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HUMAN RESOURCE MANAGEMENT FOR AGRICULTURAL RESEARCH: REVIEW OF AN EXPERIENCE

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TABLE OF CONTENTS

APPROACHING HUMAN RESOURCE MANAGEMENT EXPERIENCES IN NATIONAL AGRICULTURAL RESEARCH SYSTEMS

Human resource management in national agricultural research systems (NARS) is affected by the strategy, operation, and structure of the NARS itself as well as by its need to cope with an environment that may range from friendly to hostile. Various approaches may be taken for analyzing experiences in human resource management. Each incorporates a theoretical perspective and sets limits to usefulness.

A "no-formula" approach to human resource management conceives of the social world as a predominantly disordered place; at least, as a place in which there are so many influences that they cannot be sorted out, classified, and understood. It implies that each case is unique and that management must deal with issues on a case-by-case basis.

A rigidly prescriptive approach would take the opposite view -- there are "right" and "wrong" ways for doing things and these are to be taken into consideration in as uniform a way as possible. The underlying conception of the world is one which implies that one or two dominant factors are responsible for the state of things and we know them very well.

A third theoretical perspective suggests that there is no universal formula for dealing with human resources. On the other hand, there are aspects of the organization, such as technology, size, organizational experience, and environment that limit the possible alternatives for effective management by excluding some of them and making others more appropriate for a specific case. Identifying such contingencies and relating them to appropriate choices of action for similar cases is desirable for the understanding of human resource management in agricultural research. It is also of both theoretical and applied relevance. The implicit worldview is typical of a social science perspective -- of a complex place in which many influences act and interact. However, in many instances it is possible to identify a few dominant aspects that set the trend and to apply the resulting knowledge to other, new, situations.

Five aspects or tasks of human resource management for agricultural research have been identified and defined by Bennell and Zuidema (1988), namely, planning, staffing, development, compensation, and evaluation. These five aspects are used here as the basis for organizing the material to be presented.

The present paper draws on the experience of a NARS (Brazil) and attempts to highlight what contingencies had the greatest influence on each of the five aspects of human resource management at the Brazilian Corporation for Agricultural Research (EMBRAPA), the leading organization of the Brazilian agricultural research system.

The EMBRAPA experience may be relevant for other NARS as a source of inspiration and most of all as a source of actual experiences with both positive and negative outcomes. Although it has had its own specific contigencies and has developed against a unique historical background, the approach here attempts to sort out what is unique and what may have more general relevance.

Institution building was the long-term goal expressed by those at the managerial level in EMBRAPA when it was first organized (Alves 1985). An institution-building approach is a series of actions that culminate in creating an institution and providing it with the means for fulfilling its objectives in a continuous and sustainable manner. Short-term goals were focused on client satisfaction, defined by improved profitability for farmers. As the process of institution building continued, internal and external characteristics changed and the organization or parts thereof went through different phases. Therefore, decisions on human resources were made contingent upon the phase the organization was in, as well as current long- and short-term goals, with varying degrees of success.

The following section of this document will provide some background material for understanding the situation in which EMBRAPA was first conceived and organized, and its effects on human resource management. The section after that will analyze each of the five central management tasks for human resources as they occurred in EMBRAPA. Differences in contingencies and the ensuing adaptations made at the management level are the focus. After that, using a contingent-approach frame of reference, there is an overview of the organizational arrangements that had a positive impact on making management more aware of the opportunities and pitfalls of managing. Finally, the material is summarized and possible approaches for other institutions are indicated.

EMBRAPA AND THE BRAZILIAN AGRICULTURAL RESEARCH SYSTEM

The present configuration of Brazilian NARS was organized in 1973 to meet the demand for food and other agricultural products that arose from the country's rapid urban and industrial growth. New solutions for sustained growth were required, and Brazil's natural endowments pointed to a system where agriculture could play a central role. Technology should be mastered and integrated into such a system so that sustained growth would be obtained.

A task force was appointed by the central government to study the previous agricultural research system, to determine the country's needs, and to analyze the experiences of other systems. The task force included experienced agricultural researchers along with economists and sociologists.

The old system had been created under the influence of turn-of-the-century European liberalism (Pastore 1979). It was based on publicly funded and maintained regional institutions in which researchers had a lot of freedom for pursuing work on diverse (although not always complementary) themes. The central government exerted a loose coordination through the National Department of

Agricultural Research (DNPEA), a division of the Ministry of Agriculture. A few states had their own institutes or programs and had been able to produce first-rate research for their own needs, while at the same time other national priorities were not being examined by anybody. Erratic coordination with extension services was another problem, but this is a separate issue and will not be pursued further here. The analysis indicated that a cooperative system of agricultural research was needed. The new system was designed to represent a middle-of-the-road solution for the problems of centralization and coordination.

The Brazilian Corporation for Agricultural Research (EMBRAPA) was created as the head of the system, with the Brazilian Enterprise for Diffusion of Agricultural Technology (EMBRATER) as its twin sister in charge of technology transfer at the federal level. Both were given a place in the government organigram, affiliated with the Ministry of Agriculture, but they were given the juridical status of public enterprises. This would permit much more freedom over all managerial aspects than any other possible arrangement.

State-level institutions, mostly organized as public enterprises, received the mandate for adapting research to local conditions and supplying knowledge that could be applied to specific demands at that level. Coordination with university agricultural departments, private research, and existing federal- and state-funded research agencies working with a few important export crops such as cocoa, sugarcane, natural rubber, and coffee completed the system.

A participative, although centralized, planning process was designed to avoid duplication of effort and to boost complementarity. This was intended to be a concentrated system in contrast to the previous, diffuse system (Alves 1985). It was designed to meet five major contingencies in Brazil:

1) the large size of the country;

2) climatic and environmental diversity;

3) the political organization (in federative states with diverse political strength and economic power);

4) the central role that agriculture is called upon to play in the economic development process;

5) the need for balance between agricultural products intended for internal consumption and those for export.

No doubt the strong centralized power in the hands of the military government at the time of reorganization was one of the factors that helped change the system. However, the robust meritocratic orientation of the task force prevented this from becoming an unfortunate liability for the new organization and its members.

The system is presently functioning with 42 research centers under EMBRAPA's direct jurisdiction and 16 state enterprises or integrated research programs. Universities, institutes, and research centers are a part of the NARS insofar as they take a role in the process of planning research priorities and are totally or partially funded for doing their own research on agreed-upon priority themes. They benefit from many sorts of EMBRAPA services as well, such as access to libraries and other information systems, use of germplasm banks, and participation in training programs and auditing procedures. Private research complements the system. Cooperatives, agroindustries, producers of agricultural inputs, and international corporations are the main actors in this area.

Efforts by the federal government to contain the public deficit have made some changes in the configuration of the system. The specialized institutes for research on export crops will become part of EMBRAPA's structure in the near future. Moreover, technology transfer was recently declared the sole responsibility of the states, only to be returned to the central government a few months later. It is still unclear what the final organizational arrangement will be.

The new constitution, formalized in October 1988, contributed strongly to these changes, since it gives the states a much larger share of the budget than used to be the case. EMBRAPA's coordination over the whole system now tends to be more technical and less budgetary. Its influence has declined in the richer, more advanced states as well as in those states where agricultural research is not a priority. It is expected to increase in the frontier states that depend on new technology for expanding and fortifying modern agriculture. EMBRAPA needs to find new ways for exercising its policy of balancing local interests and weighing them against a framework of long-range national development.

HUMAN RESOURCE MANAGEMENT IN EMBRAPA: AN INSTITUTION-BUILDING APPROACH

EMBRAPA's overall strategy for long-term institution building was set by an operational arrangement that highlighted human resource training. At the time there were very few PhDs or the equivalent among the agricultural researchers in the country. Realizing that having well-educated researchers is essential to an efficient NARS, the first thing the Board of Directors did was establish a large training program with emphasis on postgraduate training. The training division was the first to be implemented at the Department of Human Resources (DHR). Other functions were deeply influenced by this strategy, as we shall see.

Planning

When EMBRAPA was created, there was no formal plan for human resource management. The classical exercises of quantifying supply and demand and matching requirements to availability were never implemented in their own right. However, a set of related reflections, decisions, and implementations substituted for them, probably beneficially.

EMBRAPA replaced an existing agricultural research network. The earlier mandate of research centers was completely restructured, with new locations added to existing ones and concentration on a few products or resources clearly attributed to each of them. During this reorganization, the experience and location of the old institutes and the expertise of the research staff were taken into consideration. As a result, the process permitted expansion and set clear priorities for the whole system.

The resulting structure is composed of product centers and resource centers at the national level, supplemented by special services (soils, basic seeds) and by small subregional units located in the states (UEPAEs) where for one reason or another no state system can be immediately organized. There are also a few transitory units for special problems which may evolve into full centers or be deactivated in the future. The administrative headquarters are located in Brasilia DF. Figure 1 shows the location of the decentralized units in the country's 26 states and the federal district (DF).

