importance. In contrast, factors associated with human resource management and development have emerged. Thus, it appears that in order to take advantage of the expanded infrastructure and well equipped facilities, there are several human needs to be satisfied: 1) more personnel (both researchers and support staff), 2) a continuous education policy, 3) better teamwork, organization, and functioning, 4) permanent up-dated bibliography access, and 5) the most important, a more reasonable time allocation. This last preoccupation refers to the need for allowing researchers to be more efficient in the use of their highly specialized and costly time.

The most important factors indicated to improve quality are summarized in Figure 5.2.

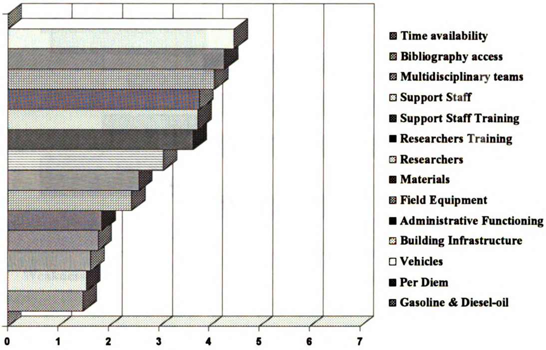


Figure 5.2 Opportunities to improve quality of the projects according to researcher opinions.

5.2.3 Strengths and Weaknesses of Factors

There was an in depth discussion among the staff about internal environment analysis. This was done in development of the strategic planning of the MTIP. The organizational strengths and weaknesses were examined in relation to the external opportunities and threats. The meetings were very productive in terms of the broad scope of exchanges of ideas treated from diverse perspectives (Díaz and Durán, 1995). It started a brain-storming process. After screening them, some remarkable issues were established to be considered in the strategic planning.

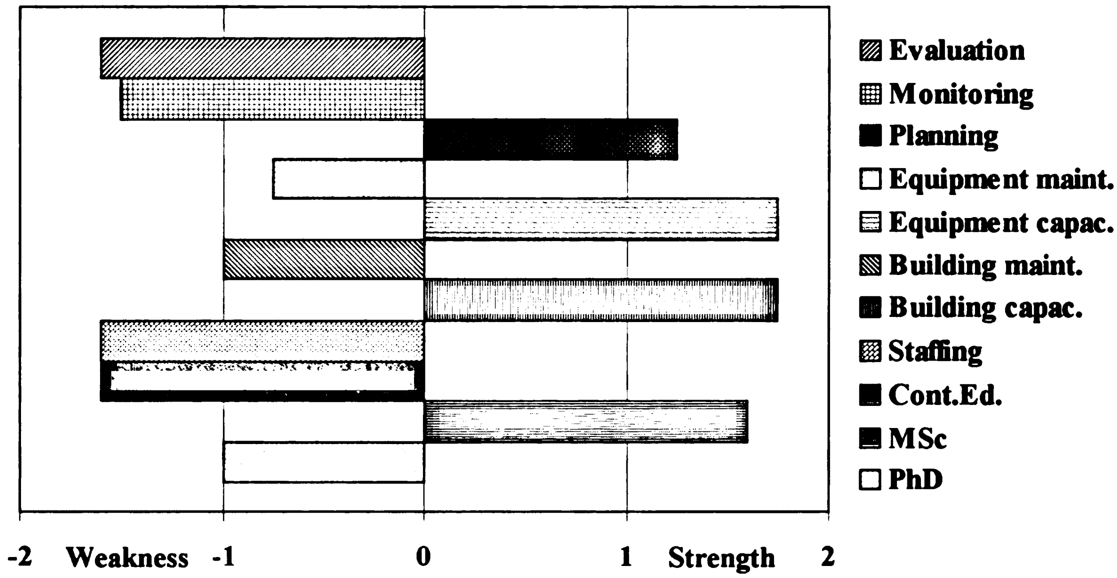


Figure 5.3 Strengths and weaknesses of main factors included in the Internal Environment Analysis, during the Medium Term Strategic Planning.

In relation to organizational capacity, the results found in this internal survey (Figure 5.3) showed similar tendencies to the ones presented before in section 5.2.2.

The judgment about the factors from this survey in relation to organizational capacity can be summarized as follows:

Regarding the physical resources, the building and equipment capacity was considered high, principally based on the INIA/IDB Project implementation, but the maintenance of them seemed to be a future problem.

Human resources staffing was a critical area needing improvement. With regard to training, the post-graduate study at the level of the M.Sc., was considered a strength. It was based on a Project developed by INIA with the U.S.A. University Consortium for Generation and Transfer of Agricultural Technology in Uruguay, coordinated by M.S.U., and supported by the IDB Project. However, the proportion of Ph.D. degrees in the total research group should increase significantly. A continuous education program for all the staff was also recommended.

Regarding organizational management, it is clear that monitoring and evaluation were considered critical factors to be improved. But planning was considered to be already advanced.

This analysis may help future decisions on capital investment.

All the resources are necessary but not one alone is sufficient. Some direct consequences of the capital investments in the INIA/IDB Project were the building of capacity. This included three new buildings, remodeling of others, laboratories, new sophisticated equipment, and machinery, green houses, growth chambers, seed units, and information system (Chapter III).

There appears to be a synergic complementarity between the IDB funds applied mainly in capital investment, and the increase in INIA's own resources, mainly for human resources salaries and for operating costs. This has resulted in a relatively balanced organizational capacity development in recent years.

That point is critical because the human capacity must be closely related to policies and priority setting. It is difficult to re-orient an organization to different purposes because of the extended gestation period for activities in agricultural research. The operating costs, on the other hand, are more related to the execution of current projects.

Before the re-formulation of INIA, agricultural research was characterized by unbalanced availability of resources. This may be explained by the restricted allocation of different sources of funds, leading to inefficiencies and inadequate utilization. The diagnostic work helps anticipate these future problems related to conservation of the expanded infrastructure.

These are well-known problems in agricultural research, and decisions on new investments must be linked closely to decisions on how to overcome inadequate funding for operations and maintenance.

FPTA plays an important role in complementing resources with those of other organizations for increased potential.

5.2.4 Infrastructure

The significant inputs of the IDB project were applied mainly to develop an appropriate infrastructure. This enormous effort was used efficiently.

The buildings were constructed with reasonable dimensions, taking into account the experience of other Experiment Stations in design, materials, laboratories, conference rooms, functional distribution of offices, and meeting rooms.

The concern for developing an infrastructure that would facilitate the teamwork philosophy was reflected in the new buildings. The oldest Experiment Station had just two meeting rooms; the latest has a much higher proportion of meeting rooms in relation to individual offices. There was strategic distribution to encourage people to work together in teams.

INIA has also incorporated modern equipment, and information technologies.

The challenge will be the future maintenance of buildings, and the renewal in equipment to keep it updated.

5.2.5 Financial Sustainability of INIA

INIA has been increasing its budget since it was first organized (INIA, 1998a). Figure 5.4 shows the evolution of the INIA budget and its sources for the last five years.

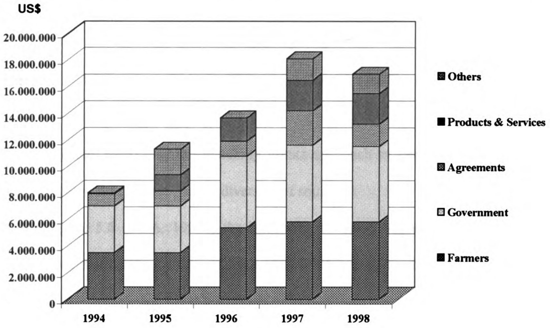


Figure 5.4 Evolution of the INIA budget and sources of the income structure (1994-1998)
Source: INIA, Unidad de Administración y Finanzas (1998)

All components of the budget are increasing, particularly the contribution of farmers and, consequently of the government. Sales of their own production and services are also growing.

This increase in the budget is accompanied by a controlled human resource policy which allows allocation of up to 43% of the expenditures in operating costs (INIA, 1998a) ((Figure 5.5).

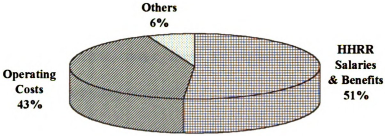


Figure 5.5 Global composition of INIA expenditures (1998)

A main reason for that is the matching grants approach to financing that INIA has adopted, in which funds come from a diversity of sources.

In the Figure 5.6 (INIA, 1998c) the increasing income obtained from licenses and royalties of crops and forage cultivars released by INIA is presented.

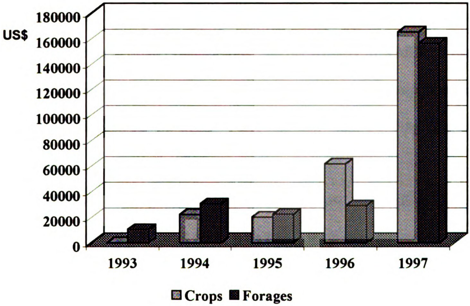


Figure 5.6 Incomes obtained by licenses and royalties of crops and forage cultivars released by INIA in the last years.
Source: INIA, Area Cultivos (1998).

The Royalties are an example of outcomes that are increasing INIA 's income, as consequence of successful release of well-adapted material to improve the systems of production. At the same time, these show an indirect indicator of relevance and effectiveness in the plant breeding programs.

5.2.6 Human Resource Development

The internal surveys at the beginning of the process showed that human resource management and development issues were the most important limitations in improving the quality of the products, services, processes and management in INIA. ISNAR had provided the basis for establishing a Human Resource Unit in INIA that was described in Chapter III. INIA's is autonomous status had provided the opportunity for a thorough appraisal of the previous conditions of service in the central administration.

Nevertheless, the results found in the internal diagnostic work at INIA reflect the same situation common in other organizations, and particularly in NARS. It included the following dimensions of organizational behavior: motivation, leadership, communication, conflict management, delegation, decision making, and team building (Bennell, 1989; Wagner, 1995).

A long process was developed to reformulate human resource areas in INIA. Its main feature was teamwork at the national level, with a high level of personnel participation.

The *Human Resources Re-Formulation (1999)* was a process in which the author was involved in the coordination. It resulted in new staffing, job description and analysis, appraisal performance system, career planning, and rewards, covering the main area of human resource management and strategies (Schuler and Huber, 1993). As a result of this participative process, more competitive salaries in relation to the market were assigned, increasing at a general average of about 11%.

The Board of Directors′ resolution, dated 3/5/99 refers to "the external specialized consultant support, a first adjustment of critical cases in December of 1997, and then, the participation of the personnel, during June and July of 1998, through facilitators Teams, based on a proposal related to Job Evaluation, Appraisal Performance, and Career Plan, and these suggestions from the personnel were studied and incorporated in the proposal" (INIA Board of Directors' Resolution N° 1.424.99)

As a consequence of this participative human resource re-formulation, INIA has adopted a new staffing pattern, appraisal performance system, and career plan. These are well known by the staff because they were discussed during this process.

An important insight on this process comes from comparing two questions. One was a question in the initial survey in December of 1996 about what personnel were willing to contribute to the continuous improvement process. That was very positive, even with the natural doubts on the implementation of something new in the organization. After participating in this experience, the final attitude of strong support in continuing with it was expressed in the final survey.

Figure 5.7 presents data from the survey of all INIA's staff at the beginning of the process (December 1996). The very positive position at that time expressed the need for strong teamwork, cooperation, commitment and involvement, training requirement and communication.

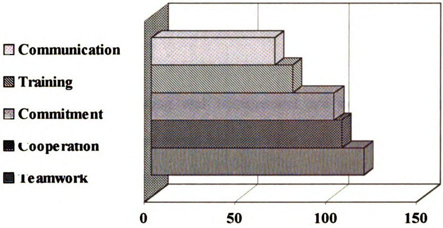


Figure 5.7 Contribution of personnel to the implementation of the Continuous Improvement Process at INIA.

In this process, the attitude of the personnel seems to be reinforced. The frequencies of respondents to the question about continuing the application of the continuous improvement methodology to organizational development, showed a mode of 6, in a scale ranging from 1 to 7 (Figure 5.8).

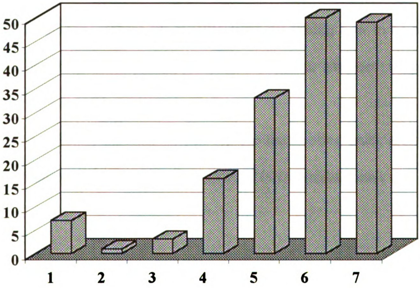


Figure 5.8 Frequencies of respondents on continuing the application of the Continuous Improvement methodology to Organizational Development.

The most important guidelines of this reformulation were the following:

a. Staffing

Human resources planning and management are centrally concerned with the establishment of appropriate reward systems. The main objective of any compensation scheme is to seek to maximize employee productivity in accordance with organizational objectives.

Attractive careers based on appropriately designed grade and salary structures are an essential prerequisite for: a) high quality searches, by recruiting the most qualified professionals, and b) keeping researchers well motivated to carry out their duties and responsibilities.

A comprehensive scheme for the grading and pay structures of researchers, technicians, and support staff was developed.

The new scheme is a matrix structure of positions, including 13 categories of jobs and 14 levels for each category. There are specifications describing how to be promoted in vertical and in horizontal directions, based on the scores obtained in performance appraisal.

These grades and salary schemes, which replace the existing ones, are designed to meet the motivational and overall career needs of INIA professionals and other staff categories.

b. Appraisal Performance System

The performance of the staff is the main objective of the agricultural research manager.

