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Strategic planning in public R&D organizations for agribusiness: Brazil and the United States of America☆

Antonio de Freitas Filho[a,*], Maria Lúcia D'Apice Paez[a,1], Wenceslau J. Goedert[b,2]

[a]*Brazilian Agricultural Research Corporation (Embrapa), Parque Estação Biológica, Final Av. W/3 Norte, 70 770-901 Brasília, DF, Brazil*
[b]*Department of Soil Sciences, University of Brasília (UnB), UnB-FAV, 70 910-901 Brasília, DF, Brazil*

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Abstract

There is increasing evidence that public organizations dedicated exclusively to research and development (R&D) in agribusiness need systematic management tools to incorporate the uncertainties and complexities of technological and nontechnological factors of external environments in its long-term strategic plans. The major issues are: "What will be the agribusiness science and technology (S&T) needs be in the future?" "How to prepare in order to meet these needs?" Both *Empresa Brasileira de Pesquisa Agropecuária* (Brazilian Agricultural Research Corporation, Embrapa), attached to the Brazilian Ministry of Agriculture and the Agricultural Research Service (ARS) of the US

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* Corresponding author. Tel.: +55-61-448-4497; fax: +55-61-448-4319.

E-mail addresses: antonio.freitas@embrapa.br (A. de Freitas Filho), marialucia.paez@embrapa.br (M.L.D'Apice Paez), goedert@unb.br (W.J. Goedert).

[1] Tel.: +55-61-448-4442; fax: +55-61-448-4319.

[2] Tel.: +55-61-448-4497; fax: +55-61-448-4319.

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Department of Agriculture (USDA) have developed a comprehensive strategic and operational planning process in order to answer these key questions in the 1990s. The main objective of this article is to present a comparative and preliminary analysis of concepts, methodologies, and processes utilized, and some results obtained by these public organizations.
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1. Introduction

At the turn of the century, there is increasing evidence that the planning of public agricultural research and development (R&D) organizations must be based on systematic procedures to capture uncertainties and complexities associated with the future of their mission area and incorporate them into the decision-making process both at strategic and operational levels. As a first step, key issues that emerge are: "What be the science and technology (S&T) needs for the agribusiness sector in the future?" "How should be R&D organizations prepared to meet them?" On the one hand, the intensity of S&T advances and, on the other, the growing and diversified R&D demands of global markets need to have a different pattern of answers compatible with the new challenges imposed on the sustainability of these organizations at the turn of the 21st century. In order to answer the first question, it became necessary to redefine the vision of the future, broadened by the relatively long horizon of S&T planning, considering a set of external environment uncontrollable factors that affect, directly or indirectly, technological trajectories of agricultural research. In answering the second question, it became necessary to review internal management tools that translate this vision of the future into actions that are more in tune with the solution of priority problems of societies in changing economies.

Preparing to face these challenges, *Empresa Brasileira de Pesquisa Agropecuária* (Brazilian Agricultural Research Corporation, Embrapa), at the end of 1989, adopted the technique of alternative scenarios to visualize possibilities of evolution of future contexts in which agricultural research would be inserted. As of 1990, a process of organizational readjustments was initiated based on strategic planning techniques. The intention was to have necessary and sufficient conditions to attain higher levels of efficacy/efficiency in the use of R&D public resources for the development of Brazilian agribusiness competitiveness, abiding by principles of productivity, social equity, health/life quality, and sustainability of natural resources/environment to benefit society.

With the evolution of this process and results obtained, Embrapa became interested in the general position adopted by its North American counterpart — the Agricultural Research Service (ARS), US Department of Agriculture (USDA) — in search of answers to those questions. An Embrapa mission made up of researchers went to ARS headquarters (Beltsville, MD) in June 1997, which allowed the gathering of information to be used as reference for a internal report and a preliminary comparative analysis. As Embrapa, the ARS also developed

a broad process of adjustments, initiated in 1994, based on consultations with the external and internal environments for the elaboration of its strategic/operational plans, utilizing strategic planning methodology in compliance with federal law — the Government Performance and Results Act (GPRA) of 1993 [1].

The main objective of this article is to compare transformations undergone in both R&D public organizations in terms of: (a) processes adopted — origins, concepts, methodologies, mechanisms, and tools used; (b) results obtained — respective contents of strategic and operational plans. The intention of this article is to contribute towards expanding discussions on the role to be played by public agricultural research organizations in their future environments as well as to create opportunities for sharing and exchanging interorganizational experiences, taking into account particular contexts of new S&T paradigms and socioeconomic changes on the brink of the 21st century.

2. USA: the ARS

Considering that ARS adjustments underway are a part of a broad process of US Government reformulation, it is necessary to introduce a summary of general guiding principles contained in GPRA, based on general documents [2–4]and interviews with the personnel involved. The US Congress passed the GPRA to make activities developed by federal agencies compatible with objectives intended by taxpayers with minimal losses, like private corporations in relation to interests of shareholders. Main reasons that justified this law were the increase on federal budget deficits, the need to update management practices for new information and communication technologies, the excessive fragmentation/overlapping of federal programs efforts and tendency of public agencies poorly positioned to meet demands of the 1990s, and the new government responsibilities. In brief, the ultimate goal of this legal instrument was to shift the focus of US government performance from "means" (or, output/input applied to implement a federal programs) to "ends" (or, outcomes, understood as real results that make the difference in the economy and program participants' lives). In other words, legislators intended to increase the US executive branch accountability in the eyes of society, making it more effective in results, in quality of services, in consumer satisfaction as well as to improve congress/federal agencies decision-making process and performance evaluation. To support GPRA implementation, general procedures, concepts of reference and final products to be obtained were previously defined. In this preparatory period (1993–1997), additional material was supplied, agency pilot tests were scheduled, and financial resources were allocated by the US Congress for this task. Based on successful experiences of leading public sector organizations, pursuing management reform oriented by outcomes (like some US states and foreign countries), the US legislators identified three key common steps adopted: (a) to define clearly mission and desired outcomes, (b) to measure performance to monitor the progress of actions, and (c) to use performance information as a basis for decision-making and feedback. Considering these characteristics, the GPRA made mandatory for all federal agencies the elaboration of three documents: (a) strategic plan with a horizon of 5 years, aiming to define agencies' mission statements and outcomes-related