The internal structure of each center is a flat one composed of specialists in relevant fields. Research teams are built around topics that have been identified as sociotechnical problems for producers or for the region (Quirino 1982). In many centers, plant breeders are the specialists around whom expertise developed. Other specialists have been added depending on need and availability. The resulting structure is more flexible than the matrix arrangement as it gives the researchers themselves more initiative as well as reducing pressure for having a "complete" team for each center. Coordination is loose and horizontal and evolves within the context of national leadership on research on a product or a resource. Actually, the matrix model applies more to the division of labor among NARS centers than within them. This general organizational plan took the place of a more formal plan for decisions about human resources.

The DHR was expected to provide for creating the following structural characteristics: researchers should emphasize applied research or the impact of their research upon agriculture production and productivity, they should work on interdisciplinary teams, and programs should focus on products, not on disciplines. This loose method of planning was very efficient as a device for institution building because it allowed the DHR to take advantage of opportunities and potentialities as they appeared in a poor human resource market.

The absence of a formal plan for human resources was also compensated for by a number of important studies on the character and priorities of the organization as a whole (Alves 1980; Gastal 1980). The result has been that most of the functions that should be covered by a human resource plan -- like protecting the organization from the special interests of politicians, producers' groups, and local entities -- have been performed through means such as purposefulness and centrality of command. The thin line between surrendering to political pressures and being sensitive to group needs was a difficult one to navigate, especially as the political process of negotiating priorities and interests was influential in determining the location of centers and the mix of specialities and abilities.