Staff appraisal has greater potential for improving performance than any other area of human resources. In general, appraisal performance assessment systems have the problem that the performance of scientists, in common with other knowledge workers, is difficult, given the complexity, uniqueness, and novelty of the tasks carried out by the agricultural research organization.

An appraisal performance assessment system was approved by INIA in 1994, based on objectives accomplished, and introducing great changes from the central administration system (Allegri and Cerizola, 1994).

However, it was reviewed in the whole participative human resources re-formulation.

c. Human Resources Training

The Institute has a long tradition of encouraging researchers to participate in continuous training, and the post-graduate formation degree is a main requirement. These programs are supported by different international cooperation agencies, and complemented when needed with INIA´s own funds.

During recent years, a large program, funded by an IDB loan, was developed with seven USA Universities, coordinated by MSU, providing funds to 35 post-graduate researchers.

The training policy for Ph.D. degrees has changed considerably, and increased the proportion of Ph.D.s among INIA researchers. The 6% Ph.D. and 3% Ph.D. candidates in 1994, increased to 16% Ph.D. already finished and 10% currently studying in 1999 (Figure 5.9).

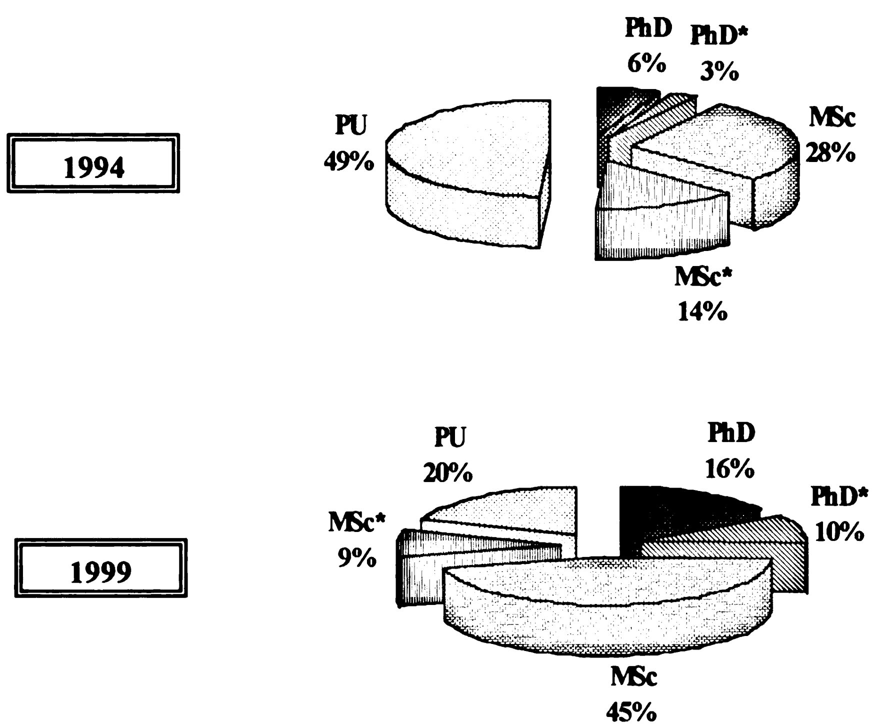


Figure 5.9 Evolution of the post-graduate degree distribution. 1994-1999

PU (Bachelor Degree); MSc* and PhD* (researchers currently studying)

It is shown in Figure 5.10 that 55% of researchers have been trained in Universities in the U.S.A. M.S.U. has prepared the largest number.

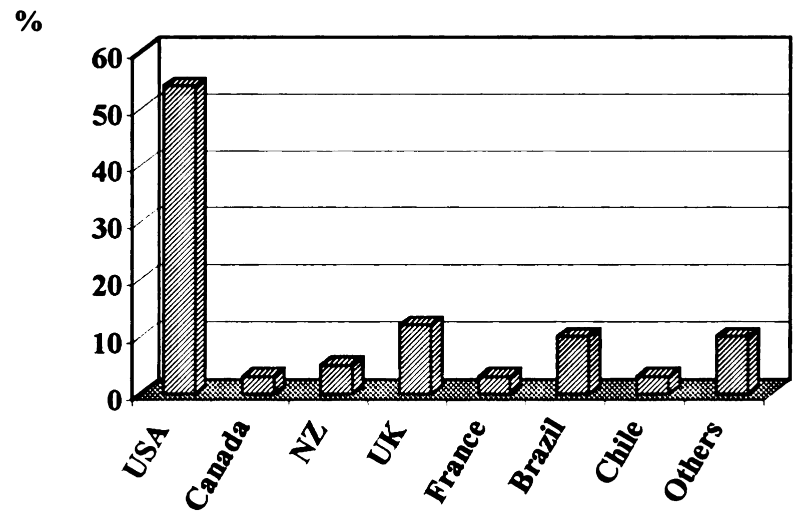


Figure 5.10 Post-graduate degree distribution according to countries.

Participation in international activities through short courses, training in specific techniques, seminars, workshop and congresses is also encouraged by INIA.

5.2.7 Planning, Monitoring and Evaluation (PM&E)

"INIA will have to go in depth with the permanent system of planning, monitoring and evaluation integrated to the Continuous Improvement Process and Total Quality Management" (Bonino, P., President of INIA at the inauguration day of the present Board of Directors, May, 1997).

In relation to this, INIA is currently revising its PM&E processes, and planning to establish a new Unit, based on the experience obtained in recent years. This study has contributed with methodology and instruments for future actions. These modifications are included in the new project profile guide adopted by INIA.

To consolidate a PM&E Unit in the new organizational structure, a specific strategic project has been included in the IDB/INIA II Project.

5.2.8 New Project Profile Guide

As a result of this reflective process, a new Project Profile Guide was defined and internally distributed in 1997.

Research projects were formulated based on problem identification within the framework of the strategic documents. This was done at the level of each Area, which defined the orientation, the main areas of strategic intervention and within each of them, the research topics in the Medium Term Indicative Plan.

A Project to be carried out by INIA was defined as: a set of activities, oriented to the solution of an identified problem, with established results to be obtained in a defined term, through a determined methodology. It is to be executed by a research team, with the application of given resources through an established budget process, and with indicators of accomplishment which facilitate its monitoring and evaluation.

The project is the smallest unit of institutional management. Projects are used to organize research activities to accomplish common objectives, and to identify needed resources.

This new guide for formulating projects includes indicators to facilitate the monitoring of activities and evaluation of their results.

A guide for the new format for research Projects in the next Medium Term Indicative Plan was developed at a Workshop at the Experiment Station INIA La Estanzuela. It was then improved by the Project Unit in collaboration with the researchers (INIA, 1997b).

5.3 Organizational Motivation

The participation in the learning process teamwork for continuous improvement, in the multidisciplinary approach, in the shared mission and vision, as well as in seeking ways of improving communication has been vital in strengthening the organizational motivation.

5.3.1 The Learning Process Teamwork for Continuous Improvement (LPTCI)

A vital contribution to organizational motivation is the Learning Process Teamwork for Continuous Improvement (LPTCI). It is based in the Total Quality Management (TQM) approach, as a tool to engage in this organizational development process.

This process was promoted and it is increasingly encouraged by INIA's Board of Directors. The main steps developed in the implementation of this process were the following:

1) Guide Team Actions.

A multidisciplinary team was established and it started by defining its mission as follows:

Guide Team Mission: "To lead the Process of Continuous Improvements, being an example in the action, promoting and encouraging the implementation of the Master Plan, defining indicators of success of Quality, strengthens of definition of shared Mission, Vision and Values, connected with the reality, creating in people empowerment and the commitment of Quality" (Guide Team Mission as defined by the members themselves).

The guide team examined the available information, basically found during the execution of the projects in the MTOP (Table 5.1), the opportunities identified to improve quality of the projects (Figure 5.2), and from the weakness, that were viewed as opportunities to improve quality, from the internal environment assessment in the MTIP (Figure 5.3).

The different diagnostics were in general agreement, showing that the organization, at that moment had a very satisfactory infrastructure (in terms of buildings, field machinery and experimental equipment, greenhouses, laboratories, computer hardware and required software, integrating network among the experiment stations, vehicles), and the operation costs (such as inputs at the level of field and laboratories, per diems, gasoline and diesel to travel within the country, and resources to cover participation in international events).

However, compared with the physical and financial resources, the human resources management and development were considered the main areas that needed to be improved.

2) Experiment Stations Meetings survey

After the meetings at the Experimental Stations with INIA authorities and all the staff from November to December 1996, the guide team analyzed the data collected. They identified the most important ideas, the main obstacles and restrictions that might interfere with the implementation of the continuous improvement process, the best attitude to contribute with actions to be taken, emerging doubts, and related suggestions.

The opinion of the personnel about the suggestions to improve quality in the organization (December 1996) is presented in Figure 5.11.

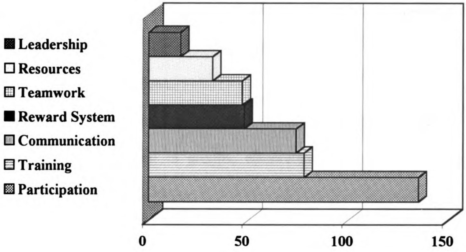


Figure 5.11 Suggestions to improve quality in the organization from the INIA's personnel.

It was shown that participation was required from the staff in: a) the process, b) training to contribute effectively to it, and c) to improve communication, the reward system and teamwork, which were new ideas introduced and are related to organizational motivation.

3) Reaffirmation by Board of Directors

In his inauguration speech, the new President of INIA said that "the concept of quality in the products, processes and management is integrated to everyday language of any productive initiative, and it transforms an imperative to internalize in the INIA organization, and it will have to incorporate definitively the continuous improvement process and total quality management." (Bonino, 1997).

The President of INIA, on behalf of the Board of Directors, also supported reinforcement of the continuous improvement process through a letter sent to each member of Facilitator Teams remarking the highest priority given to this process.

4) Training Facilitator Teams.

During the intensive seminar/workshop in July 1997, the members of the guide and facilitators teams, working in groups, elaborated and defined the following shared missions:

Facilitator Team Mission: "To contribute to identify problems and to support methodologies of working, interacting with the staff of the Experiment Stations, National and Regional Directors, and Board of Directors, promoting the process of continuing improvement, facilitating communication, a better working environment, as well as motivation and human resource development, towards improvement of the quality of products and services offered at regional level, taking into account the mission and vision of INIA, in order to satisfy the requirements of clients" (facilitator team mission as defined by the members themselves).

This training had received a very positive evaluation from the participants about the organization of the workshop, the program and thematic content, the methodology utilized, and the level of participation. It was rated from 3.4 to 3.9 in a scale from 1 to 4.

Reflections written by participants in the evaluation of it also were very enthusiastic. Some of them are presented here:

"The best way to improve the organization"

"The only road for INIA to transit to improve its management, but I have doubts that the urgent activities will put this process in second place"

"It is the boat that will take us to new ports, it is different, challenge and feasible to address in an institutional teamwork effort"

"Very positive if it is well applied, promotes teamwork, personal motivation and self-development"

"We are in a good road and we feel motivated to collaborate through this process"

"Excellent opportunity to grow institutionally and at the individual level"

"As in any journey I see potential problems, but manageable, particularly with the strong support expressed by the members of the Boards of Directors"

"It will be a great contribution to improve the internal environment, and principally, the relationship with the external environment, our users."

"We came to this Seminar/Workshop with lack of trust and we left with the conviction that it is a must to do it as the only way toward improvement."

"The moment is very appropriate to start with"

"An essential activity, it should be faced seriously to become leaders"

"It is the process to achieve the excellence"

"It is the way to adapt to the modern vision of organization for the XXI Century"

Suggestions:

"To continue with this process, INIA authorities have to support it, strengthen it and give it priority to the Plan of action of the Teams"

"Permanent and unconditional support, to continue with training"

"To continue in contact, there was a very friendly activity, with high collaboration in the group"

" To improve daily in order to achieve quality leadership of our organization"

"To keep the leadership by internal staff, developing activities at the experiment stations"

"To prepare own manuals and specific bibliography for INIA related to the issues treated"

"To internalize in the simplest way indicating what we are looking for at all levels in the Institution,"

"My recognition for considering me for this challenge mission"

"Go ahead!!"

5) Teamwork Groups for Continuous Improvement.

Teamwork groups were developed in relation to the regional level emergent problems from each experiment station's surveys, as well as institutional problems identified and prioritized at the national level (from the internal environmental analysis during the strategic planning. Each facilitator team identified specific problems on which to work, and some of them also work on institutional problems at national level.

At the regional level, there were prioritized problems such as, receptionists and internal communications (INIA National Direction-headquarters), toxicity from agrochemical products manipulation (INIA La Estanzuela and INIA Salto Grande), the movement to a new building (INIA Treinta y Tres), lunch facilities and functioning (INIA Tacuarembo), arrangements for staff transportation to works (INIA Las Brujas).

At the institutional national level the main problems prioritized were human resources reformulation, administrative procedures, communication, and work safety.

As an example, there was a working safety group, in which specialists participated with staff at the experiment stations. A diagnostic process was carried out with the purpose of identifying labor risks and the causes.

Based on the recommendations, INIA is improving labor safety and environmental protection, dealing with such potential problems, as: risks in the management of agrochemical toxicity, risks in agricultural equipment, industrial risks, risks of fire, risks in laboratories, traffic accidents. As a consequence, teamwork has been established in relation to each of these main issues.