Figure 1a): **EMBRAPA's DECENTRALIZED UNITS**

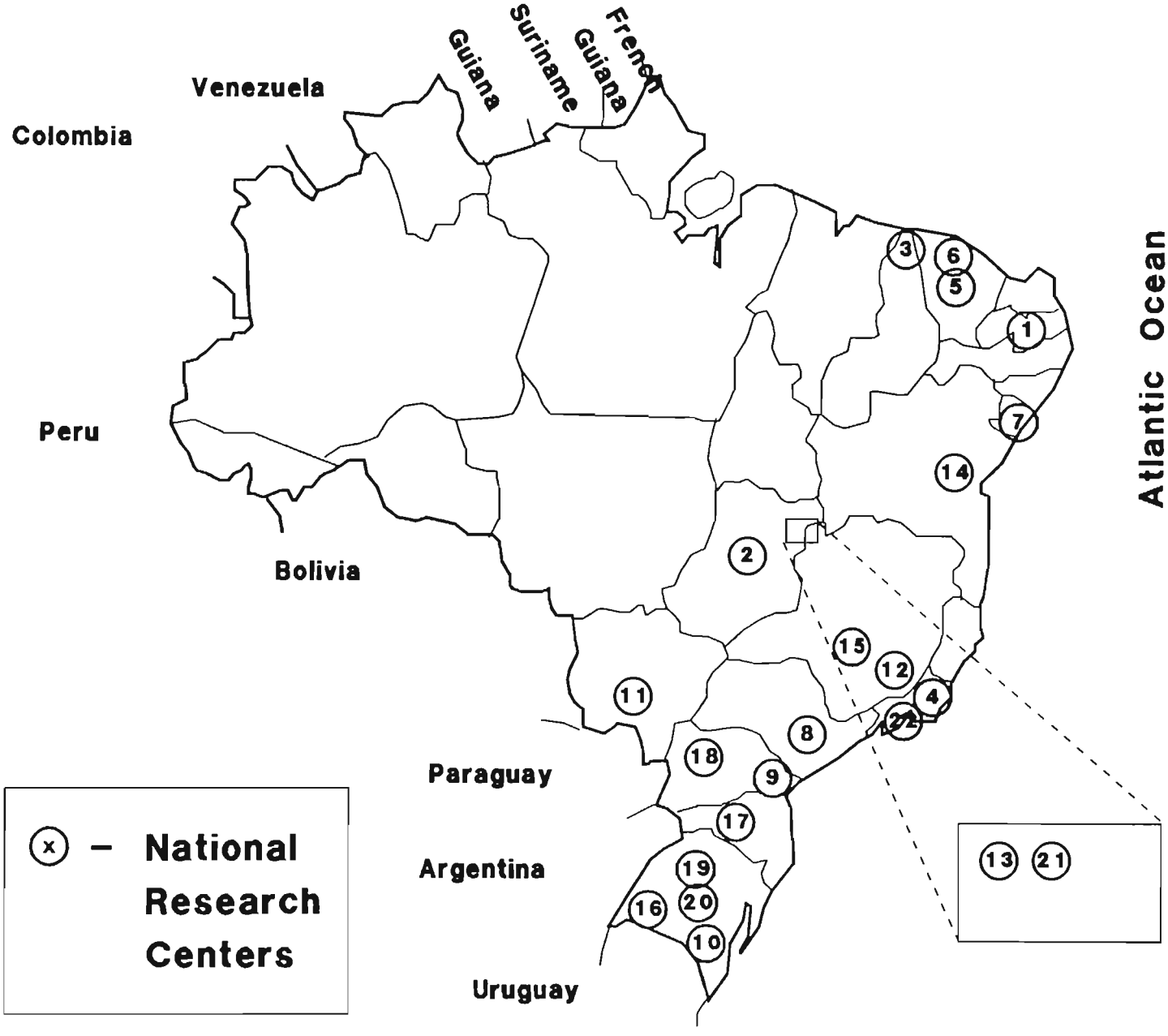


Figure 1b): **EMBRAPA's DECENTRALIZED UNITS**

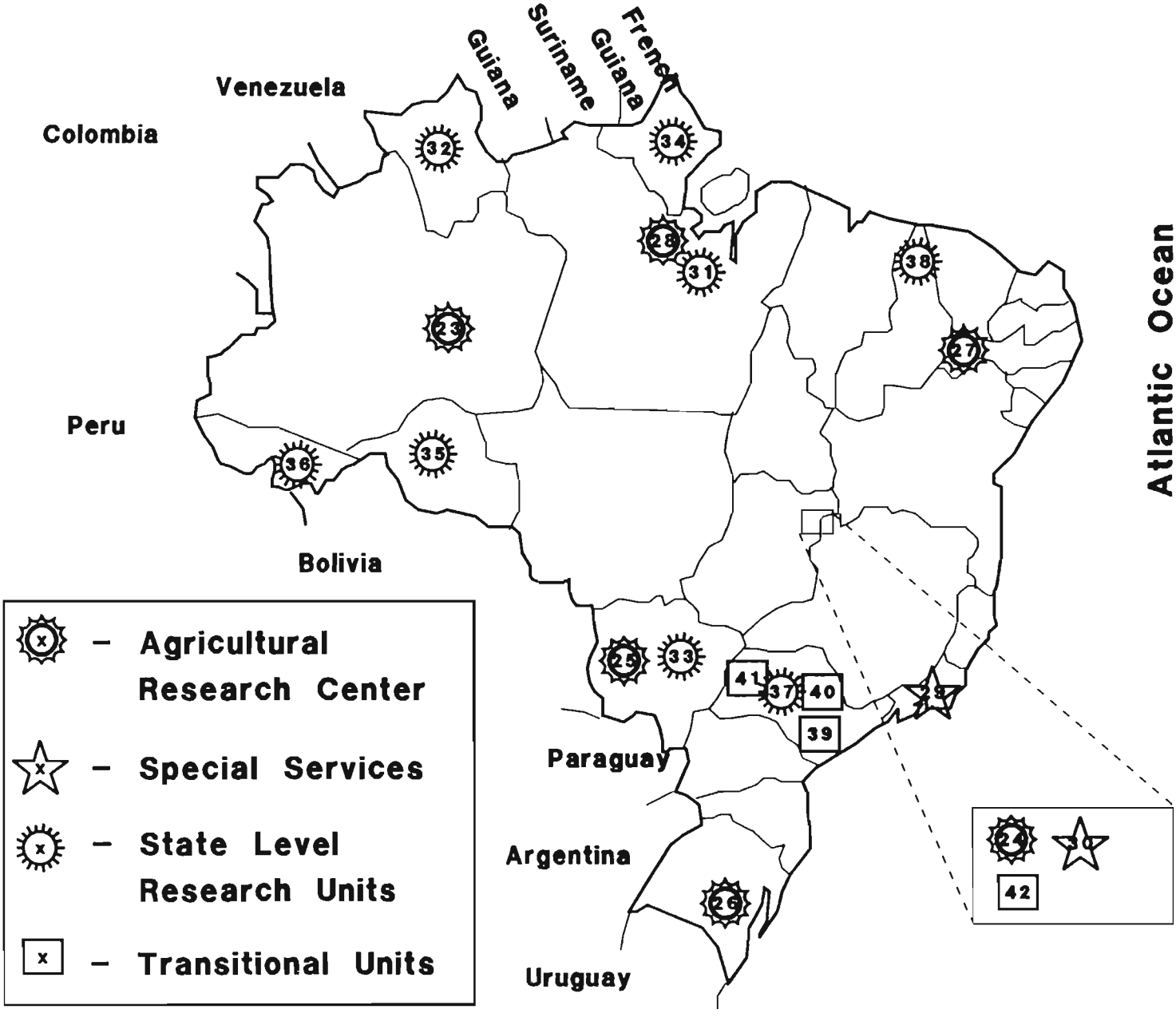


Figure 1c): **EMBRAPA's DECENTRALIZED UNITS**

A - NATIONAL RESEARCH CENTERS

1.	CNPA	-	for Cotton: Campina Grande/PB
2.	CNPAF	-	for Rice and Beans: Goiânia/GO
3.	CNPAI	-	for Irrigated Agriculture: Parnaíba/PI
4.	CNPBS	-	for Soil Biology: Itaguaí/RJ
5.	CNPC	-	for Goats: Sobral/CE
6.	CNPCa	-	for Cashew Nuts: Fortaleza/CE
7.	CNPCo	-	for Coconuts: Aracaju/SE
8.	CNPDA	-	for Defense of Agriculture: Jaguariuna/SP
9.	CNPF	-	for Forestry: Curitiba/PR
10.	CNPFT	-	for Temperate Fruit Crops: Pelotas/RS
11.	CNPGC	-	for Beef Cattle: Campo Grande/MS
12.	CNPGL	-	for Dairy Cattle: Coronel Pacheco/MG
13.	CNPH	-	for Vegetables: Brasília/DF
14.	CNPMF	-	for Fruit Crops and Cassava: Cruz das Almas/BA
15.	CNPMS	-	for Corn and Sorghum: Sede Lagoas/MG
16.	CNPO	-	for Sheep: Bagé/RS
17.	CNPSA	-	for Pigs and Poultry: Concórdia/SC
18.	CNPSo	-	for Soybeans: Londrina/PR
19.	CNPT	-	for Wheat: Passo Fundo/RS
20.	CNPUV	-	for Grape and Wine: Bento Gonçalves/RS
21.	CENARGEN	-	for Genetic Resources and Biotechnology: Brasília/DF
22.	CTAA	-	for Agroindustrial Food Preparation Technology: Rio de Janeiro/RJ

B - AGRICULTURAL RESEARCH CENTERS

23.	CPAA	-	Agroflorestal Research Center for the Amazon Region: Manaus/AM
24.	CPAC	-	for "Cerrado" Region: Brasília/DF
25.	CPAP	-	for Pantanal: Corumbá/MS
26.	CPATB	-	for Lowlands: Pelotas/RS
27.	CPATSA	-	for Semi-Arid Tropics: Petrolina/PE
28.	CPATU	-	for Humid Tropics: Belém/PA

C - SPECIAL SERVICES

29.	SNLCS	-	National Soil Survey and Conservation Service: Rio de Janeiro/RJ
30.	SPSB	-	Basic Seeds Production Service: Brasília/DF

D - STATE LEVEL RESEARCH UNITS

31. Belém/PA
32. Boa Vista/RR
33. Dourados/MS
34. Macapá/AP
35. Porto Velho/RO
36. Rio Branco/AC
37. São Carlos/SP
38. Teresina/PI

E - TRANSITIONAL UNITS

39.	NMA	-	Environmental and Natural Resources Remote Sensing Unit: Campinas/SP
40.	NTIA	-	Agriculture Software Unit: Campinas/SP
41.	UAPDIA	-	Agricultural Instrumentation Research and Development Unit: São Carlos/SP
42.	UAPNPSA	-	Animal Health Research Unit: Brasília/DF

Personnel were divided into three groups -- researchers, support staff, and administrators. The numbers of employees required in each category were decided upon on a case-by-case basis, according to the type of commodity or resource they would be researching.

Management effectiveness, continuity, and coherence were facilitated by an organizational arrangement that put the DHR under the direct supervision of one of the three directors.

This first phase took about six years. At that time, an attempt at developing a master plan for EMBRAPA was made, but it was never put into effect and the human resource portion of the plan was generally ignored.

A second phase, characterized by an emphasis on allocation of the available research capacity, then began.

Since the beginning, EMBRAPA's program has been largely determined by policy and funding considerations, with little attention given to the availability of human resources. Because of this, it became impossible to plan ahead for staff needs, and many researchers have been seriously overloaded with work. As a trade-off, EMBRAPA built a public image of being hard working and client-oriented, at the service of agricultural interests. The situation has been aggravated by the control at headquarters over means, by privileged access to information, and by the leadership at headquarters toward the envisioned system of agricultural research. Institution building has overwhelmed any considerations of planning or orderly management.

By 1985-86 EMBRAPA experienced a drastic though short-lived change of command, but this did not have much impact on human resource policies and procedures.

In April 1988, a third phase in EMBRAPA's development was inaugurated when its first master plan was put into effect. Covering the period through 1992, two sections of the plan take care of human resource planning -- a section on macropolicies and another on specific goals.

The section on macropolicies builds on an analysis of the evolution and perspectives of the national society and the world, as well as on the institutional mandate of EMBRAPA. It lists 16 policies, including human resource availability and utilization, but the productivity of the organization (visualized as the socioeconomic impact of research on agriculture) is its central point. The section on specific goals translates policies into actions. Seldom are numbers (such as size, recruitment, and training needs for priority areas of research) given. These actions are more processes, such as implementing sabbatical leave, restoring the purchasing power of salaries to earlier levels, and building leadership and management capacity.

Intentionally, there is still little formalization as far as the human resource structure is concerned. However, there are clear criteria for making decisions, which tend to be focused on institution building.

The trend is from looser to more precise human resource planning. Relationships with the organizational environment as well as strategic institution-building considerations have in a certain measure inhibited the use of conventional methods of quantitative planning for human resources in EMBRAPA. Explicitly formalized, qualitative, decision-making criteria have been used instead.

Comparing EMBRAPA's experience with that of other NARS suggests that human resource planning is not the typical path for building an agricultural research organization (Bennell and Zuidema 1988; Sachdeva 1988). Usually more urgent requirements have to be dealt with first. Three environmental factors may be effective for influencing the pace at which the process of planning is implemented: the human resource market, donors, and the political environment.

Poorly to moderately adequate markets tend to trivialize planning the most, as these conditions force an opportunistic strategy of staffing for which there is no need for a detailed inventory of requirements. Abundant or extremely poor markets, on the other hand, put planning at a premium. In abundant markets, choices among the many available alternatives need to be carefully considered and decisions on equally good competitors must be wise and defensible. In extremely poor markets, external markets must be searched, and hiring of expatriate personnel is usually the only option, albeit an expensive one.

Donors tend to require plans and use them as a basis for decision, a codification of intentions, and an explicit statement of agreement. Human resource planning often becomes a condition for help, at least a powerful supportive argument, and when receivers lack decisive capacity, it may clarify positions and build consensus and mutual understanding.

Politicians in many less developed countries may be eager to transform employment opportunities into actual support and administrative power. Experienced institution builders may then want to use planning as a barrier against pressure for indiscriminate hiring of less qualified people. Others may try to use the absence of it as a bargaining opportunity for buying political support. In this case, low productivity is usually the unavoidable result for the institution, and politicization is all too often the beginning of a permanent crisis.

As the organization becomes better established, the need for more precise planning grows. As the human resource market becomes more sophisticated and abundant at the supply side, demand must be precisely identified by the research organization.

Presently, implementation of human resource planning is at a midway point in EMBRAPA. Centers were asked to identify their own needs for carrying out their share in the goals of the master plan. Hiring and training were explicitly analyzed; however, the results were not incorporated into the plan because the difficult process of making all their different requirements compatible was not performed. The burden to apply the plan's general directives to specific cases falls then on top management and the DHR.

Staffing

Making incremental decisions is a tactic that allows decisions to be taken step by step. Despite disadvantages such as uncertainty of outcome, it has the one big advantage of allowing the organization to adapt to the environment and to changing political and market situations. It is particularly important as an institution-building strategy, especially when mitigated by a strong general sense of purpose.

The development of job descriptions and promotion and salary guidelines was basically made step by step as each research center of EMBRAPA was restructured. It wasn't until later that general systematization was undertaken.

Hiring and deployment underwent a longer and more subtle evolution. In 1972, just before EMBRAPA was formed, the Ministry of Agriculture had a staff of 872 researchers. Only 11% had received a master's degree and three held a PhD. A few were enrolled in postgraduate courses at that time (Alves 1985). Many of those researchers used the institutional changes of 1973 as an opportunity for retiring or engaging in other kinds of work at the ministry or elsewhere. Only 451 were brought into the new organization (Guimarães and Borges-Andrade 1987). However, EMBRAPA did not incorporate all of them at once. Together with other staff, they were allowed to apply for employment in EMBRAPA. The basic selection process relied on interviews, psychological tests, and curriculum examinations to select those who would be hired. If hired, individuals were then required to give up their tenure, but the new salaries were significantly higher than the old. They also had to accept posting at any research center in the country and/or postgraduate training, either domestically or abroad. Candidates who were not selected for employment in EMBRAPA could maintain their tenured civil service positions and be integrated into a division of the Ministry of Agriculture.

Because of the tough requirements imposed upon them before and after the selective process, many of the researchers in the old system felt they really had been given no choice, and the whole process left an atmosphere of tension and discontent, and even active opposition to the new system. However, this opposition vanished as time went by and recent data show (Borges-Andrade, personal communication) that today that group is the most committed of all in EMBRAPA.

On the other hand, the majority of employees came from outside the old system. At the end of this period, 365 researchers had been selected from the old system and 1188 from other sources (Guimarães and Borges-Andrade 1987). Many of them were from the academic and diffusion sectors and many were new graduates. This group was glad to have the opportunity to join the new system and they were excited about the new ideals it stood for. Special care was taken to be sure that all the selected researchers had the potential for creative activities and had career goals to spend their lives as researchers.

Team building for creativity had been envisaged since the beginning. Standardized thinking and approaches were avoided by employing scientists from a variety of university traditions and including all possible personality types. It was intended to build teams with varied behavioral styles in order to create and benefit from cognitive competition and to establish a meritocratic elite. However, the ideological spectrum was limited by the constraints of the national political system at that time (Guimarães and Borges-Andrade 1987).

Central positions were given to the few senior researchers who were selected. The number of expatriates among the permanent employees was very low; however, external consultants played an important role during the conception and implementation phases. Many of the best international experts contributed to this phase by identifying priorities, locating and structuring centers, and organizing research.

Academic performance was the main consideration for hiring higher-level employees entering the system for the first time. There was a great deal of freedom in hiring at this time, and any individual who appeared to have the potential to contribute to EMBRAPA could be invited to join the staff. Fortunately, the hiring team possessed a good deal of foresight and used their administrative freedom well for building the institution we now know.

As a rule of thumb, researchers were recruited at the national market; intermediate manpower, at the regional market; and lower-level personnel, at the local community. These selection criteria were followed until recently when problems with satisfaction induced a change in favor of recruiting researchers at the local and regional levels as a priority.

Center directors had a large say in the whole process of staffing. They were free to propose what kind of personnel should be added to the team, and to suggest names. In practice, the central files fulfilled a very important function as they provided directors with names of specialists in other regions when the local market was too poor. Top management played an important role in discovering and attracting talent, especially because of contacts with universities and national agricultural leadership. In this way, staffing was carried on as a political process of institution building as well as a technical process of applying standardized selection and development criteria.

The process of staffing was not free of conflicts and tension, especially at its onset. Arbitration between the interests and goals of conflicting parties (center directors, old personnel, employment candidates and their external patrons) had to be dealt with firmly and sometimes with an iron hand by the DHR, especially as far as deployment was concerned.

Seventy-nine percent of EMBRAPA's principal staff was hired during the first six years. After that, a second period of slower expansion began, together with a lower rate of turnover. The turnover rate fell from 6.2% in 1978 to about 2% thereafter, with a small increase to 2.5% after 1985. This contributed to a temporary slowdown in hiring.

Selection was decentralized in order to give more voice to the researchers on the recruitment of peers. Also, as a result of growing criticism about the indiscriminate use of psychological tests in selecting employees, testing was discontinued. Actually, psychological tests had never played a major role in the selection process.

After 1983, because of the third-world economic crisis and Brazil's attempts to control the national deficit, there was a significant change in hiring policy. On the one hand, at EMBRAPA's initiative, a law was enacted that required a public selection process for all new employees. Exceptions were those who already held a PhD and had 10 years of research experience on the one hand, and unskilled laborers on the other. One of the main objectives of this move was to avoid political pressure in hiring new employees. The new process requires that the DHR define positions and recruit and deploy staff in an orderly way and in harmony with the policy of manpower development.

A ban on hiring any employees was decreed shortly thereafter on the initiative of the executive branch. In order to get around this ban, hundreds of "temporary" employees have been quietly hired to meet increasing research obligations. These employees come under a number of disparate legal situations. During 1988, this parallel staff made up about 30% of the total 8800 EMBRAPA employees. This was clearly an untenable situation, and it was widely agreed that this group must somehow be legally integrated into the normal employment structure.

After a hard negotiation process EMBRAPA obtained approval for a staff of 11,000 and was ordered to open a public selection process. The "temporary" personnel are required to submit to this if they intend to keep their jobs. They have no other advantage over the competitors than having been trained in EMBRAPA for many years. Such a tough position taken by the enterprise against the interests of a large group of its own employees was very well received by the public at a time when the public service was being criticized for its low level of commitment and widespread use of clientelism and nepotism.

Normal hiring can take place only after public selection, which is usually open only for the lowest positions of each career track. The newer centers in outlying areas are largely understaffed and are most subject to the public selection process. Because of the expense and length of the procedure, there is a tendency to wait for staffing needs at different centers to accumulate and then to fill them all together by holding two or three selections a year.

Periods of ban and let-go have been alternating ever since. The result is an erratic hiring policy dominated by factors external to the organization. Presently, a huge public selection is taking place to fill the need for middle-range and research personnel that originated during the periods of no hiring.

Taking an encompassing view, these different stages in the selection procedure have corresponded to phases in the evolution of EMBRAPA. At first, with the large numbers of applicants from the old system, painstaking screening was done to prevent the hiring of less competent and less motivated individuals. During the following stage, selection was made by the directors and those directly

responsible for developing the new programs at the local level. At that time, the Department of Human Resources was an instrument for both formalizing the selections made by the administrators and arbitrating conflicts. The selection team had very little to do for awhile as they didn't have much influence during most of the process. This situation has continued during the hiring of parallel staff, as the DHR has had little input into this process.

The most recent developments in the hiring process have revitalized the selection team. They would like to see an efficient, well-organized, professionally run selection procedure under the command of the Department of Human Resources. Legal and political considerations are basic concerns for this, and they cannot risk developing inappropriate procedures. At this stage, integration with organizational planning and with development and compensation procedures has been achieved and is taken for granted.

Public selection begins by publicizing the available positions along with complete job descriptions and requirements for training and experience.

Usually a master's of science is the minimum requirement for researchers because it minimizes future investments in training. More recently, there has been a tendency to relax this requirement in order to hire young, promising professionals and inject their enthusiasm into the organization.

Public selection has still not been fully tested at EMBRAPA. Guimaræs and Borges-Andrade (1987) point out four positive and four negative aspects of public selection. On the positive side are a larger and more diversified pool of candidates from which to take employees; an expansion of opportunities for those who, because of social barriers, might not have known of them before; avoidance of nepotism; and standardization of criteria for the whole organization, avoiding regional and local differentiation.

On the negative side, there are higher costs; the time lag between need assessment and actual hiring of new employees; excessive standardization caused by the use of standard, comprehensive tests and the consequent risk of eliminating more specialized candidates; and the risk of picking up good memorizers of content rather than bright seekers of creative solutions.

Public selection is becoming the standard as the negative aspects can be minimized and the positive ones maximized. This is the direction of efforts right now. Planning, efficiency, and professionalism can diminish costs and time lags. Increased familiarity with tests and performance indicators can improve the control over their use and over their reliability and validity.

Compared to other international experiences, EMBRAPA was fortunate to have almost complete freedom for selecting and allocating manpower by its own criteria and rules. This was especially true during the crucial period when the permanent body of researchers was being constituted (a welcome circumstance that was used by management to emphasize institution building).

Priority was given to quality, potential, and ability, with fitting the needs of the programs in the short-term seen only as a secondary consideration. The implicit philosophy was that good talent could always be mobilized from one subject to another and that well-trained creativity pays more than any other specific ability.

Freedom to select and deploy personnel was a result of the correct choice of the juridical framework, namely, public enterprise. However, external economic conditions became the dominant forces and tended to erode the freedom of the juridical model. They impaired management and limited alternatives for decision. This is the current trend and makes the environment much less predictable and more complex than it was earlier. Finally, external political and economic conditions, as well as internal expansion have turned the selection procedure into a highly formalized one.

Development

In 1970 there were few individuals in Brazil holding postgraduate degrees. The courses taught at the postgraduate level at Brazilian universities were few and had been created less than 10 years earlier. Agriculture was not largely represented among them.

Despite that, the government decided not to hire individuals from the international pool for the following reasons: expatriates tend not to settle permanently in a country but remain for only limited periods; nationals are already familiar with the country, language, and culture; hiring nationals had strong domestic support and political appeal that could be capitalized on in favor of implementing changes.

There were many problems with this decision. One was that there were few experienced researchers in the country and they had to be divided among several universities and research centers. So, it was decided that EMBRAPA's strategy would be to upgrade its own researchers, including those most recently hired, by using the existing educational network. Priorities for using existing training capabilities were based on the need to upgrade the training capacity in the country as well as assuring future supply of qualified researchers. In order to do this, however, postgraduate programs had to be expanded and fortified, and research facilities had to be modernized and enlarged.

EMBRAPA developed a training program and sent young researchers to domestic universities for master's degrees. These universities were given additional funds to support this increased demand on their research and teaching resources. More experienced researchers from both EMBRAPA and the universities were sent abroad to obtain PhD or MS degrees in subjects on which there was no domestic expertise. International donations and loans from recognized sources, such as USAID, World Bank, and Inter-American Bank, were instrumental in this program.

The training division of DHR had been a busy and powerful part of the organization ever since its inception. The goal of the program was to create a stock of knowledge in accordance with the organization's needs. That was specifically understood to include training the largest possible numbers of researchers both from EMBRAPA itself and from other organizations

of the NARS (Guimarães and Borges-Andrade 1987) in order to produce agricultural research of good scientific quality within a reasonably short period of time.

The decision for favoring postgraduate training over specialization and on-the-job training, was based on the need to create leadership for agricultural research. Besides having a high level of specialized knowledge in their own specialty, researchers should have the ability to apply that knowledge for generating new, creative knowledge and for correctly identifying research priorities. This requires the broad perspective acquired through formal postgraduate programs at good universities. No specialized short courses or on-the-job training could possibly substitute for this.