6) Human Resources Teamwork

The human resources area, was identified as the most important problem to be treated under this methodology. It involved all staff, at different moments, and it was very high in time consumption.

A group including personnel from different experiment stations and categories (researchers, technicians, administrative, labs and field workers), worked with the support of a private consultant to develop a draft proposal. After discussion with the National Coordination Committee, and the Board, a tentative proposal was introduced through the facilitator teams in a two-day workshop at INIA La Estanzuela. Later, it spread out to the rest of the staff, and feedback was received from them. This was a clear signal that the most important issue at that moment in INIA was analysis of it through a structured questionnaire to obtain a systematization of the ideas and contributions. Even though the people were in an early stage of the process, and taking considerable challenge (risk to fail for lack of enough training), the Board gave strong support and there was a consensus among the teams regarding taking this responsibility.

The principal suggestions to incorporate in the proposal, evolved through consensus by the staff, were introduced by the Board in the final document. It was adopted in Resolution dated March 11, 1999.

At the end of the human resources reformulation process, the opinions of the staff were collected and analyzed through the parameters available in the statistical package. The description of the most relevant parameters, are presented in the table 5.2.

A global analysis considering Staffing category, age, sex, and region were analyzed globally because of the independence of variables found.

The results show that the opportunity to include this proposal on human resources within the LPCIP was considered appropriate. While the knowledge of the proposal on human resources previous to participation of the staff in this process was very low, it was improved by the effective transmission of the proposal. The methodology of working in groups to accomplish the stated objectives, the contribution of these actions to improve the communication at the institutional level, the possibility of expressing the opinion from the staff in this consultative process, and, particularly, the desire to continue the application of the LPCIP methodology to organizational development in INIA, were very high.

These tendencies are demonstrated through the median and mode values.

Table 5.2 Mean, standard deviation, median, and mode of the INIA personnel after the human resource participative reformulation process (n=197).

	Mean	*St.Dev.*	*Median*	*Mode*
To include HHRR in LPTCI	5.295	1.447	6.000	6.000
Knowledge previous of proposal	2. 489	1,122	2.000	1.000
Effectiveness in the transmission	4.506	1.418	5.000	5.000
Appropriateness of methodology	5.375	1.286	6.000	6.000
To be able to express your opinion	4.839	1.644	5.000	6.000
Contribution to communication	5.236	1.347	5.000	6.000
To continue LPTCI in INIA	5.597	1.364	6.000	6.000

These results show the very strong support from the INIA staff for continuing with the application of the continuous improvement and teamwork methodology as a way to achieve organizational development.

Administrative issues, information technology system, communication and work safety or security, were also selected problems.

5.3.2 Multidisciplinarity

By promoting the format of mega-projects, the number of projects was reduced and the size of their corresponding research teams increased. The expected impact, also, will be higher.

The great increase in number of disciplines in each project, and also, number of researchers and commodities in each project, as a result of this strategic planning has been accompanied by the culture of teamwork. This is more important than the quantitative analysis. The research teams were formed to create proposals according to the problems/opportunities prioritized, and this was accomplished through work together, from the beginning, looking for consensus in the decisions regarding the projects.

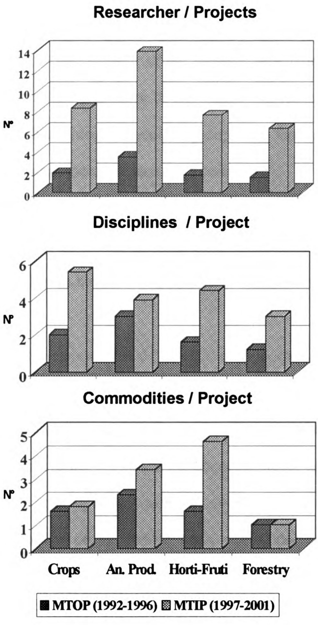


Figure 5.12 Changes in the number of disciplines, researchers and commodities by project from MTOP (1992) to MTIP (1996).

5.3.3 INIA's shared Mission and Vision

The collective exercise, including external and internal participation in the discussion about "our mission and vision", resulted in simple, clear and precise shared statements, as follows:

Shared Mission:

"To contribute to the development of the national agricultural sector through the generation, incorporation and adaptation of knowledge and technologies, making them available for the benefit of farmers, considering important factors such as government policies, sustainability, agro-industrial sector and consumers".

Shared Vision:

"To be a national and regional institution providing leadership to foresee agricultural needs and recognized for its human and professional excellence and the quality of its services and products".

The mission and vision established for first time at INA, during this strategic planning, were included in all institutional publications, in picture frames in all conference rooms at the experiment stations and headquarters, and well as displayed in other different convenient forms, within and outside of the organization.

The shared mission is in agreement with the results from the survey of researchers about ex - post evaluation of the MTOP (May 1996), that indicated the primary importance of farmers as immediate users of the research outcomes (Figure 5.13).

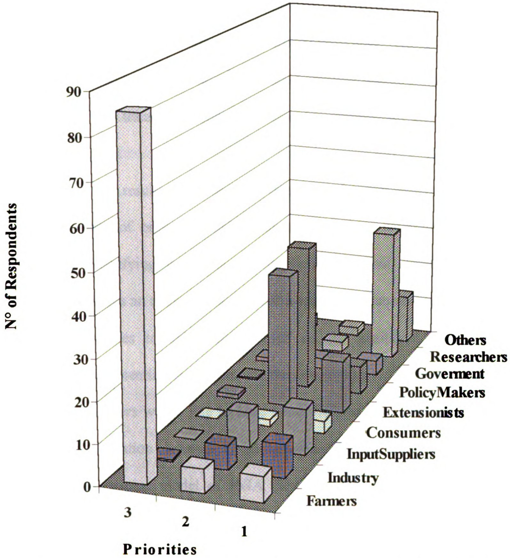


Figure 5.13 Immediate users of research outcomes, according to the researchers.

5.3.4 Communication

Communication is one of the main concerns drawn from surveys carried out in INIA during this process. This is considered a common situation in organizational behavior in general, and particularly in agricultural research organizations.

Internal communication is crucial and it is a weakness to be addressed. The implementation of a participative continuous improvement process, involving all personnel, will contribute to improve this crucial weakness. This general assumption was drawn from the survey at the end of the human resource teamwork in July 1998.

Fluent and transparent communication are essential for an open environment and healthy workplace.

Based on the results from surveys related to internal environment assessment, a diagnostic study of organizational communication was developed in INIA with the purpose of identifying problems restricting the internal communication processes. Besides that, it was an attempt to analyze the causes, consequences and implications, and feasible alternatives to solve them based on the available resources, as well as identification of potentialities to continue the development of communications.

Some researchers would like to have better defined roles, operating procedures, and vertical communication channels. These considerations are related to the matrix structure and the organizational model of INIA. The conflicts that arise, mainly overlapping programmatic and operative areas, require appropriate management to keep conflict to a minimum.

Even though the level of motivation is most directly influenced by the compensation scheme, the motivational needs and responses of research scientists have particularities. The optimal compensation scheme for research scientists will recognize that researchers place considerably more value on non-financial extrinsic rewards, such as the need for professional recognition and autonomy, opportunities for achievement, challenge, and self-actualization than conventional intrinsic rewards based on material gain, such as salary and other benefits.

5.4 Organizational Performance

The programmatic analysis of past and current institutional performance, through the Collaborative Evaluation Process (CEP), was the first phase of the research. It supplied essential information required for the internal environment analysis within the strategic planning process.

This was an ex–post evaluation of INIA's technical-scientific research activities carried out during the Medium Term Operative Plan (1992–1996).

It was programmatic diagnostic institutional research, based on the following criteria:

5.4.1 Effectiveness

5.4.2 Efficiency

5.4.3 Scientific Quality

5.4.4 Programmatic Consistency

5.4.5 Relevance

5.4.1 Effectiveness

Effectiveness was defined as accomplishment of the explicit technical-programmatic goals, and was measured on a scale of 1 to 7. The 100% effectiveness included the final reports, and the evaluation was made during the last year of execution. A generally high effectiveness in the research projects of the previous plan was found (see Table 5.3), with a mean = 4.80, and standard deviation = 1.29.

The incorporation of projects as the basic units of work in research had been incorporated in the previous plan. These facilitated the accomplishment of the expected outcomes.

As an example, according to a recent report (INIA, 1998c), INIA's cultivars in legumes and grasses for forages are covering most of the seed used for improving pastures, and 17 cultivars were released during this decade. In cereals and oil crops, the adoption is increasing rapidly, achieving 97% in rice (Figure 5.14).

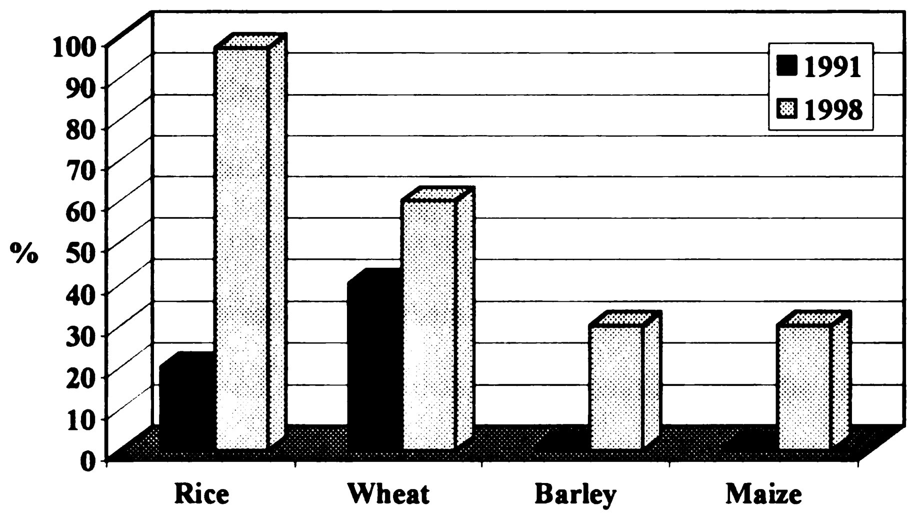


Figure 5.14 Evolution in the proportion of the market occupied by INIA's cultivars
Source: INIA, Area Cultivos (1998)

5.4.2 Efficiency

Efficiency was determined as an estimation of relationship between effectiveness and costs, and was judged on a scale of 1 to 7. It was also high for most of the research projects (see Table 5.3), with a mean = 5.14, and standard deviation = 1.01.

The administration had developed a detailed information system to control costs. The center of costs for total allocation as a new administrative way to manage projects by responsible researchers has contributed to the increasing institutional efficiency in using the allocated resources.

5.4.3 Scientific Quality (Methodological Rigor)

The evaluation by leaders of the methodological rigor of the projects was high, and is shown in Table 5.3.

This can be explained by the high level of post-graduate education and experience of the researchers working in INIA.

Also, the previous External Scientific Committee, established at the beginning of the MTOP, was in charge of reviewing each research proposal, and making recommendations to reformulate them when needed. This was a requirement for each project to be approved, and contributed to accomplish with the standards of scientific quality of the research projects.

Table 5.3 Organizational performance scores given by leaders in the ex–post evaluation of the Projects executed in the Medium Term Operative Plan (1972-76).

	Mean	Standard Deviation
Effectiveness	4.80	1.29
Efficiency	5.14	1.05
Methodological Rigor		
Suitable Tittle	5.93	1.10
Methodology Validity	5.60	0.89
Data Collection and Analysis	5.51	0.98
Conclusions Drawn	5.67	0.95
Strategy Applied	5.56	0.91
Term Set	5.19	1.36
Scientific Literature Review	5.89	0.97
Publications Quality	5.06	0.97
Extrapolation of Results	5.16	1.23
Contribution to Thematic Units	5.17	1.32
Contribution to Programs	5.11	1.28
Relative Importance	5.33	1.34

5.4.4 Programmatic Consistency

The hierarchical contribution leads from Projects to Thematic Units, then to Programs , then to Areas, and finally to INIA's mission and vision.

The high score values found in relation to the projects' contributions to Thematic Units, and to Programs (means of 5.37 and 5.11, respectively), indicate a programmatic consistency. This is confirmed by the high values (mean = 5.33) for the relative importance of the projects within the Programs (Table 5.3).

5.4.5 Relevance

Relevance has been assessed in relation to the utility of the research results from the MTOP. At this time, it was about the new objectives for research projects. The process involved the external stakeholders as a main source of valuing.

During the discussion meetings, with RACs and WGs, the relevance of the research results and the diffusion activities were given very positive comments.

These are reflected in the relevance of the present Projects included in the MTOP, when evaluated as the first input for the formulation of the MTIP.

The proposed ideas about problems/opportunities for Projects to be included in the MTIP were discussed at meetings of the Regional Advisory Committees. The relevance of the Projects, mainly in relation to the next Medium Term Indicative Plan, was an input. Some projects were recommended to be continued without modification; others, for reformulation; and some of them, to be finished.