The DHR took special pains to ensure continuity in the program by making sure that donors' loans would cover successive support periods. The complex administrative procedures centered on creating excellence. On the one side, good trainees were chosen as often as possible. On the other, first-rank universities were always given priority to send trainees, especially abroad. This was probably an approach that paid the highest dividends to the organization and the country. By studying in good universities in different countries, the researchers gained confidence in their own intellectual capacity, created the right "invisible colleges" and reference groups, and instituted sufficient internal diversity and scientific emulation to create a stimulating competitive environment.

More than 3000 researchers were trained by the program, and about 40% of them were incorporated into it in its first three years. A mean of 300 incorporations a year was maintained until 1977 and then reduced to 100. The present tendency is to return to the historical overall mean of 200 a year despite the economic difficulties inherent in maintaining such an ambitious program. A higher proportion of well-trained researchers will meet the needs for more complex research at the beginning of the twenty first century.

The postgraduate program was designed to benefit all the partners of the NARS, including universities and, eventually, private research (usually researchers from big production cooperatives). As much as one-third of all trainees came from NARS institutions other than EMBRAPA. As a result, the research capacity of EMBRAPA and other state institutions was being created at the same time the training capacity of the universities was being developed. Today, there are strong master's level programs as well as a good start for PhD programs in several areas. These achievements are evident in the form of changed market conditions for researchers. The recently adopted master plan takes issue with these conditions and recommends more hiring from the market, as well as more stringent requirements for granting scholarships and for choosing graduate centers to send trainees to (EMBRAPA 1988).

Procedures for selecting candidates for scholarships (Guimarães and Ferreira 1988) have changed. At first, the initiative almost always began in the DHR, which selected candidates and universities with little active participation from the prospective student. The Technical-Scientific Department would give its approval on specialities and universities to send students to.

This draconian method was only possible because the researchers' contract included a clause agreeing to be sent for training. In a later phase (1978-80), the Technical-Scientific Department almost completely took over the entire process. The most important part of this phase was the care with which priorities were set on areas of study and the institutions to which students were to be sent.

Since 1981, a new procedure for selection has evolved and has finally been fully implemented. Candidates take the initiative by presenting a proposal to a selection committee at their own center. The committee gives approval if it is in accordance with the needs of the Center and if it will be convenient to the center's work schedule. Local management sends the proposal and its approval to the DHR. The final selection is made by a committee of researchers from different departments, both at headquarters and the research centers, under the coordination of the DHR. For each candidate, a standardized questionnaire with information supplied by the center is fed into a computer, where each item is weighed and a list of priorities is printed out. Items include indicators about the training needs of the research center and the NARS, the qualifications of the candidate, and the appropriateness of the training opportunity to the center's workload and the candidate's career development. The committee then goes through the computer list and makes the final decision by using supplementary information and weighing its relative importance within other organizational references. Usually the final result only differs from the computer printout in border cases. High-level management gives the final approval.

Selecting candidates for training has always been the exclusive responsibility of EMBRAPA. The results suggest that this has been successful. However, the Presidency of the Republic alone has the power to approve an employee of any federal agency to leave the country for reasons of work. The rules that govern these approvals are not always clear and are subject to fluctuations, usually as a result of difficulties with the country's balance of payment. Sometimes these fluctuations have a negative effect on careful planning and introduce undue uncertainties.

High-quality students are sent to graduate programs in Brazil and abroad, reach an exceptionally high level of achievement (89% among EMBRAPA's own employees, 79% among those of other institutions), and come back to be researchers. These highly positive results are an effect of the selective process described earlier, together with careful follow-up efforts and evaluation during the training process.

Indirect follow-up is made by means of questionnaires and academic results. In the case of courses abroad, part of the program is administered by specialized organizations which help in the follow-up as well. Direct follow-up consists of visits to the universities by EMBRAPA's human resource specialists. Usually data for program evaluation are also collected then (Quirino et al. 1980; Quirino and Ramagem 1982). Based on these materials, subsequent evaluations have been made that have contributed to decisions both within and outside the organization.

The strategy for development of human resources did not stop with long-term, formal, degree-granting courses. Since 1974, short courses and other activities have also been implemented.

The socialization of researchers to their jobs has been of special importance. A three-month course was designed to give researchers a general orientation to the logic of science, scientific writing, statistics, and the newest plant breeding techniques. At the same time they are given an indoctrination in the new organization.

Exchange with international centers and with leading universities has been very active. Researchers are encouraged to attend and contribute papers to national and international symposia and professional meetings. Supporting meetings of professional agricultural specialities with financial and other resources is but one of the means EMBRAPA has contributed to the development of the country's human resource base in agricultural research.

The relative abundance of funds and EMBRAPA's unity of purpose and coordination have been instrumental in the success of both the long-term and short-term programs.

These training programs have formed the basis of DHR development activities. The postgraduate training program provides a strong base for scientific research. Short-term training, such as short courses, seminars, international trips, and on-the-job training, update and refresh this base. Researchers are encouraged to attend courses and scientific meetings. Support and administrative personnel receive lower priority for that.

Presently, 50% of all researchers with postgraduate diplomas have been trained in EMBRAPA's own program. Research conducted in 1981 in four host countries (USA, UK, France, and Spain) with 68 advisors and 126 of EMBRAPA's postgraduate program participants indicated that 34% of them were described as "exceptional" students (upper quarter) and another 38% as "good" (Quirino and Ramagem 1985). Completion rates are high (more than 80%) and compare very favorably with the 50% completion rates in the international set and the 15% completion rate in Brazil's postgraduate courses in agriculture.

Part of the success of EMBRAPA's training program is due to its integration into the reward system. Any researcher who earns a degree is automatically promoted to a higher career level, and these promotions cannot be achieved without acquiring an advanced degree. Short-term training does not lead directly to economic rewards, but participation in short-term courses and seminars, in meetings and workshops, is viewed very favorably by the administration and by peers.

With the tendency for redemocratization of the country that began shortly after 1983, researchers and training specialists alike have identified training in social sciences as a rising need. That need has been met by a series of short courses and seminars, the goal of which is to help researchers understand the changing national scene and the role of agricultural technology in it. Economics, sociology, and political science have all been used to help researchers with the difficult task of translating sociotechnical problems into research priorities and scientific problems.

As the organization becomes older, there has been a trend towards giving priority to studies and actions that avoid human capital decay. At the present time, the training system is being reevaluated in this light, with more emphasis being given to training in specific disciplines. Training programs for laboratory and field technicians are also being developed. However, state enterprises still receive priority for basic postgraduate training. Postdoctoral and sabbatical leaves have begun to be implemented. They are seen as a common field between the compensation system and the need for refresher courses.

Attention is also being focused on internal mobility, especially for administrative and support personnel. The external labor market is tighter than it was, and with the rigid public selection process in force for hiring, hiring and promoting from within is essential. It can also serve to strengthen the institution and contribute to keeping good employees in the system and to reinforcing meritocratic principles.

EMBRAPA's experience with development is one of its most important achievements and is accounted for by four main factors:

1) the emphasis on quality;

2) the foresight and planning of funds;

3) the balanced use of what is available in the training market and what has to be specially implemented by the organization;

4) the explicit bond between training and compensation.

The first aspect has already been explained here. The last will be dealt with in the next section. There is no doubt that international contingencies on granting loans and making donations for training were very favorable during the seventies. The merit of management was to explore and to maximize those opportunities and, more than anything else, to coordinate between donors' sources and interests in order to create a continuous flow of means that fit the organization's schedule and possibilities. This active search for support, together with the quest for excellence, allowed the development of an elite group of agricultural researchers and to institutionalize the means for supplying its needs in a continuous way.

By explicitly signalling its demands, the NARS fortified and expanded an internal market for training in the country. However, it also used offers from international centers, universities, and (when possible) private organizations. This was the case with training for administrative and support chores.

At the same time, DHR assembled and created a body of competent specialists in order to have quality control through continuous evaluation of all phases, including needs, objectives, processes, and results. When the market was unable to provide needed training, DHR took the responsibility to find that training both by using its internal resources and finding external help.

Lately, this capacity has been used to fortify the capability of the NARS to have impact on agriculture. Courses are organized and monitors trained to improve the linkages between research and technology transfer. Most of the initiative is at the level of the research unit and the target clientele includes other researchers, university professors, extensionists, and agriculture professionals working for banks and cooperatives. However, this is part of another story and will not be pursued here.

Compensation

When EMBRAPA was first created, jobs in the public sector offered a combination of salary and various fringe benefits. However, the fringe benefits were difficult to administer, and EMBRAPA chose to shift to larger salaries without the benefits. There was almost no competition for researchers in the job market, and the main aim in establishing EMBRAPA's salary plan was to make it an attractive career choice for the best students in the agricultural sciences. Other employees were also paid top salaries in order to attract the best candidates and to keep salaries in line with the private sector.

Care had to be taken not to deplete the research staff at the universities and state institutes. Although many of these researchers were hired at the better salaries offered by EMBRAPA, they were then allowed to continue at their old jobs, since the universities and state institutions were tied up in the public-service system and couldn't pay the higher salaries.

The results were positive. The institute was able to attract well-qualified employees, and their level of satisfaction remained high, despite tough measures and difficult living conditions at some of the research centers. A survey of 203 researchers who received postgraduate training in Brazil in 1979 included some questions that measured satisfaction. It showed that 93.0% of the respondents agreed that EMBRAPA offered good research conditions to its researchers; 96.1% felt that "it is very satisfying to be an EMBRAPA researcher" (Quirino et al. 1980).

Despite the purpose of simplifying administration by avoiding the complexities of fringe benefits, after a few years the situation was anything but simple. A study by Quirino and Coqueiro (1985) was able to identify the following kinds of compensation. The new Plan of Jobs and Salaries (PJS) recently introduced a few changes that will be explained as well.

1. Basic salary. The scale of jobs and salaries was used to divide jobs into three groups, namely, researchers, support staff, and administration. There was a salary scale for the first group and another for the next two. The new PJS subsumed the last two groups under the name of "research support group" and renamed the researchers as a "technical-scientific group". These apparently perfunctory changes justified the application to EMBRAPA of less stringent rules for its personnel budget. There is, then, a general referential salary scale with 59 degrees.

The salaries of researchers are tightly tied to their academic level, which represents their career level as well. Each level carries a correspondingly higher salary. Career level I (references 38 to 47) corresponds to a BS degree, level II (references 44 to 53) to an MSc, and level III (references 50 to 59) to a PhD.

This system is a powerful incentive for training. A researcher is automatically moved upward to the next level after receiving a higher degree. Even in the unlikely case that a researcher only receives a small salary increase in the move up, the horizon for future upward mobility is expanded so substantially that changing levels becomes a reward in its own right. The technical-scientific group is divided into five career levels, namely, auxiliairy services, agriculture and transportation workers, support to research, data processing, and administrative operations. Each career level is composed by three to four job lines which have their lowest and highest referential salary delimited (Table 1).

There are still two other scales of basic salary and these are for transitory positions. One is for managerial positions and the other is for high-level advisory positions to the directorate. During the earlier years, salaries for transitory jobs could not be added to those of effective jobs. Employees who occupied a transitory post had the right to choose either their own effective salary plus a 20% transitory increase or the transitory salary, whichever was higher. This was expected to make these jobs less attractive to older, more experienced researchers and thereby to reduce the pressure on management to appoint them to administrative posts when a place was open. Younger, higher-achieving researchers, on the other hand, were expected to find these jobs attractive because of the higher pay they could receive, compared to their effective job salaries.

More recently it was felt that transitory positions were not attractive enough for talented people. So, the new PJS established that they should be payed by the addition of a fixed amount to the basic salary.

Employees rise in the effective salary scale by two kinds of movement, functional relocation and promotion. The first aims at adapting employees' abilities to new, presumably more challenging, jobs. It does not automatically result in a higher salary, although in practice it usually does. Promotion results in an employee's salary increasing within the same job or with access to another, higher-level job in the same career path.

Usually basic salary increases are provided once a year under rules that almost guarantee a promotion every other year. However, external factors such as lack of funds make it difficult if not impossible for the organization to maintain control and consistency in salary increases.

2. Additional salary. Working conditions in Brazil are heavily controlled by the government. The legal requirements for supplementing salaries under specific working conditions cover almost every conceivable contingency. Additional pay based on the number of dependents, dangerous working conditions, unhealthy working conditions, night work, and overtime, as well

Table 1: SALARY REFERENCES OF CAREER JOBS AT EMBRAPA

CAREER	JOB	SALARY REFERENCE Initial	Final
Research	Researcher	38	59
Auxiliary Services	Laborer	01	13
	Artisan	10	20
	Master of Maintenance	16	26
	Maintenance Technician	21	42
Agricultural and Transportation Workers	Rural Worker	07	20
	Rural Foreman	13	26
	Operator of agricultural machinery and vehicles	13	26
Support to Research	Laboratory Assistant	13	26
	Research Assistant	21	42
	Specialized Technician	32	53
Data Processing	Data Processing Assistant	30	26
	Operator of Data Processing	20	30
	Programmer	21	42
	Systems Analyst	32	53
Administrative Operations	Administrative Support	13	26
	Administrative Assistant	21	42
	Executive Assistant	32	53

Source: Plan of Jobs and Salaries, 1989 version.

as provisions for special professional uniforms are all included in the legal requirements binding EMBRAPA. Annual increases for seniority have also been adopted from the civil service. In order to deal with the unique conditions in the (then) new federal capital and in pioneer regions, two other benefits were added: allowances for housing and transient placement.

3. Indirect compensation. There are two types of indirect compensation -- social obligations and nonfinancial incentives. Both represent an immediate financial burden for the organization, but the employee perceives them as nonfinancial because of the indirect, sometimes postponed, way they are realized. The first one, social obligations, can be as much as 60% of the base salary. Vacations, paid holidays, contributions to the social security system, justified absences, and paid sick leave are examples of social obligations. Nonfinancial incentives include the following:

a) supplementary retirement insurance (the cost of which is shared with the employee -- it provides a supplement that raises retirement benefits to close to actual salary levels);
b) group insurance;
c) plan of medical assistance;
d) subsidy for rent of residence;
e) free transportation for employees assigned to research units located outside the urban perimeter;
f) subsidized meals;
g) facilitation of personal credit;
h) subsidies for moving to a new working place.

Indirect compensation is important in enhancing the attractiveness of the institution to prospective employees in a competitive job market. The new PJS added a special 90-day vacation after the first 10 years of work and after every subsequent period of 5 years.

Because of the importance of understanding what kinds of characteristics the salary is actually rewarding, a study was carried out among EMBRAPA's employees in 1981. The data were analyzed twice, using a slightly different theoretical approach each time (Quirino and Coqueiro 1985; Quirino and Hanna 1986). The following results are from the second, expanded analysis.

Drawing from economic theories of human capital, from sociopsychological theories of motivation and from sociological theories of the division of labor, an inclusive theory of salary determination in an agricultural research organization was proposed. It conceives the present basic salary as a result of two sets of variables. The first set (model 1) acts at the time the employee joins the firm and determines the initial salary. The other set (model 2) represents rewards that result from the time the employee joins the firm to the present. The variables of the first set cover the concepts of ability, occupational opportunity, and work market. The second set deals with changes in ability, with performance, and with occupational opportunity. Figure 2 specifies the theory and lists the respective variables.

Data from a stratified random sample of 736 EMBRAPA employees were used to compute standardized partial regression coefficients (beta) for the two models. Table 2 reproduces the results and figure 3 shows the resulting empirical models, after nonsignificant relationships have been dropped and the remaining coefficients recalculated. The models have one serious limitation: a good measure of performance was not included because one was not available. However, the one included explains the second largest area of variance of the present salary.

Ability, occupational opportunity, and work market explain 71% of EMBRAPA's first salary variation. First salary, changes in ability, performance, and occupational opportunity explain 84% of present salary.

The small unexplained residual and the comparisons between the two models suggest that salaries cover what they are supposed to pay for, that salary attribution by the time an employee joins EMBRAPA is an effective process, and that whatever happens thereafter is far less important for determining salary.

Changes in the political and economic environment of the country took a toll on the system of higher salaries. Salary is more visible than fringe benefits, and the first reduction made by the government when cutting the public deficit included NARS salaries. Tight controls on fringe benefits have since been instituted as well. Salaries are periodically upgraded according to the purchasing power index, although they are not always brought that high. Bringing NARS salaries into line with other categories has been the result of a difficult bargaining process, which is time consuming and diverts managerial resources from more relevant duties.

Although salary levels in EMBRAPA do not have the comparatively favorable position they had at first, they are still relatively high. Unfortunately, the relative loss may have a negative effect in the long run for attracting some of the best candidates for agricultural research.

If relative salary levels are important for maintaining the overall attractiveness of a career in agricultural research, indirect compensations and criteria for salary increases are important for organizational performance and individual satisfaction. A study of working conditions in 32 of EMBRAPA's research centers (Quirino and Xavier 1987a) shows that although researchers' overall satisfaction with 33 aspects of life quality increased between 1980 and 1983, satisfaction with salary levels decreased. The data also show that high salary is less important for researchers than are those items related to scientific achievement. However, salary increases proportional to performance are identified as the first priority for improvement of organizational satisfaction. Further analysis (Quirino and Xavier 1987b) suggests that sufficiency of and satisfaction with fringe benefits (but not with salary levels) are moderately correlated with an organization's performance, as measured by the impact of research on agricultural productivity.