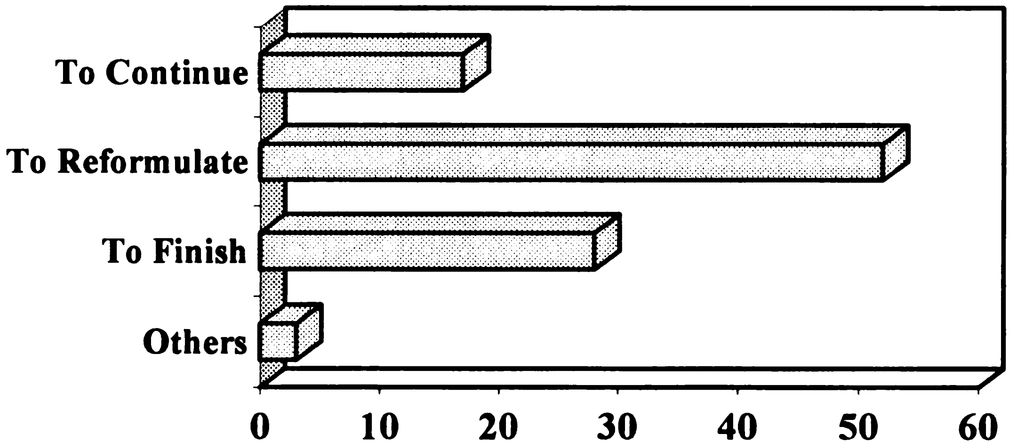


Figure 5.15 Leaders' recommendations based on prospective analysis of the projects in the Medium Term Operative Plan in relation to the next Medium Term Indicative Plan

As shown in Figure 5.15, more than a half of the Projects were recommended for reformulation, just 18% to be continued without modifications, and 29% to finish with preparation of their final reports.

These recommendations were related to the consideration on the stage of maturity of the process of technological development for each Project of the MTOP. According to the survey, most of the Projects were in early stages of the curve of developing, exploration or starting, taking risks, but when the opportunity of impact is very high, and in the stage of validation, transferring the technology to be adopted. The resources then, are allocated to other researchable problems with high priority and potential impact, instead of continuing work on adjustment with very low impact on the same line of research (Figure 5.16).

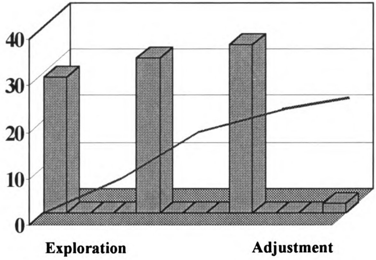


Figure 5.16 Stage of maturity of the process of technological development of the projects of the MTOP.

The general evaluation of the relevance was concentrated in the problem/opportunity identification for the coming planning (Section 5.5).

Relevance is strongly related to this issue, which had a deep change as a result of the strategic planning in INIA.

5.5 Problem Identification

The problem/opportunity identification is considered a key element in the research orientation process. It influences the demand-driven research process, and it consequently affects the future relevance and impact of the research outcomes.

5.5.1 Problem Identification in the MTOP (1992)

The data obtained from the self-evaluation of researchers (December 1996) are presented in Figure 5.17.

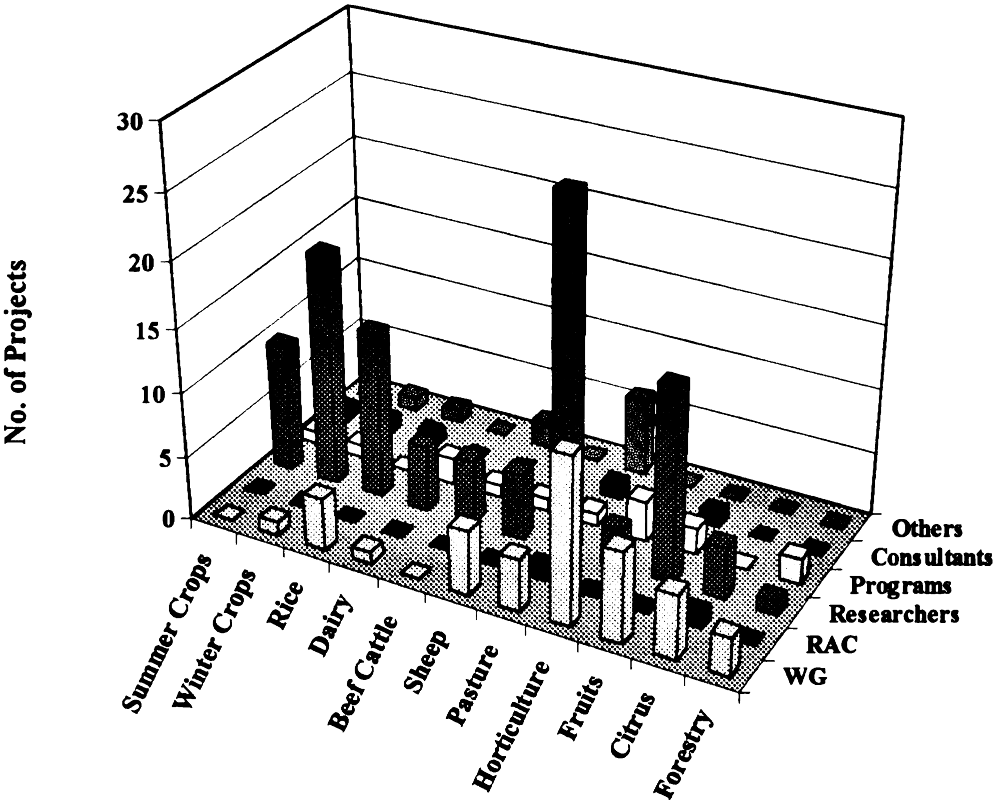


Figure 5.17 Sources of Problem identification, by Programs, in the planning of the Medium Term Operative Plan (1992-1996), according to the researcher's self-evaluation

This table shows that the past Plan was mainly deliberative, in which the researchable problems were proposed by the INIA researchers (supply-induced research). Even though the proposals were submitted to the Regional Advisory Committees to be approved before being implemented, the members considered that their function was mainly a legitimization of the problem assessment.

The WGs were the second source of problem identification, being the most important in the projects related to Horticulture.

This procedure of identifying the researchable problems by the researchers in 1992, may now be compared with the participatory strategic planning in 1996.

5.5.2 Problem Identification in the MTIP (1996)

A contrasting way of problem identification emerged in INIA. The sequence in the strategic planning basically was: 1) to identify the problems/opportunities, in collaboration between researchers and stakeholders, and then 2) to formulate research proposals by teams.

The priority ideas for projects for the next plan were developed in continuing back and forth dialogue among the RACs and WGs. Researchers and stakeholders utilized a set of connected steps as follows:

a) Prospective Studies by Areas.

The prospective studies by Areas were drafted by teamwork taking into account the documents on external environment analysis and the document on evaluation of MTOP. These studies were internally and externally validated, later on, and were the expected documents of reference to orient the technological agricultural research for the MTIP.

This framework characterized the principal productive systems (production, transformation and consumer) from economic, productive, and technological points of view.

They included (i) tendencies for the future 15 years, (future scenarios and expected changes in the components of the systems, threats and opportunities, analysis of critical factors, the main themes for research); (ii) the available technological solutions and the potential from research (characteristics of present demand, advances obtained in available technologies, lines of research to go in depth, capture of international available knowledge);

and (iii) conclusions and recommendations on the principal lines of research to develop and guidelines for prioritization and size.

In general, a technological gap was found between the national average rate of production and the advanced farmers, which is an opportunity for technical assistance organizations. But, a gap was also detected between these farmers and the results that could be obtained by applying the available validated knowledge and technologies, which should be faced by the articulation of generation and the technology transfer system.

As a principal conclusion, these analyses demonstrated the relevant tendencies in the present demand in the markets for higher quality requirements. The predominant productive paradigm in recent decades was concentrated on quantity and efficiency of agricultural production. The quality and value-added products were remarkable in all of them.

The sustainability of the system of production, and the effects from the application of the proposed technological changes on the natural resources (soil, water, atmosphere, biological diversity) have become a new essential responsibility for most of the NARS, taking into account the requirement of providing for future generations.

Therefore, the challenges for the agricultural research system, in a country where the agro-industrial continuum plays a key role in the national economy, is to contribute to improve the productivity, satisfying quality demands of final products, taking into account the markets which better value for the agricultural products offered, within a context of concern about sustainability of the systems of production and the natural resources.

The INIA plan of work has to be responsive to the demand, as expressed through the identified needs at the levels of systems of production. To satisfy these, INIA should utilize all the knowledge and technology already generated (in the institutional memory); capture all information available internationally; and seek relationship, coordination and collaboration through strategic alliances with public and private institutions at the national and international level.

This process of synthesis and the economic evaluation of technological information according to the needs of the systems of production should be the fundamental tool for communication among farmers and extensionists, promoting this two way mechanism.

INIA should try to harmonize the increasing requirement for disciplinary specialization with an effective integration in multidisciplinary teams, with the economic evaluation and validation of each proposed innovation of technology, to improve the relevance, effectiveness, efficiency and quality of the research as well as to facilitate the transfer of the obtained results.

These four documents by Areas were published by INIA (INIA, 1999a, 1999b, 1999c, and 1999d).

b) Identifying Strategic Issues

After including all the internal and external inputs, the strategic studies were drafted by the specialized technical committees, as a framework for setting priorities for the future planning.

Strategic issues facing INIA were described in terms of "windows of entry", taking into account the opportunities and threats (external environment) and strengths and weaknesses (internal environment), as well as reaffirmation of the mission and vision.

c) Topics of Prioritization.

The Prioritization of areas and themes were discussed among the researchers and the Regional Advisory Councils and extended Working Groups. These were main criteria for setting priorities based on the magnitude of the technological demand. The criteria to prioritize the objectives of agricultural research took into account quantitative and qualitative information about the (i) efficiency (importance of the commodities through production value), (ii) beneficiaries contribution related to INIA, (iii) international trade, (iv) future demand, (v) competitive advantages, (vi) probability of success, (vii) potential adoption rate, (viii) institutional capacity, and (ix) participation of other institutions of the national system, and international cooperation. Also considered were factors such as equity, number of farmers, effects on use of resources such as land, labor and capital, the magnitude of the effects on productivity, costs of production, and quality; and sustainability including contribution to sustainable agriculture and to conservation of the environment.

d) Drafting Pre-Proposals

After the topics were prioritized based on consensus in the discussions among researchers and stakeholders, then the researcher teams formulated pre-proposals to address the problems/opportunities selected.

The encouragement to form multidisciplinary integrative teamwork in relation to major problems/opportunities in order to achieve potential impact, was reflected in the resulting 56 Mega-projects.

e) Relevance of Pre-Proposals

There was external participation and consultant validation in meetings with RACs and WGs. These took place in the experiment stations where the Programs are conducted.

There were several meetings with the RACs and expanded WGs during the process, offering continuity of participation in the discussion of the relevant problems/opportunities for the next MTIP.

In November 1996, the progress of the on-going process and the ideas for Projects were summarized and shared with the involved stakeholders. These ideas were presented by researcher leaders, and discussed in open consideration with group members.

In order to quantify the feed-back, the opinions of the participants about the relevance of these ideas, and suggestions to include them in the list, were collected and analyzed (November 1996).

This opportunity, even to add and incorporate some that might have been left out during the process, illustrates that the methodology applied tried to assure that participants could review their contributions in the final MTIP.

These ideas of Projects, elaborated by teamwork of Regional Advisory Councils and extended Working Groups at the five Experiment Stations, were generally accepted by them, as shown in Table 5.4. These judgements were expressed during the discussion in the meetings, and were reflected in the survey conducted at that time. The means values were defined by the stakeholders (as they are agricultural research's client and customer). The values assigned by stakeholders are high for most of the ideas. That is clear in the modes, which are between 5 and 6, with a maximum of 7.

In the case of the rice sector, with a very positive experience in collaborative research during the last years (Echeverria et al., 1989). there was meaningful participation by farmers and mill representatives at the regional level in the Experiment Station in the planning process. The delegates of the Rice Growers Association and the Millers Association sent a letter to INIA after this consultant process, expressing "our full conformity with the final presentation of the researchers about the ideas of research projects for the next plan, which was under consideration in several instances in the RAC and WG. We consider very valuable all these instances carried out and the discussion about planning in the framework of a good or effective development of the research in the cultivation of rice" (August 6, 1997).

This stakeholder participation during the planning process is critical. The recent USDA stakeholder input requirements for recipients of agricultural research, education, and extension formula funds, is an outstanding example in the USA. The Department of Agriculture, through the Cooperative State Research, Education, and Extension Service (CSREES), introduced the requirement for land-grant institutions that receive agricultural research, extension, or education formula funds to establish a process for stakeholder input on the uses of such funds, reporting annually to CSREES the actions taken to encourage stakeholder input and a brief statement of the process used by a recipient institution to identify individual or groups as stakeholders and to collect input from them (USDA, 1999).

Table 5.4 External Stakeholder's opinions on the relevance of pre-proposals of Projects to be included in the MTIP (1997-2001). RACs and WGs.

	Projects	**Mean**	**St. Dev.**	**Mode**
Cereals and Oils	13	4.3-6.2	1.7-0.8	5-7
Rice	9	4.9-6.6	1.2-0.5	5-7
Animal Production	20	4.7-5.9	16-1.4	5-7
Horticulture	11	4.7-6.0	1.2-1.0	4-6
Fruit	15	4.8-6.2	1.1-1.0	4-7
Forestry	5	4.9-6.2	1.2-0.9	5-7

f) Approval of the overall Medium Term Indicative Plan.

Finally, the Board of Directors, approved the Medium Term Indicative Plan, with adjustments, for the next 5 years, in December 1997. After a final review, they were published.

In summary:

The probable scenarios for the integrated agro-industrial chains were established, considering the tendencies of relevant critical factors in the external environment analysis.

From the internal environment analysis, the discussion of relevant technological themes advanced significantly.

Strategic Areas of intervention for INIA were established, as main "windows of demands". Later on, the possible themes with the most potential impact for INIA were defined, identifying the principal technological limitations.