Figure 2: **Theoretical models of salary determination**

(Quirino and Hanna, 1986)

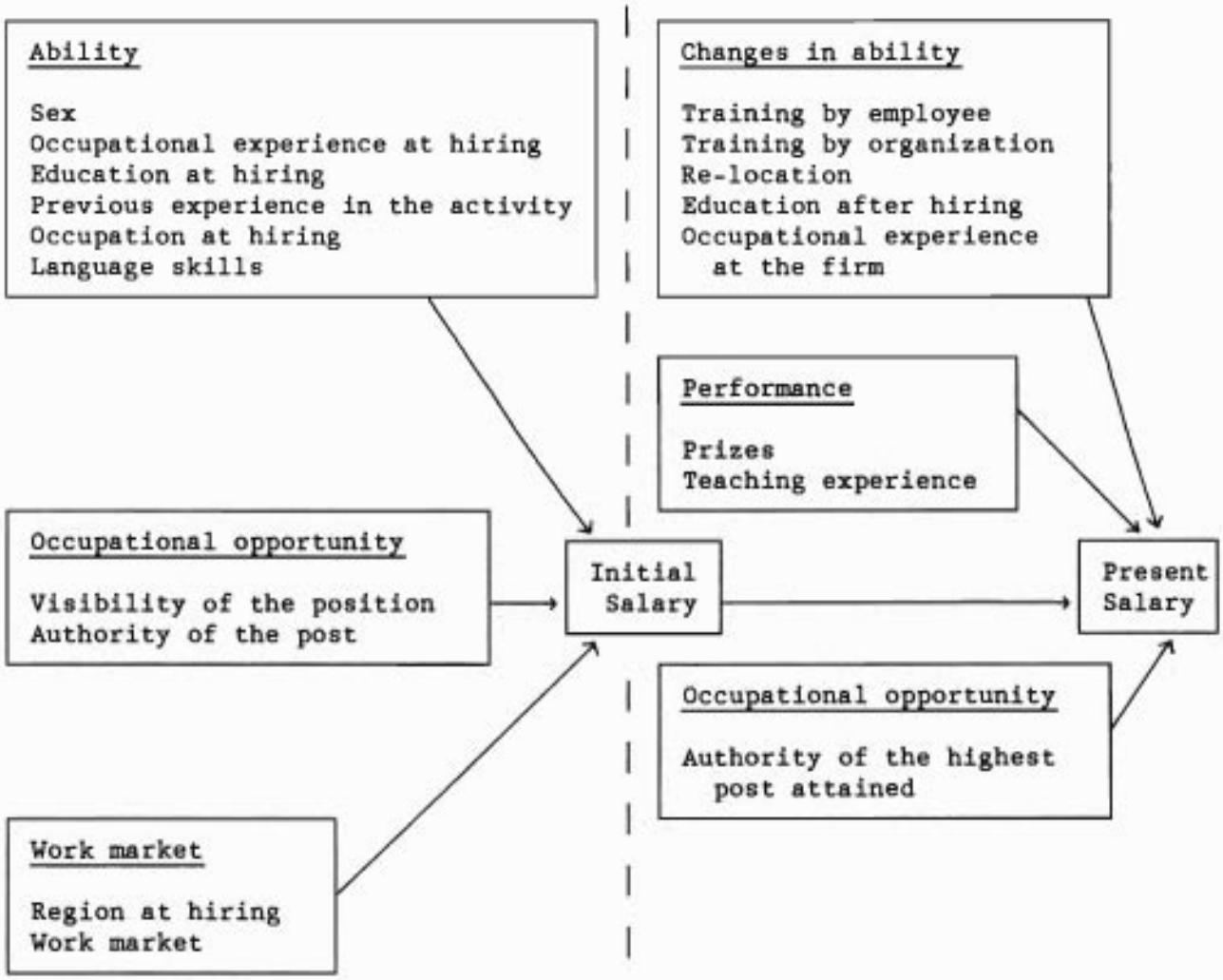


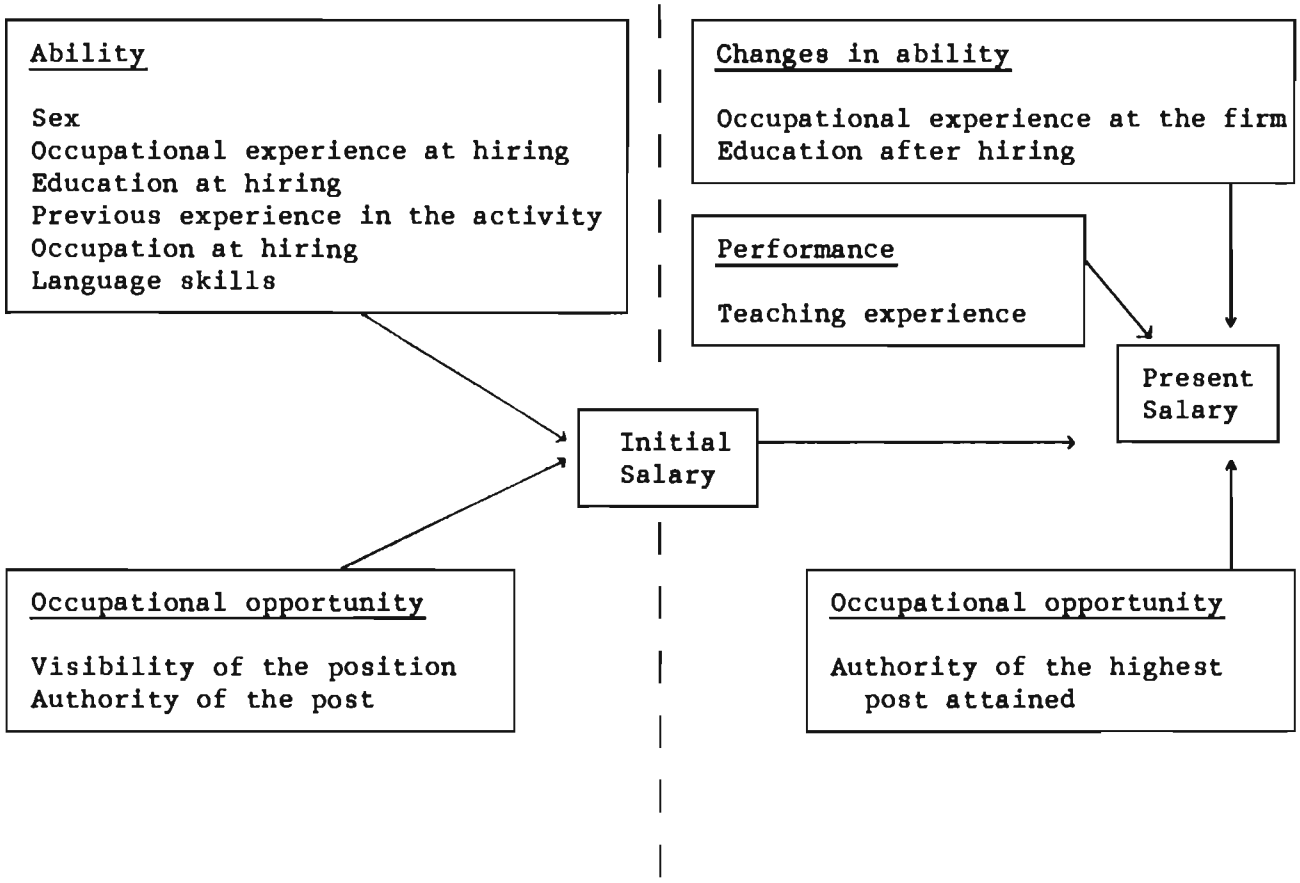
Table 2: DETERMINATION COEFFICIENTS (R^2), DEPENDENT (DV) AND INDEPENDENT VARIABLES (IV) AND STANDARDIZED PARTIAL REGRESSION COEFFICIENTS (BETA) OF THE EMPIRICAL MODELS OF SALARY DETERMINATION*

(Quirino and Hanna, 1986)

Model	R^2	DV	IV	Beta
1	.71	Initial salary	Education at hiring	.476
			Occupational group "researcher"	.365
			Language skills	.130
			Occupational experience at hiring	.101
			Previous experience at hiring	.098
			Post visibility "headquarters"	.060
			Occupational group "support"	-.072
			Sex	-.070
2	.84	Present salary	Initial salary	.779
			Authority of the post	.156
			Teaching experience	.124
			Occupational experience at the firm	.112
			Education after hiring	.057

* Beta coefficient were completed after having non significant variables (P = .05) excluded from the models.

Figure 3: **Empirical models of salary determination**



MODEL 1 MODEL 2

There is a trend towards introducing new fringe benefits and restoring some of the old ones. These cover such things as dental care, subsidized meals, free transportation, health insurance, sabbatical and special leave, and supplemental retirement programs. Experience is rewarded by means of a supplementary financial benefit.

Evaluation

There have been repeated attempts at setting up an evaluation system, but there has been no satisfactory outcome (Quirino et al. 1981). Initially, EMBRAPA adapted recognized international evaluation techniques to its own system. The results of the evaluation were supposed to be the basis for promotions.

As their experience grew, the DHR discontinued the evaluation process because it appeared that it was doing more harm than good. Many researchers felt that their efforts were not given full consideration and that a lot of personal bias was interfering with the process. The forms included psychological criteria, particularly personality characteristics, that were inappropriate. There was excessive reliance on academically oriented outputs that researchers in more applied fields felt was unfair. Many supervisors failed to fill out the evaluation forms, while others failed to take responsibility for the evaluations they had made. Basically, the atmosphere surrounding the whole evaluation process was very negative and was bad for morale.

A few years later another scheme was tried, but it also failed. This one proposed to make the evaluation process separate from promotions and raises. Instead, it emphasized planning for the next year and then following up on the planning rather than judging performance, per se. The employee was to be evaluated on the anniversary month of employment to avoid turning the process into a collective act. The employee and the supervisor would both fill out an evaluation and then would meet to discuss both forms. This process failed because it was not properly implemented -- there was insufficient personnel, there was no training, and there was poor control.