The proposals for Projects were formulated taking into account the technological limitations in order to carry out this demand-driven approach.

Then the research projects were defined, looking for large projects, concentrating on efforts to increase the probability of success, and consequently, the necessity of teamwork formation.

Finally, areas, themes, and projects related to commodities were identified.

Given the steps described, a demand-driven process was followed to assure the stakeholder's opinion as a main input in planning.

5.6 Research Agenda

The research agenda had introduced fundamental changes. As the President said (Bonino, P., 1997): "the changes in the world in the last years are faster, our external reality is in permanent change, and new technological concepts and methods have been introduced in agriculture. Productivity considered as a single objective has evolved toward sustainable development and environmental protection. The scientific community has internationalized the concern for environment preservation, including genetic biodiversity, soil, water, and atmosphere. On the other hand, the biotechnology, the information, and the basic sciences have had advances and continuous application in agriculture, stimulating the private sector participation to create and use highly appropriate technologies. Also, the influence of consumers, through the quality of the products and processes, has increasing importance in the markets, and this appears as a threat than can be converted to an opportunity for Uruguay".

5.6.1 Policies and Strategies

The principal policies and institutional strategies determined at the final stage of the strategic planning, after the internal and external discussion, represent a framework for INIA's future actions. They were the following:

- To take into consideration *Quality in all forms*, in agricultural products and services, processes, and institutional management, as required to expand the markets.

- To contribute to the preservation of the *natural resources and environment as well as the sustainability* of agricultural production, broadening horizons for the long term for their growth.
- To continue considering the productive *intensification* of the different agricultural sub-sectors.
- To improve the identification and prioritization of demand for technology, in order to establish a client-oriented, *demand-driven* research agenda.
- To strengthen the linkage among various components of the *agriculture - industrial continuum*, allowing for their increasing integration with primary production.
- To adapt the research to the changes produced as a consequence of the "opening" of the national and regional economies, and the *globalization* of the markets.
- To establish more *partnerships* (strategic alliances, joint ventures, networks) at the national, regional and international level to promote a more efficient development of the technologies, optimizing resources, and making complementary use of the different institutional capabilities.
- To promote *international technical cooperation* and the relationship with centers of excellence at the world level, pursuing matching interest, mutual benefits, and complementary resources.
- To construct an *institutional image*, consolidated through bridges of communication with broad sectors of the society, including those not directly related to the agricultural sector.

5.6.2 Quality

INIA is giving priority to quality issues. Some examples include:

INIA has reinforced the continuous improvement process and is working with ISO 9000 and 14000 in some specific processes, such as, seed production and biotechnology laboratory.

It is participating actively in the National Quality Committee, as a member of it with Ministries and the National Quality Laboratory (LATU).

INIA and LATU are both supporting and financing the implementation of the Uruguayan System of Accreditation, Normalization, Certification, Calibration and Testing (SUANCE).

INIA has been designated by the Uruguayan Association of Enterprise for Quality and Excellence (AUECE), as an institutional member, based on the effort and encouragement for quality at the national level.

Increasing quality requirements from final consumers are translated to the primary agricultural sector through the industrial and export sector. The required tracebility of the products by consumers in international markets are forcing producers to identify the origin of the animals in the system of production, and through the agro-industrial chain. At this moment this is critical with meat for the European Union.

This is why Uruguay has to strengthen the linkages among various components of the agriculture-industrial continuum, allowing for their increasing integration with primary production.

This relationship between the constituents of the agro-industrial continuum, is facilitated by the mechanism of round-tables, promoted by INIA. These involve representatives of all actors interested in a specific product during production, processing, and commercialization to final consumers. At the moment, there are round-tables on barley for beer, wheat, rice, and forestry.

5.6.3 Sustainability and Environmental Concern

Agricultural research in Uruguay has a long tradition of considering sustainability of the systems of production. An example is the rotational systems evaluation established in INIA La Estanzuela since 1963. The idea of rotational systems, based on integrating and complementing grass-legume pastures with crops, has been extensively adopted by farmers in Uruguay. The success of this practice, beyond the effects on the productivity of the whole system, is essentially based on the economy of nitrogen fertilizers and chemicals for crop protection.

In the last three years, there also has been in collaboration with LATU and farmers, a study on rice production, analysing residual effects of agro-chemicals in grain, soil and water. This type of monitoring, preventing contamination and pollution is spreading to another types of systems of production.

INIA has introduced in the Projects in the MTIP, what is called "green page", setting indicators to be measured in relation to the impact on natural resources (positive and negative) and the environment, as well as sustainability in the long term. This refers to effects from the execution of the projects and from the application of their results.

As a concrete response to this need, INIA is considering incorporating an Environmental Unit in the new organizational structure. It will be implemented in the matrix structure, including the main disciplines related to it (soil, water, agro-climatology, environmental economy, biological control).

5.6.4 New Technologies for Agricultural Research

After a specific evaluation of the Biotechnology Unit conducted in 1997, in which the author was involved, this area was reorganized. A new coordinator was recruited, and it is strengthening the biotechnology research capacity, in the context of the national strategy. Biotechnologists are linked with plant breeders, incorporating the breeding programs techniques, such as marker-assisted breeding, tissue culture, and PCR. Biosafety is an increasing concern, considering risk assessment for releasing transgenic materials, and the technical, commercial and political implications. The protection of intellectual property rights, international trade (Uruguay is member of UPOV), licensing, and policy issues related to technology transfer are increasingly analyzed and studied in INIA.

In communication, INIA is developing a growing plan. It is connected internally and on the internet, with an average of 1.4 computers per researcher. The programs needed for research (general and specific software), and intensive internal and specialized training for researchers and support staff are in place. INIA's site on the web, since 1995, has received an increasing number of visitors. Information systems are applied to research activities, laboratories, geographic information systems, services and institutional management, integrating research projects, administration and the human resources data base.

5.6.5 Partnership

INIA is strengthening partnerships with public and private organizations, at the national and international level, seeking for collaborative projects on developing technologies of common interest, complementing in a synergistic way the use of institutional capabilities and resources.

A key mechanism to coordinate effective collaborative research is through the Agricultural Technology Development Fund (FPTA). In the Law creating INIA it was introduced as a new way of strengthening collaborative research carried out between INIA researchers and outside researchers. It was established stipulates that INIA must reserve 10% of its core funds annually to contract research with other organizations as an average target. This is complementary to INIA's own research, and a researcher of INIA is the counterpart responsible for monitoring and evaluation of the research.

The FPTA has been instrumental for INIA as the key coordinator of the Uruguayan NARS, and it has strengthened collaboration with international organizations, such as CIMMYT and foreign Universities. FPTA's strength lies particularly in establishing and reinforcing strategic alliances, and in responding with greater flexibility to demands from farmers and stakeholders. INIA has over 77 Projects and contracts with more than 25 institutions.

In the next INIA/IDB Project II, the partnership will be reinforced. Based on the FPTA mechanisms, these will be competitive funds and research topics will be developed in strategic alliances with international centers.

Regarding alliances, INIA is trying to commercialize research products when it is convenient, developing joint ventures with private sector where the opportunity for production of appropriate technology exists, sharing funding responsibilities. INIA is doing joint ventures to complement the structure and experience of private companies for marketing, multiplication and massive distribution of research results. Such was the case of new cultivars released by the plant breeding programs of the Institute. When the new cultivar is ready, INIA calls through media for a public competition for this arrangement, considering royalties offered and background of the private firms.

INIA is also complementing efforts in some areas of common interest, in which the specialized human resources and infrastructure of the Institute combine with operative costs provided by funds from the private sector. One example is the case of malting companies financing research in the public sector to improve the malting quality of barley for the export. There is an agreement to cooperate on improving malting quality signed by INIA, the Faculty of Agronomy, the Technology Laboratory, and four malting companies. Because of the export orientation, the malting quality of barley provides significant value added. The results were new varieties developed and management practices recommended that improve malting quality.

This type of agreement to complement resources of private sector was also successfully developed with rice growers and dairy farmers, including the industrial sector (mills and factories).

These joint ventures between public and private sector organizations, in which costs and benefits are shared, may provide additional funds to INIA, but the public-good character of the research organizations and the fact that the farmers are co-funding the research conducted, have to be carefully considered.

The growing number of national (universities, farmers associations, public and private organizations) and international agreements signed by INIA give an idea of the diversity of areas and institutions.

The technical international cooperation with centers of excellence at the international level (mainly universities and international centers of the CGIAR) are on the Web site of INIA in Internet (www.inia.org.uy).

In brief, INIA is promoting international technical cooperation and the relationship with centers of excellence at the world level, pursuing matching interests, mutual benefits, and complementary resources, by using FPTA, and MOUs for bilateral relationships with universities and research institutes, country's agencies (USA, NZ: Australia; Canada, UK, Holland, Spain, France, Germany, Japan), technical financial agencies (IDB,WB), and active participation in regional Programs (PROCISUR, IICA, FONTAGRO).

By reason of co-funding projects with the international centers (CIMMYY, CIP, CIAT / FLAR, the three centers in the Latin American region, also ISNAR, IFPRI), Uruguay got a Seat as an Observer, and is becoming active member in CGIAR, since October 1998 (CGIAR, 1998).

5.6.6 Institutional Image

A survey on attitudes and behaviors was conducted in the rural areas. The results shown that INIA is well known and that most of the farmers identify with INIA's objectives (Equipos, 1997).

Based on the identified need to construct an institutional image, consolidated through bridges of communication with broad sectors of the society, including those not directly related to the agricultural sector (the rural but also urban society), INIA has developed a strategy based on massive media, and since the last couple of years other mechanisms, such as participation in Agricultural Active Expo-Show in different regions of the country. Last year in the main national Agro-Industrial Expo in the capital city, organized by the Uruguayan Rural Association, (600,000 visitors in two weeks, including from foreign countries), INIA has its first participation with a booth and other activities (video-conferences through all the country from there, active laboratories demonstrations, measurements related to productive parameters in animals, open discussions with farmers interested in round tables, and tours for schools). INIA's President, at the opening, expressed the Board satisfaction to be present. He spoke about "why (it is necessary that the whole society know what is INIA, what it does in benefit of the country, ...as the symbol of the indispensable technological autonomy that any country must have) and how rather for its ideas than for its structure, because our capital are the ideas and the knowledge, our power relies on creativity, seeking for new ideas, in the permanent purpose to move ahead our technological frontier), the challenge, then, is to show austerity in the materials and richness of thought, because this also is a national symbol". (President of INIA, Bonino, P. 1998). INIA got the highest award, registered the most visitors, gaining enormous repercussion through the media. This INIA presentation is a good example of collaborative multidisciplinary teamwork, in the proposal, implementation and functioning. It was evaluated as a positive process, involving the Board, Directors, leaders, researchers, diffusers, and support staff. Therefore, this successful participative process in a very professional context, has had external repercussion and also internal to foster spirit of the corps, and contributing to go in depth in the cultural transformation toward teamwork, as well as to strengthen the sense of belongness and identification with INIA.

CHAPTER VI

CONCLUSION

In the introduction of this dissertation the problem statement and research questions were described. Chapter II dealt with the related literature review, including the proposed framework and the protocol for collaborative action research. The context of the case study was described in Chapter III, and the methodology utilized to implement the framework, in Chapter IV. The findings from the processes were presented in Chapter V. This final Chapter provides a summary of the main conclusions driven by the research questions, some reflections and further implications, external evidence related to this process and research limitations.

6.1 Summary

Some conclusions can be drawn from several questions that have driven this research. They are as follows:

1. From a structural approach, how to assess the effectiveness, efficiency and quality of agricultural research activities?

In relation to organizational performance, a methodology was developed to assess effectiveness, efficiency, quality and relevance, adapting the CIPP model, including self-evaluation for researchers themselves (effectiveness, and efficiency), leaders of Areas and

Programs (effectiveness, efficiency, and quality), external peer evaluation (quality), and stakeholders (relevance). Instruments were created for data collection and analysis.

All these parameters of organizational performance were ranked with high scores. The Collaborative Evaluation Process gave valuable information about organizational effectiveness, efficiency, methodological rigor and relevance, and became a main programmatic input for internal environment analysis, to create the permanent ascendant spiral cycle of continuous improvement.

As a consequence of the process a new guide for project proposals was developed, incorporating constituents for later monitoring during the execution and ex – post evaluation of the results.

2. *From a systemic approach, to what extent are stakeholders involved in supporting the research programs to ensure that the research undertaken is what is needed? Is the institutional ability to respond to client demands increasing?*

Stakeholders in INIA are deeply involved in several ways. Responsible stakeholders are contributing significantly to the budget, matching the government with at least a similar amount. The farmers' associations have delegates in equal number with the government in the Board of Directors. These stakeholders have been collaborating in strategic planning with the researchers over a long period of time, discussing all issues in an iterative process. There were formal opportunities for stakeholders' opinions on the relevance of the first ideas of pre-proposals. Priorities were set in this collaborative way with the objective of addressing relevant problems. There was evidence of a demand-driven approach.

INIA had a clear transition in this process, passing from a deliberative approach, submitting proposals to the RACs and WGs for approval, to a demand-driven approach, started by defining the priorities problems/opportunities and then formulating proposals by the researchers to solve problems or to take advantage of opportunities.

INIA is improving its organizational capacity, and has developed a modern infrastructure in buildings and equipment, and improved their human resources, mainly at the level of postgraduates. This is essential to address the challenge to respond to increasing demand, but at the same time, is defining the future resource allocation.

3. *From a human resource approach, how is the staff involved, how is their interest/commitment strengthened, and how does the institution respond to their interest?*

The researcher staff has been involved in the evaluation and strategic planning, throughout the whole process. All personnel were involved in the internal organizational diagnostic, and the most relevant needs were expressed. They also participated in developing the continuous improvement process, based on the main problems identified previously. All staff collaborated in the process of the reformulation of the human resources areas. Data from a survey at the end of the process show that the personnel considered it to be a very positive experience. The methodology is continuing for the future.

4. *From a learning organization approach, what is the organizational commitment and capacity for learning? How are the mental openness for generative learning, the shared mission and vision inspiring the future, the system thinking view, and teamwork learning developing?*

INIA has been applying the strategic planning methodology, first analyzing the external environment (threats and opportunities), and then the internal environmental analysis (strengths and weaknesses). Scenarios, taking into account tendencies of the critical factors and premises, were considered (proactive approach). A shared mission and vision were formulated and validated jointly by stakeholders and staff. The learning process teamwork for continuous improvement was established and reinforced by INIA' s Board of Directors. Teams tackled the main constraints identified by the initial participative diagnosis. INIA is practicing the disciplines of learning organizations.

5. *From an ecological approach, how are the linkages with other organizations improving? How is the collaborative mode (internal multidisciplinarity and external networking) increasing? How are sustainability, environment, and quality issues taken into account in the research agenda?*

INIA is encouraging partnerships, developing strategic alliances with public and private national and international organizations (centers of excellence). The FPTA, which represents 10% of the INIA total budget, has been demonstrated to be very useful for promoting outside linkages, and in seeking synergistic complementarities.

The new strategic planning process promoted multidisciplinarity, creating mega-projects of greater potential impact, and increasing the number of disciplines, researchers, and commodities per project. The research teams discussed from the beginning planning, defining and taking decisions by consensus.

The research agenda has changed. From a restricted focus on a productivity approach, INIA's research agenda has evolved, after careful analysis of the strategic planning, towards a more complex agenda, including intensification of the production but also building heavily on the concept of sustainability, and concern for the environment, quality, and food safety.

The agenda was incorporated with emphasis on an agro-industrial approach, taking into account the increasingly more exigent requirements of final consumers through the industrial sectors.

Even though in LAC the NARSs budgets are in general decreasing, INIA has been increasing the diversified resources available, without objection from farmers, and without interference in the funds allocated from the public central administration, showing farmer and political support.

INIA is increasingly concerned and working to improving its image. According to external sources from the last years, stakeholders have an excellent image and opinion of INIA.

6.2 Reflections and Further Implications

Implementation of the framework:

It was feasible to implement the proposed framework in the case of INIA. However, it should be noted that this case study was developed in a particularly favorable environmental context, making it possible to engage in organizational development based on collaborative participation and to gain accountability progressively.

The main factors were:

1) The country

Uruguay has traditionally had a strong democratic system, which encourages participation of people in organizational issues. It is increasingly involved at national level in an international open economy consolidating a regional common market (MERCOSUR).

There is a growing favorable consensus about the important role of technology in agricultural development, and the need of incorporating it in the system of production to compete successfully in increasingly international markets.

Uruguay has been characterized by a firm political, social and economic stability during recent last years. It has a high educational level of the population, an equitable income distribution, and social capital investment, in comparison with other countries in the region.

There has been remarkable improvement in the quality of products, services and processes in the agro-industrial chain, and increasing concern for environmental impact, natural resource preservation, and sustainable development.

2) The law creating of INIA

It gave importance to the role of technology in relation to agricultural sector development, and has provided great potential power to the new autonomous organization. This type of legal entity is a key requirement to formulate and to implement a collaborative participative process of organizational development. It is based on the principles of co-participation of both government and farmers in directing and financing the Institute, increasing the resources assigned to agricultural research.

INIA operates as a private organization with an effective administrative and operational decentralization through the creation of RACs, and later the WGs, functioning as antennas advising in the diagnosis as well as in the technology transfer to solve these needs. It is an organization with reasonable size but with great capacity for external articulation, creating the FPTA for strategic alliances with other public and private, national and international organizations.

3) The leadership commitment

INIA´s Board of Directors had the initiative to conduct this process and sponsored this study, to analyze the relationship with the external and internal environment, organizational performance, capacity and motivation.

The Board continues leading and supporting the on going process providing continuity, and gaining trust and reliability.

4) Stakeholder and staff interest and experience in collaborating

An effective participation of external responsible stakeholders as well as internal staff in the process and in the institutional decision making was present. This collaboration is vital for gaining institutional accountability and fostering a long-term sustainable cultural and financial organizational transformation. The Institute is currently opened to learn, involving staff and stakeholders, in a proactive approach, to rapidly reposition INIA in response to context changes, avoiding doing more of the same.

Lessons learned from this experience:

The collaborative strategic planning methodology had internalized a proactive approach and new concepts leading to culture transformation and a widespread effect in the organization. To involve the external stakeholders and the internal staff in the exercise, and to understand how the process works, is probably more important than the results themselves.

This process also put in practice a new approach, starting with demand identification. Consideration of current and future demands required listening to the farmers, first about relevant problems, and then about future scenarios, and opportunities. Then, proposals were formulated based on the priorities. It was an effective tool to think and act strategically in order to shape INIA's future.

Key actors must be involved in this process. This requires the strong inclusion of members of the Board, National and Regional Directors, National Coordinator Committee, leaders of Areas and Programs, researchers, all internal support staff, and outstanding stakeholders. This type of collaboration is sometimes considered too time consuming for very busy persons. It has a high transaction cost, but it is worthwhile

The participation of internal staff encouraged their commitment to the organization, and a better understanding of what is happening and what is being planned, how it is being planned, and, particularly, why it is being planned.

The participation of external stakeholders strengthened their involvement and support, and also provided a better understanding and a sense of caring about the specific requirements of agricultural research.

All participants, internal and external were learners in this process. But at the same time, they were shaping the future participative process to be developed in INIA. The participation in this process helped to improve communication, which is often one of the weakest factors in organizational behavior, and was identified as such in the case of INIA.

An excess of meetings should also be avoided. The number of meetings can be reduced by improving their effectiveness. Some draft documents can be prepared by small teams to be distributed prior to the meetings, with enough time to be studied, but only as inputs for the open discussion that needs to be done.

A reasonable timetable, including a tentative deadline, should be set and accomplished. In this particular experience, the strategic planning took more time than was expected.

At the same time, it appears to be necessary to conduct this process more frequently, because of the turbulent and rapid changes in the external environment. Therefore, this process might be better if shorter but reviewed more often.

The agenda of activities has to be established early and must consider all other relevant activities. For the participation of farmers, in particular, the overlapping with multiple agricultural tasks which require presence at the farm (such as planting, harvesting, pest control, sheep shearing, milking cows) has to be considered.

It was threatening for some researchers to submit progress reports to the CARs and WGs to evaluate their relevance. It also was threatening for some researchers to be exposed to an ex-ante external peer review evaluation. The risk of sharing ideas for proposals with other researchers who may compete for funds, and the bias where there is small critical mass of researchers, suggests that it may be useful to discuss in internal seminars and to include foreign experts. Comprehensive external reviews are planned for the future, starting at the level of Programs.

Regional Advisory Committees and Working Groups have a great potential contribution to make to INIA. During these meetings, even though general satisfactory participation was expressed, there were suggestions from members to improve the functions of these important organs for INIA.

The new research agenda:

The increasing concern of the final consumers, both for health and environmental conditions, represents an opportunity for export-oriented countries, like Uruguay, through marketing strategies and research with an ecological approach, committed to the development of its own natural resources. The systems of production based on processes in harmony with the natural cycles, resulting in natural products, will be able to meet an acceptable environmental and natural resources cost. Consumers will put pressure on organizations for environmental management reconversion (ecolabels), and increasing quality requirements of products, processes and management. A potential threat can be transformed into an opportunity (strategic planning).

Economic globalization, regional trade blocks, sustainable development and environmental problems are main elements of the world frame. The international standard norms ISO 9000 and 14000 are embedded in this globalization process. Future restrictions are expected, and countries that produce under negligent management conditions of their natural resources, will be considered degrading the environment, with the associated commercial consequences. A proactive approach, preventing these problems is relevant for agro-export countries such as Uruguay, and it will be a major competitive factor in the long term.

The Uruguayan research-extension challenge will be how to develop sustainable agriculture, increasing productive capacity while conserving its resource base and taking advantage of better prices for natural and organic products following consumer preferences, and to design a system which could contribute to achieve society's goals, in terms of quantity and quality of food, considering environment and health.

The increasing importance of the relationship among environment, agro-industrial activities, and international trade will affect agricultural research priorities. Based on the relevance of establishing demand-oriented objectives, it is necessary to consider the priorities of the different clients involved: productivity (farmers), quality of products (industries), and environment (society).

6.3 External Evidence

There were some reports of external specialists from other studies in INIA, related to some organizational issues analyzed in this research, and conducted during the same period, mainly by ISNAR and IDB Project evaluation.

Considering the relationship of the knower to the known, the external evidence contributes to explain the epistemological (philosophy of knowledge) question: "how can be sure we know what we know?"

Organizational capacity:

The organizational capacity, analyzed during this process, was confirmed basically by these external studies.

"INIA's excellent infrastructure is another important strength of INIA. Research activities are supported by appropriate equipment, including modern information and communication technologies. Buildings are in very good shape, partly due to a loan from

IDB. A major investment in these core resources has been made, but funding will be needed to keep them operational in the future". "The institute maintains strong human resources adequate for the current demand. A substantial training program, supported by a loan from the Inter-American Development Bank (IDB), has had an important impact on the level of research training" (Borges, 1998: 123).

INIA Uruguay is an example of an organization that changed its organization and management and increased its budget through a combination of farmer funding and matching state grants. This experience suggests it may be possible to find a sustainable and client-driven public-private funding mix. Direct funding of research by farmers contributes to the increase in the total funds available for research. When these are matched by government funds, they provide a convenient vehicle for promoting a more demand-driven research system, influencing research priorities. "To date, the most ambitious arrangement for farmer funding of research is found in Uruguay" (Echeverría et al, 1998:333).

The flexibility and agility in resource allocation and utilization, is a fundamental change given by creation of the Law of INIA, like in private sector. INIA Uruguay is an example of the participation of the private sector in agricultural research, contributing to make research systems more effective in forging improved new technologies (Moscardi, 1992).

An evaluation of the IDB Project argues that "INIA has done important progress in planning, starting with the MTOP and incorporating a more strategic vision to the planning process in the MTIP. In relation to monitoring and evaluation, the methodology that started developing represents an important background to the entire institutionalization of a management system to guarantee the programmatic consistency of all activities of INIA, including the relevance, quality (methodological rigor), and measurements of performance, in terms of effectiveness and efficiency" (Vázquez and Picerno, 1996:95).

A survey on a sample of researchers in INIA last year showed that the PM & E capacity in INIA has improved from the past MTOP to the current MTIP, particularly in planning, but also, in monitoring and evaluation, with values of 2.6, 1.9 and 1.8 respectively, measured on a scale from 0 to 3 (Horton et al., 1999).

Organizational motivation:

Borges pointed out that a very positive aspect motivating the organization's current performance was the process whereby it was established. "The idea of INIA began within the past organization (CIAAB), and was discussed at length by researchers. The participation of both staff members and key stakeholders in the design of the institute has contributed to the development of organizational commitment. The prior research experience of staff members contributed to a solid technical basis for the new institution. INIA's current mission is viewed as very positive in motivating performance. The institute's mission and objectives are strong motivators" (1998:122).

Changes in the motivational dimension of the institution, from 1992 to 1997, has shown high values, particularly in the staff participation in decision making (2.0), staff identification with the institutional mission (2.0), and teamwork (1.7), measured on a scale from 0 to 3 (Horton et al., 1999).

Culture:

"In general, there are excellent ethical values in the institute, a high level of respect for the work of others, strong commitment to the organization, and good interpersonal relationships. Nonetheless, two aspects that could be improved are integrated work teams and integration with other institutions. For its employees, working for INIA means status and career development. It would be hard to find another institution in Uruguay that offers the same possibilities of training and excellent working conditions. Although organizational commitment remains very high, the institute is in need of a method for performance assessment that motivates staff by recognizing and rewarding individual achievements" (Borges, 1998: 122).

According to Scheler (1996) the internal communication is a main weakness. INIA is an institute that works with the minds of its employees, and it is important they feel comfortable in their work environment.

Organizational performance:

High values in relevance, effectiveness and efficiency found in this study, are in agreement with the results from the recent ISNAR case study (Borges). "It can be said that INIA's relevance is ascending. Client satisfaction is high. Today, the institute is a frequent object of discussion in producers' associations, partly because of its performance and partly because of the current international demand for technology" (1998: 124).

Partnerships:

"INIA is establishing more partnerships (strategic alliances, joint ventures, networks) at the national, regional and international level, to promote a more efficient development of the technologies, optimizing resources, and making complementary use of the different institutional capabilities" (Scheler, 1996:12).

"INIA has found the FPTA an excellent tool to establish strategic alliances with other agricultural research organizations and institutes in Uruguay and help coordinate their research efforts and to achieve a multiplier for its own research efforts. ISNAR therefore chose INIA's FPTA as benchmark for other agricultural research organizations" (Hobbs et al., 1998:1).