At the present, a committee system is being used. Part of the committee is nominated by the department or center and part is elected by each employee category. Performance evaluations are directly tied to promotions, which are decided by the committee. Only 3% to 4% of the annual personnel budget is allocated for promotions, so the committee has a difficult task. Each committee is free to set its own rules. The DHR only suggests a list of performance attributes that should be taken into account. A typical case could be described as follows. The process begins by examining lists for promotions submitted to the committee by managers at all levels, including their subordinates. Each manager is free to apply the suggested criteria. The committee's main job is to issue the final list within the present budget limits. Negotiations inside and outside the committee are the usual procedure for approaching consensus. There are indications (a drop in discontent among employees, an increase in praise for this system) that the system is working reasonably well. But there are tentative plans for a more comprehensive system. Experiences at the local level are being examined and analyzed and may contribute to the development of a new system.

Research results (Lima, et al. 1986) indicate that employees like the idea of being evaluated, but some changes must be made before they are satisfied with the evaluation process itself: employees must be involved in the entire process of setting up and using the evaluation system -- from the initial formulation of the system through implementation to its routine use; the relationship between evaluation and other human resource management functions should also be clear; and the evaluation process should be open and direct. This last condition is crucial for avoiding tension. Instead of blaming individuals for a lack of performance, the evaluation process should try to identify what conditions have contributed to it and how these conditions can be remedied.

There is a group studying that approach at the moment, but no data are yet available. Given other more pressing problems in the NARS, it will take some time to get another evaluation system ready to try. In the meantime, local experimentation is allowed and encouraged.

All in all, EMBRAPA's experience with evaluations has had its ups and downs, without any sense of direction. However, it has tended to be negative, and the present system is admittedly tentative and experimental.

There are two factors that were mainly responsible for this lack of success. On the one hand, the systems that were introduced did not fit the psychological profile of the organizational culture of the NARS, and instead of creating an environment that enhanced performance, it contributed to a sense of partiality and unfairness, resulting in avoidance of the whole process. On the other hand, the means for implementation of the process were not adequate, leading in turn to failure and discrediting the entire concept.

INSTITUTIONALIZING REFLECTION ON HUMAN RESOURCES

It is generally accepted that human capital is the most important asset of a research organization; in spite of that, it is not always managed on a high-priority basis. The fact that EMBRAPA's first act was to set up a training program to signal their intention of giving first consideration to human capital is symbolic. It indicates the willingness to give priority on principle to human resources. A study of the economic results of such an approach indicated that it brought dividends. The study found that the rate of return to educational investments is at least 22% a year (Avila et al. 1985), which in itself is unusually high. This compares very favorably with most other types of investments.

Proper management of human resources is neither automatic nor obvious. Situations vary, resources are usually scarce, and agonizing decisions need to be made about priorities. Despite the advancements of the last 20 years, knowledge on the matter is lacking and there is a lot of folk wisdom and myths around that are accepted as fact. There is a need for continuous fresh reflection on human resources, especially when the organization depends primarily on the quality and performance of its human capital. These needs were faced by EMBRAPA in a creative way.

EMBRAPA's DHR has set up a small group composed of two to five specialists who act as a think tank and internal advisory service. This group forms an integral part of the head office and provides a scientific basis for DHR actions. The group attempts to integrate an understanding of the environment, objectives, and strategies of the organization with the tenets of sociology, psychology, social psychology, economics, and administrative science. It acts as a resource for DHR and the NARS as a whole. The way it is set up gives its members professional, not bureaucratic, authority, so its influence is based on convincing evidence.

The group research and advisory service has focused primarily on training, compensation, and evaluation. Training has been examined from the level of postgraduate programs and their economic impact on agriculture to the level of what makes an effective training program. Compensation has been looked at in both its monetary and symbolic forms. And evaluation has been examined from the aspect of human resources to that of organizations, both quantitatively and qualitatively. Analyzing the effects of changes that were initiated as a result of previous studies is also part of the group's program.

The role the advisory group has played in the organization is perceived as being extremely positive. Group members are frequently invited to participate in important working groups, including the master plan working group, and they are recruited for positions in top management. They are also constantly requested to give courses and to participate in conferences and symposia.

The primary mandate of the advisory group is to apply science to the management of human resources, and it has done that effectively. It has also helped preserve the best aspects of the organization and to change what does not seem to work properly. Moreover, it has contributed to the overall perspective of the organization's future and mission. The group is currently working on a series of books that will make the results of its studies on the administration of human resources available to the public.

Besides monitoring the progress and hindrances of human resource administration, the advisory group systematically tries to assess the effectiveness of its own work (Quirino 1983; Borges-Andrade 1985) and to identify undexplored directions for new efforts. The present trend is toward studying aspects of the decay of human capital, relationships between organizational structure and scientific performance, employee commitment, and aspects of life quality at work and its impact on the organizational mandate.

The empirical research produced and the volume of knowledge it has generated is leading the group towards exploring theoretical implications and identifying the relationships between previously unconnected organizational, economic, and psychological characteristics of human resources and its administration. Theory construction becomes, then, a welcome by-product of the use of science for practical purposes.

CONCLUSIONS

EMBRAPA's experience indicates that contingencies internal and external to the organization match together to characterize evolutionary stages in the development of a NARS and have a strong effect on human resource management. The size of the organization can also have an effect that should be studied in a comparative way, but it is not a variable in the present case.

Not every task is influenced equally. Human resource planning in EMBRAPA has been conducted in a variety of ways, ranging from loose objectives, centered on the needs of the process of organizing and creating a body of researchers, to more precise objectives, centered on structuring for reaching the overall goals of the institution. It has never reached the precision and clarity usually required. At first, clear setting of organizational objectives (such as research priorities) and criteria for recruiting (such as academic competence and scientific experience) substituted for formal planning of requirements. Later on, external factors prevented full adherence to formal plans. However, the trend towards formalized planning is there.

Staffing was first influenced by the conditions of an inherited work force, then by restrictions in the human resource marketplace. Incremental decisions and interaction with development were the usual means of coping with these conditions. Later on, there were external pressures that necessitated the creation of legal barriers, and these were established to protect organizational efficiency and effectiveness. Economically difficult circumstances that were external to the organization ended up dictating narrow limits to management. Staffing was affected the most strongly by all this and unbearable imbalances were created. Solutions are still pending.

Development was the reverse, that is, it has moved from a clearly central position to one that is becoming less important. However, training content and objectives are currently being reexamined, so training could become more central and receive first priority again if the external constraints over financial resources would ease.

The balance between long-term, formalized, academic courses and short-term, informal, contact-type training programs is a strategy that worked well and should be continued and refined. The same is true of the integration between training activities and the reward system.

The large size of the country and the priority given to training by the NARS were used creatively to provide incentives for the educational system to build its own capacity for postgraduate training in agriculture.

Compensation has been most strongly affected by external influences. Sound internal policies were eroded by external factors out of the control of the organization. The trend has been downward as well. Fortunately, there are indications that it is leveling off for now. If this doesn't happen, turnover may bring about the need for more hiring and development and make any prospects of saving on salary illusory in the long run.

Finally, evaluation represents the most erratic and the least successful of the five human resource management tasks. Despite that, the trend seems to be toward improving the process, as this is the desire of both employees and management.

What general lessons does EMBRAPA's experience suggest for institution building?

One of the most prominent features is the role of planning as related to human resources. Although no comprehensive plan was available to the organization at the onset, there was clarity of purpose, mandate, and strategy, together with strong leadership, so that the coherence and continuity that are expected from a formal plan were achieved by other means. In the specific case of human resources, this organizational arrangement was beneficial because the organization was able to substitute formalized planning with a less formal plan but one with a strongly reinforced sense of purpose. This permitted the institution to capitalize on unexpected opportunities in a way that would have been impossible under the directives of a formalized plan.

In this context, incremental decision making substituted for strategy and planning, not for goals and objectives.

The second important feature is the way competence was used as a theme for organizing action and inspiring decisions. The central point is that doing science is a long-term job in which quality is second to nothing. Human capital becomes then the basic factor of production and was treated so.

However, in order to make this priority defensable, other measures were taken in such a way as to attract, maintain, and enlarge support among relevant interest groups. Research priorities were set to identify, create, and diffuse technology that would have a significant impact on agricultural production and show high returns in the short run. Installing and sustaining an organizational culture for applied research aimed at producing results was the tool.

Finally, the interactions between phases internal to the organization and factors that impinge on it from outside point out the need for appropriate managerial attitudes toward both. When an organization is first being established, the attitude should be one of institution building. This requires a more or less opportunistic strategy of action confined within well-established limits that give and maintain a sense of direction. Creating and strengthening ties between the different aspects of the organization in general and the administration of human resources in particular is an invaluable strategy for institution building.

After the organization is instituted, an attitude of maintenance becomes appropriate. It is essentially reactive because it depends on actions that come from the external environment. Proactive positions are mostly restricted to very top management and require codification in formal planning.

The belated role of planning in the institution-building process does not fit into the usual justifications for its adoption. But this approach is supported by empirical evidence from the present case as well as from others. These cases should be examined and carefully compared in order to get a better understanding of this process, and perhaps to obtain new lessons from it.

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