Organizational image:

"INIA has an excellent image within the agricultural sector, which is strengthened by producer participation on INIA's boards and councils. The organization enjoys substantial support from the agricultural producers' organizations. ......The stakeholder environment at the level of producer's organizations is very favorable for INIA. Producers' representatives participate in the Board and in the Regional Advisory Committees and Working Groups, and this contributes to their feeling of belonging to the institution" (Borges, 1998: 120)

"Regional Advisory Councils at each Experiment Station, known as the lungs of INIA, provide an important forum for a regular exchange of views between farmers and INIA staff". The institute's communication with the external environment is in a two-way interaction. Researchers are into a intimate dialogue with both technology users and policy makers to find out what their problems and aspirations really are, to understand how they think, and to design their public relations accordingly". The respondents emphasize that the researchers of INIA who are working closely with farmers, are fully aware of their public relations responsibilities. According to the respondents, the policymakers have a good image of INIA. "The farmers have high expectations of INIA as well. " INIA has been able to break the image of the isolated researcher and change this in a researcher that speaks the language of the farmers". (Scheler, 1996:9)

In evaluation of the INIA/IDB Project, Vazquez and Picerno indicated that "the important participation of farmers in the top management level (Board of Directors), and in different organs of advising (RACs, and WGs), makes difficult to find a representative vision from the farmer sector that could be independent of INIA. The general vision is positive regarding the INIA performance, considering good to very good in all the cases (farmers leaders and agronomists belonging to the main rural associations)" (1996:54).

The principal strengths were cited: institutional organization and structure, participation of farmers at different levels, particularly at the Experiment Stations (RACs and WGs), clear vocation and efforts done to link the research work with productive reality, great effort for training of staff in the last years, products generated considered of exceptional value to compete internationally (i.e. new cultivars released in crops), and valuable efforts to improve technical publications. Within the weaknesses observed were: insufficient coordination with extensionists to become more efficient in the use of resources in the whole system, too much time of researchers allocated to diffusion tasks, and to revalue the importance of economic analysis on the results of research (Vázquez and Picerno, 1996).

6.4 Research Limitations

Some limitations could be identified in this study:

The author of the study has been involved in the coordination of much of the work. Familiarity contributes to knowing the organization and the process in depth, but at the same time has the potential for a subjective perspective towards a favorable view of the findings.

There is an assumption that farmer delegates on the Board, Regional Advisory Committees and Working Groups are, in fact, representative of the opinions of farmers on relevant issues in the agricultural sector.

Timing may be an issue. This on going process should be evaluated in the long term, but this particular study had to be completed within a given period of time.

Overlapping with other proper activities of the Institute may occasionally interfere with representativeness.

APPENDICES

Appendix A

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

EVALUATION

MEDIUM TERM OPERATIVE PLAN

1992/1996

FORM TO BE COMPLETED BY RESEARCHERS RESPONSIBLE FOR PROJECTS

CODE ....

TITLE ....

....

THEME UNIT..

PROGRAM..AREA ....

Please fill the required information, indicating the number, which to your understanding, is the best representation of the following aspects:

1. *In order to determine in which stage of execution the Project is right now, indicate the trimester related to:*

- Starting implementation - (A), (add another year if necessary)
- Finishing execution (collecting and analyzing data) - (B)
- Presentation of final report - (C), (add another year if necessary)

				1992				**1993**				**1994**				**1995**				**1996**							
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

2.	*The problem identification has been mainly by initiative of: (mark in order of importance up to 3):*

- Explicit suggestion by the Working Group
- Explicit suggestion by the Regional Advisory Committee
- Induced proposal by the researchers of the Project
- Induced proposal by the Program
- Induced proposal by the Scientific Committee
- Induced proposal by Consultants
- Others (Specify)

3.	*In the conceptualization and formulation of the Project during the programming process, to what extent have contributed to the discussions:*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

- Scientific Committee
- Consultants
- Program
- Discipline
- Experiment Station
- Working Group
- Regional Advisory Committee
- Others (Specify)

4.	*In case of formal modifications to execution of the project, indicate to what extent the following has affected:*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

- Suggestions by Area
- Suggestions by Program
- Post-graduate Studies of a researcher
- Changes in Scientific staff
- Reduction in Technicians and Support Staff
- New bibliographic information
- Information outcome from the execution of the Project
- Changes in demands from production sector (RAC, WG)
- Availability of financial resources
- Technical error in the planning process
- Others (Specify)

5.	*To what extent were the following aspects improved as a consequence of the formal modifications:*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

- Objectives
- Hypothesis
- Methodology
- Strategy
- Working Team
- Period or Term of execution

6.	*To what extent were the explicit technical-programmatic goals accomplished by the results obtained?*

Scale: 1= None
7= Totally

I------I------I------I------I------I------I
1 2 3 4 5 6 7

7.	*Indicate the number of initial experimental activities, formal modifications and those executed effectively.*

	Expected	Modified	Executed
Experiments			

8.	*Indicate the number of initial diffusion activities, formal modifications and those executed effectively.*

	Expected	Modified	Executed
INIA Publications			
External Publications			
Seminars, meetings and courses			
Field Days			
Diffusion meetings			
Videos			

9.	*How many researchers are involved in the Project?*

Initial	N°	
Present	N°	

10.	*What is the estimation of the present total time allocated by the researchers involved in the Project (add time percentages and express it dividing by 100)?*

N°

11.	*What are the total operative resources allocated to the Project, expressed in American dollars?*

US$

12.	*Taking into account the difficulties to determine efficiency (i.e. effectivity related to cost) in the research activities, express your evaluation of the efficiency of the Project.*

Scale: 1 = Very Low
7 = Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

13.	*How do you distribute the specialization composition of the Project technical team?*

	Initial	Now
Number of Disciplines		
Number of Commodities		

14.	*In what way has each of the following factors limited the execution of the proposed experimental activities?*

Scale: 1 = Not limited
7 = Very limited

I------I------I------I------I------I------I
1 2 3 4 5 6 7

- Climatic conditions
- Availability of Materials
- Financial resources
- Bibliographic information
- Administrative support
- Physical infrastructure
- Equipment
- Vehicles
- Gasoline
- Per diem
- Scientific staff
- Researcher out of country for training
- Support staff
- Bird damage
- Others (Specify)

15.	*Which are the mechanisms that you consider more effective for diffusion of the Project results (mark in order of importance up to 3):*

- Technical Communications
- Presentation in congresses and seminars
- Internal seminars
- Visits to farmers and extensionists
- Training
- Field Days
- Technical meetings
- Scientific articles or papers
- Articles in newspapers and magazines of diffusion
- Interviews on radio and TV
- Videos
- Others (Specify)

16.	*In order to improve the Project, indicate the importance of the need to increase the following resources:*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

- Field equipment
- Laboratory equipment
- Laboratory inputs or chemical reagents
- Greenhouses
- Informatics equipment or computer hardware
- Informatics consultants
- Statistics consultants
- Economic analysis consultants
- Library access
- Specialty consultants
- Vehicles
- Gasoline
- Scientific staff
- Field support staff
- Administrative staff
- Scientific staff training
- Support staff training
- Training in Project formulation (PM&E)
- Programmatic structure
- Operational structure
- Administrative functioning
- Materials acquisition
- Coordination meeting frequencies
- Coordination meeting dynamics
- Discipline interaction
- Diffusion channels
- Others (Specify)

17.	*How do you consider the effects of the Projects in relation to preservation of the following natural resources?*

Scale: (-3) = Totally unfavorable
0 = Neutral
(+3) = Totally favorable

I------I------I------I------I------I------I
(-3) (-2) (-1) 0 (+1) (+2) (+3)

- Soil
- Water
- Atmosphere
- Genetics Resources

18.	*Principal products generated by the Project are related to (mark in order of importance up to 3):*

- Cultivar creation delivery
- Agricultural production technology
- Product processing and post-harvest
- Equipment and machinery
- Others (Specify)

19.	The Project objectives are fundamentally oriented to increase *(mark in order of importance up to 3):*

- Productivity
- Profitability
- Product Quality
- Sustentability
- Environmental Protection

20.	*How would you classify the principal orientation of your Project:*

- Scientific (contribution to scientific knowledge)
- Technological (adaptation and validation of technology)
- Transference (diffusion of available knowledge)
- Others (Specify)

21.	*The results obtained mainly contribute to solve needs of the following immediate users (mark in order of importance up to 3):*

- Farmers
- Transformation industry of agricultural products
- Input suppliers
- Consumers
- Extensionists
- Policy makers
- Government agencies
- Other researchers (other area of study)
- Others (Specify)

22.	*Results obtained tend fundamentally to:*

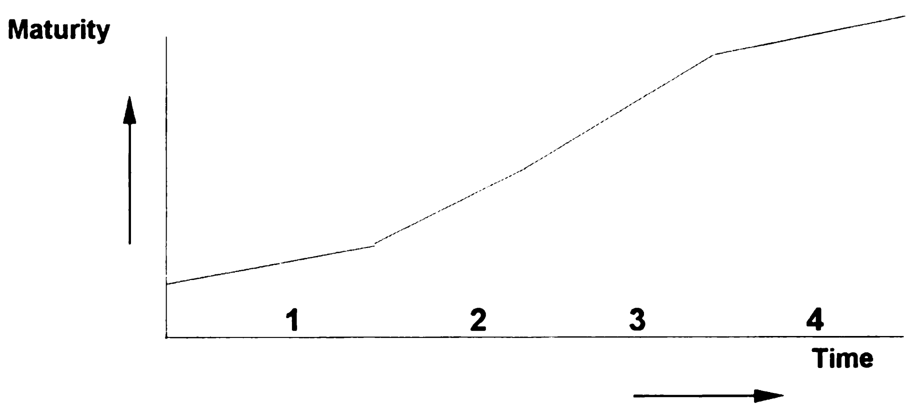
- Solve present needs
- Make knowledge available for future needs

23.	*The scope of results of the Project is:*

- Zone of influence
- National
- Regional Southern Cone
- Disciplinary
- Others (Specify)

24.	*In which stage of maturity the process of technological development would you rank the Project?*

Phase 1 = High opportunity for impact; high risk; exploration or starting
Phase 4 = Low opportunity for impact; low risk; improving and adjusting, diffusion of results



25.	*Considering an analysis of future needs, identify the likely action:*

- Finishing the Project with the obtained results and diffusing them
- Reformulating it
- Continuing it without modifications
- Others (Specify)

26.	*Add comments and suggestions on criteria for Monitoring and Evaluating that you consider convenient to introduce in the next Planning:*

Appendix B

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

EVALUATION

MEDIUM TERM OPERATIVE PLAN

1992/1996

FORM TO BE COMPLETED BY PROGRAM LEADERS

CODE ....

TITLE ....

....

THEME UNIT..

PROGRAM..AREA ....

Please fill the required information, indicating the number, which to your understanding, is the best representation of the following aspects:

1. *To what extent have the expected results (outcomes or products) been accomplished, considering all the activities of the Project globally ?*

Scale: 1 = 0-10%
2 = 10-30%
3 = 30-50%
4 = 50-70%
5 = 70-90%
6 = 90-99%
7 = 100% (Final Report)

I------I------I------I------I------I------I
1 2 3 4 5 6 7

2.	*To what extent have the mechanisms applied for diffusion or transfer of the results (outcomes or products) of the Project been effective:*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

3.	*Taking into account the difficulties of determining the efficiency (relation between effectiveness and their costs) of agriculture research activities, express your ranking of the efficiency of the Project.*

Scale: 1 = Very Low
7 = Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

4.	*How do you judge the size of the Project, in terms of the resources allocated to achieve the planned objectives ?*

Scale: (-3)= Very reduced
0 = Appropriate
(+3)= Very large

I------I------I------I------I------I------I
(-3) (-2) (-1) 0 (+1) (+2) (+3)

5.	*Indicate to what extent the results (outcomes or products) obtained by the Project contribute to accomplishing the objectives of the Theme Area.*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

6.	*In turn, indicate to what extent the results (outcomes or products) obtained at the level of the Theme Area contribute to accomplishing the objectives of the Program.*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

7.	*In relative terms within the Program, what is the importance that you give to this Project:*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

8.	*Which is the grade of fit and the internal structural consistency for each one of the following methodological aspects :*

Scale: 1= Very poor fit
7= Very good fit

I------I------I------I------I------I------I
1 2 3 4 5 6 7

a. The title of the Project reflects what has been done.

b. The general methodology of the Project showed validity in the execution and in accomplishment of the planned objectives.

c. Data collection and statistical analysis showed validity in accomplishment the planned objectives.

d The conclusions drawn are operational to the originally planned objectives.

e. The applied strategy is valid to accomplish the planned objectives of the Project.

f. The proposed term for the execution of the Project has been reasonable to accomplish the planned objectives.

g. The utilization of the scientific-technical information reviewed related to the topic of research is relevant and up-dated.

9.	*What value do you give to the quality of the publications produced by the Project?*

Scale: 1 = Very Low
7 = Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

10.	*How would you rank the results of the Project?*

Scale 1 = Very Low
7 = Very High

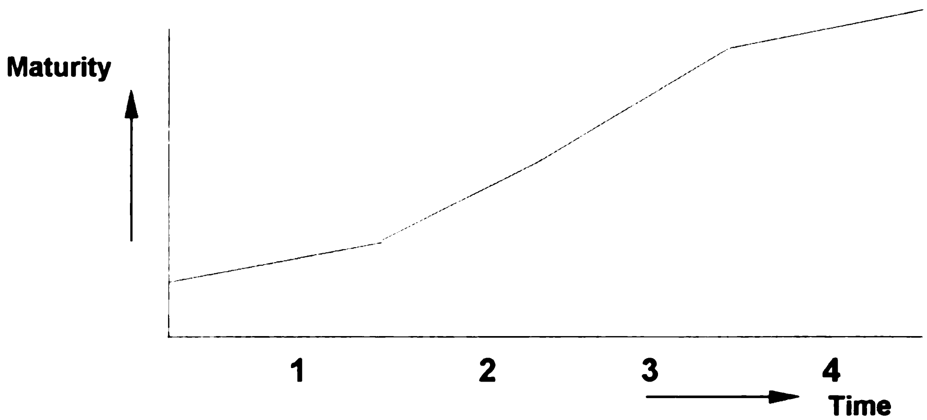
I------I------I------I------I------I------I
1 2 3 4 5 6 7

11.	*The obtained results contribute to solving needs mainly of the following immediate users (mark in order of importance up to 3):*

- Farmers
- Industry of transformation (processors)
- Input suppliers
- Consumers
- Extensionists
- Policy makers
- Government agencies
- Other researchers (other area of study)
- Others (Specify)

12.	*In which stage of maturity of the process of technological development would you rank the Project?*

Phase 1 = High opportunity of impact, high risk; exploration or starting
Phase 4 = Low opportunity of impact, low risk; improving and adjusting, diffusion of results



13.	*Considering an analytical projection prospective analysis, indicate the likelihood of:*

- Finishing the Project with the obtained results and diffusing them
- Reformulating it
- Continuing it without modifications
- Others (Specify)

14.	*Add comments and suggestions on criteria for Monitoring and Evaluating that you consider convenient to introduce in the next Planning:*

Appendix C

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

EVALUATION

MEDIUM TERM OPERATIVE PLAN

1992/1996

FORM TO BE COMPLETED BY MEMBERS OF THE REGIONAL ADVISORY COMMITTEES AND WORKING GROUPS

Based on your knowledge and the complementary information presented (enclosed), we consider it very important and opportune to know your perspective, of the relevance of the results obtained from the execution of the Medium Term Operative Plan (MTOP). Therefore, please fill the required information, indicating the number which, to your understanding, is the best representation of your opinion on the importance of the following aspects:

1. *Were you in knowledge of this information previously?*

- No
- Yes

2. *To what extent are these obtained results useful and contribute to improve the decisions made related to the principal systems of production to whom they are aimed or directed ?*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

Comments:

3. *What would be the effects of the application of the results obtained on:*

Scale: -3 = Totally unfavorable
0 = Neutral
+3 = Totally favorable

I-----I-----I-----I-----I-----I-----I
-3 -2 -1 0 1 2 3

- Productivity/hectare
- Productivity/capital
- Productivity/labor
- Quality of products
- Natural Resources preservation
- Environmental Protection
- Others (Specify)

Comments:

4. *Which mechanisms utilized by INIA do you consider more effective for diffusion of the Project results (mark in order of importance up to 3?*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

- Field Days
- Technical Meetings
- Diffusion Meetings
- Publications
- Visit to Experiment Stations
- Radio Auditions
- Videos
- TV
- Workshop/Seminars for Technical Update
- Pilots Farms or Demonstration Units
- Others (Specify)

5.	*Which other mechanisms of diffusion do you suggest?*

- Through extensionists? [ ]
- Exchanging ideas with other farmers? [ ]

6.	*What do you estimate will be the potential adoption rate of this technology or information?*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

Comments:

7.	*Which are the limitations or restrictions do you consider more important to adopt the available information or technology generated? (In order of importance).*

Scale: 1 = Not limited
7 = Very limited

I------I------I------I------I------I------I
1 2 3 4 5 6 7

- Technological [ ]
- Financial [ ]
- Economic [ ]
- Market [ ]
- Risk [ ]
- Structural [ ]
- Regional Infrastructure [ ]
- Training [ ]

Comments:

8.	*What would be the magnitude of the adjustment to introduce in the system of production?*

Scale: 1= None
7= Full

I------I------I------I------I------I------I
1 2 3 4 5 6 7

Comments:

9.	*The available information:*

- Was well presented ?
- Should be included in a major packet ?
- Should be separated from others ?

10.	*Considering projection analysis, suggest the suitability:*

- Finishing the Project with the obtained results and diffusing them
- Reformulating it
- Continuing it without modifications
- Others (Specify)

Comments:

11.	*Add comments and suggestions on criteria for Monitoring and Evaluation that you consider convenient to introduce in the next Planning:*

Appendix D

NATIONAL AGRICULTURAL RESEARCH INSTITUTE
EVALUATION **MEDIUM TERM STRATEGIC PLAN** **EXTERNAL ENVIRONMENT ANALYSIS** **1997/2001**
FORM TO BE COMPLETED BY RESEARCHERS

Based on the draft document elaborated for discussion in small groups with INIA to exchange ideas to be presented in a plenary session, please describe your ideas about the following issues:

1.	*Are you in agreement with the critical factors identified in this draft document elaborated on External Environment? What modifications do you suggest?*
	Comments:

2.	*Are you in agreement with the common premises identified? What modifications do you suggest?*
	Comments:

3.	*Are you in agreement with the Mission and Vision proposed by INIA´s Board of Directors? What modifications do you suggest?*
	Comments:

Appendix E

NATIONAL AGRICULTURAL RESEARCH INSTITUTE
EVALUATION **MEDIUM TERM STRATEGIC PLAN** **EXTERNAL ENVIRONMENT ANALYSIS** **1997/2001**
FORM TO BE COMPLETED BY MEMBERS OF THE REGIONAL ADVISORY COMMITTEES AND WORKING GROUPS

Based on the draft document elaborated for discussion in small groups with INIA to exchange ideas to be presented in a plenary session, please describe your ideas about the following issues:

1.	*Which is the opinion of your Institution about INIA, and how can you compare with the information you have in relation to the action in the last period?*
	Comments:

2.	*Are you in agreement with the critical factors and the common premises identified? What modifications do you suggest?*
	Comments:

3.	*Are you in agreement with the Mission and Vision proposed by INIA´s Board of Directors? What modifications do you suggest?*
	Comments:

Appendix F

NATIONAL AGRICULTURAL RESEARCH INSTITUTE
EVALUATION OF IDEAS OF PROJECTS **MEDIUM TERM STRATEGIC PLAN** **1997/2001**
FORM TO BE COMPLETED BY MEMBERS OF THE REGIONAL ADVISORY COMMITTEES AND WORKING GROUPS

During the process of identification and selection of relevant themes, the members of the Regional Advisory Committees and Working Groups have participated in the review of Strategic Documents elaborated at the Area of Research level. At this stage it is considered important and opportune to share with you the following ideas of evolving from Projects, therefore we ask your opinion on this issues:

1.	*If needed, which commodities or / and Projects would you add to this proposal ?*

2.	*Express the relevance of the topics included by the scope of ideas of Projects presented. Indicate the number which, to your understanding, is the best representation of your opinion on their importance from the perspective of demand, taking into account their contribution to solve technological restrictions of the system of production at whom they are aimed.*
	Scale: 1= Very Low, 7= Very High I------I------I------I------I------I------I 1 2 3 4 5 6 7

Appendix G

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

EVALUATION

MEDIUM TERM STRATEGIC PLAN

1997/2001

FORM TO BE COMPLETED BY MEMBERS OF THE REGIONAL ADVISORY COMMITTEES AND WORKING GROUPS

INIA, through the Medium Term Strategic Plan (MTSP), culminated recently, has tried to give priority to the farmers needs in the future research agenda. Based on your knowledge and participation in this process of strategic planning, please indicate the number which, to your understanding, best represents your opinion on the importance of the following aspects:

1. *To what extent this process contributes to make a real change from a model based on technology offering toward a demand-driven model, as a beginning for setting the priority topics to be researched ?*

Scale: 1 = Very Low
7 = Very High

I-----I-----I-----I-----I-----I-----I
1 2 3 4 5 6 7

Comments:

2. *To what extent have the user´s initiatives on the present problems in the production system been taken into in account this process ?*

Scale: 1 = Very Low
7 = Very High

I-----I-----I-----I-----I-----I-----I
1 2 3 4 5 6 7

Comments:

3.	*To what extent have the opportunities identified as a consequence of the prospective analysis of future scenarios been incorporated in this process ?*

Scale: 1 = Very Low |-----|-----|-----|-----|-----|-----|
7 = Very High 1 2 3 4 5 6 7

Comments:

4.	*What would be the most three important actions you would suggest to improve participation of the farmers and extensionists in planning, monitoring and evaluation of the activities of INIA ?*

5.	*Other suggestions to improve the functioning of the Regional Advisory Committtees and Working Groups:*

Appendix H

NATIONAL AGRICULTURAL RESEARCH INSTITUTE
CONTINUOUS IMPROVEMENT PROCESS **December 1996**
FORM TO BE COMPLETED BY ALL THE STAFF OF INIA

The purpose of this survey is to learn your opinion in relation to the continuous improvement process and future collaborative actions to be implemented by INIA.

In order to contribute to it, based in the presentations in this workshop, please reflect your own opinion, to be discussed later in small groups and in plenary session at the Experiment Station level, and considering the following instructions:

- Read carefully and individually the questions in this form
- Formulate answers for each one
- Once all members of the group are ready:
    - Comment on what has each one done
    - Discuss and elaborate a proposal for the group
    - Summarize it and prepare an overhead
    - Design a representative of the group to present it for discussion in the plenary session.

The information emerging from this workshop will be very useful to formulate and implement the continuous improvement process in INIA:

1.	*What were the most important ideas presented in the workshop ?*
	- - -

2.	*Which are the main internal obstacles that could constrain implementation of the continuous improvement process in the organization?*
	- - -

3.	*What is your disposition to contribute to the implementation of the continuous improvement process in the organization?*
	- - -

4.	*What are the main doubts emerging about the implementation of the continuous improvement process in the organization?*
	- - -

5.	*Other suggestions to improve the implementation of the continuous improvement process in the organization.*

Appendix I

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

CONTINUOUS IMPROVEMENT PROCESS
GUIDE AND FACILITATOR TEAMS WORKSHOP

July 1997

FORM TO BE COMPLETED BY ALL MEMBERS OF THE FACILITATOR TEAMS OF INIA

The purpose of this survey is to know your opinion in relation to this Seminar / Workshop on the Continuous Improvement Process, for bringing to the same level the knowledge of all members of the Facilitator Teams.

Please, fill the required following feedback information:

1.	*What are the principal ideas presented in this Seminar that will contribute to the implementation of the Continuous Improvement Process in INIA ?*

2.	*Which is your opinion on implementation of the Continuous Improvement Process in INIA ?*

3.	*What was the effectiveness of the general organization of the Seminar / Workshop ?*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

Comments:

4.	*How effective was the Program, the thematic content and the support audiovisual methods utilized in the Seminar / Workshop ?*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

Comments:

5.	*To what extent do you think the active participation of the members of the Facilitator Teams in the Seminar / Workshop was useful?*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

Comments:

6.	*Other suggestions related to the implementation of the Continuous Improvement Process in INIA ?*

Appendix J

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

CONTINUOUS IMPROVEMENT PROCESS
HUMAN RESOURCES REFORMULATION PROPOSAL

July 1998

FORM TO BE COMPLETED BY ALL THE STAFF OF INIA

The purpose of this survey is to learn your opinion in relation to the experience of conducting proposal preparation for reformulating the areas of Human Resources, in the context of the continuous improvement process.

Please, fill in the requested information, marking with an "x" in the corresponding box:

Group	Researcher	☐
	Support Staff	☐
Sex	Male	☐
	Female	☐
Age	< 30 years	☐
	31 – 40 years	☐
	41 –50 years	☐
	> 50 years	☐

In order to evaluate this process, please, reflect your opinion individually, in relation to your recent participation in the consultancy on the reformulation of the areas of Human Resources, that are being implemented in INIA.

Your contribution is of great value, being the main reason to pursue development of this process, strengthening the actions indicated as well as concentrating efforts on the identified weaknesses, which become our opportunities for improvement.

Scale: 1 = Very Low
2 = Low
3 = Lightly Low
4 = Intermediate
5 = Lightly High
6 = High
7 = Very High

I-----I-----I-----I-----I-----I-----I
1 2 3 4 5 6 7

1.	*Was it appropriate to include the analysis of the proposal on Human Resources within the Continuous Improvement Process ?*

Scale: 1= Very Low
7= Very High

I------I------I------I------I------I------I
1 2 3 4 5 6 7

Comments:

2.	*How has the effectiveness of the transmission of the proposal been through the presentations and complementary documents ?*

Scale: 1= Very Low
7= Very High

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1 2 3 4 5 6 7

Comments:

3.	*To what extent were you informed about this proposal on Human Resources previous to your participation in this process ?*

Scale: 1= Very Low
7= Very High

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Comments:

4.	*To what extent is this methodology based in teamwork appropriate to accomplish the objectives set ?*

Scale: 1= Very Low
7= Very High

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Comments:

5.	*Mention 3 changes that you suggest to improve the ways the themes at the Institutional level were treated.*

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6.	*To what extent do you feel free to express your opinion in this consultancy on Human Resources ?*

Scale: 1= Very Low
7= Very High

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Comments:

7.	*To what extent do you consider that these types of actions contribute to improve communication at the Institutional level (intra- and inter-Experiment Stations / National Direction) ?*

Scale: 1= Very Low
7= Very High

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Comments:

8.	*Once the Human Resources Reformulation has been concluded, list 3 topics to be considered priorities to be included in the teamwork process.*

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