strategic goals, (b) annual performance plan, aiming to develop annual performance goals and indicators to measure performance, and (c) annual performance report, aiming to prepare information measuring levels of achievement of performance goals (Table 1). In short, on specifying these figures, the GPRA emphasized a narrow link to be maintained between strategic and annual plans to meet desired outcomes and the need to facilitate control of public resources by the Office of Management and Budget (OMB), following the Chief Financial Officers Act (CFO) of 1990. In addition, the GPRA common terminology to be used was specified as summarized in Table 2.

Within the USDA structure, the ARS is subordinated to the Research, Education, and Economics Mission Area (REE), which comprises three other correlated agencies: the Cooperative State Research, Education, and Extension Service (CSREES), the Economic Research Service (ERS), and the National Agriculture Statistics Service (NASS). The ARS headquarters coordinates a total of 20 research centers all over the country under eight regional administrations and, includes two other complementary agencies: the National Agricultural Library (NAL) and the National Arboretum.

As represented in Fig. 1 and considering information obtained from Refs. [5–9], the ARS activities, in accordance with GPRA requirements, can be divided in two basic and interrelated tasks. The first corresponded to a visionary process, aiming to construct the strategic directions for agricultural research. The second was the strategic planning process, aiming at the elaboration of the ARS strategic plan and respective annual performance plan. The coordination of these activities was under the responsibility of a multidisciplinary group, composed of ARS employees and an external consultant, designated by the Senate. Maintaining close collaboration with other REE agencies, the ARS team was formed in May 1994 with the objective to organize the vision from subsidies from ARS main customers, stakeholders, partners, and employees. Based on a pilot seminar (January 1995), five regional conferences were organized between June and July of that year with the participation of 400 representatives of ARS agribusiness external environment (such as producers, processors, industries, distribution, final consumers, other research organizations, universities, correlated federal agencies). These conferences propitiated a *forum* for common discussion between ARS external and internal environments to (a) identify major forces that will influence US agriculture in the 21st century, (b)discuss how influences identified will impact agricultural research, and (c)develop recommendations to ARS on what its strategic role should be in meeting the agricultural research needs in the 21st century. The set of conclusions made it possible to identify critical factors gathered in the following major issues: international and global markets, population and demographic, environmental, sustainability of production systems, economic and government/political, consumer/societal, food/health, technological advancement, education/information.

The information from these conferences fed the ARS research agenda and supplied basic tools for the ARS strategic planning process to start in August 1995, aiming to formulate the strategic and performance plans with deadline set by GPRA in September 1997. The ARS strategic plan was elaborated in two parts. The first described the background: historical retrospective, organization, finance and identified mission, vision, principles, values, main stakeholders, key external/internal factors affecting plan objectives, budgetary resources

Table 1
US GPRA of 1993: synthesis of basic components

Strategic plan	Annual performance plan	Annual performance report
Basic components		
• Mission statement covering the major functions/operations of the agency	• Establishment of performance goals to define levels of performance to be achieved by a given program activity	• Evaluation of program performance for each of performance indicators established in the agency annual performance plan
• General goals/objectives of the agency, including output, outcome and annual performance goals	• Use goals/performance indicators to measure relevant outputs/outcomes/service levels for each program activity	• Assessment of agency performance versus performance goals established in the performance plan for that fiscal year
• Description of strategies/resources needed to achieve performance goals/objectives	• To describe operational processes and resources required to meet performance goals	• Analysis of progress toward goals and explanation for any deviations experienced and/or impediments encountered
• Justification of critical external factors potentially affecting the achievement of strategic/specific goals/objectives/performance goals	• Establishment of procedures for comparing actual program results with the established performance goals	• Discussion of any waiver provisions relative to program performance
• Description of any program evaluation used in establishing or revising the goals and objectives	• Means used to verify and validate measured values	• Summary of findings evaluations completed during each fiscal year covered by report
Additional specifications		
• Five-year period with triennial revisions	• Presentation of performance goals (if not quantifiable, subject to prior authorization from the OMB	• Inclusion of cumulative results of the preceding 3 years when in full operation in 2002
• When developing a strategic plan, the agency shall consult with Congress and entities potentially affected by/interested in such plan	• When developing a strategic plan, agency shall consult with Congress and those entities potentially affected by/interested in such plan	
• Elaboration activity inherent to the government functions and drafting strategic plan shall be only performed by federal employees	• Elaboration activity inherent to the government functions and drafting strategic plan shall be only performed by federal employees	
• Deadline: September 30, 1997	• Deadline: September 30, 1997	• Deadline: March 31, 2000

Source: Based on GPRA, Title 5, Chapter 3/Title 31, Chapter 11 [1].

Table 2
US GPRA of 1993: main concepts and examples

General goal: set of high-level policy, programmatic or managerial ends–results, covered in the strategic plan, that serve as framework from which annual performance goals are derived (to raise health standards/cancer)
Outcome measure: assessment of actual results, effects, or impacts of a program/service compared with its intended purpose (survival of patients after 5-year treatment)
Output measure: tabulation, calculation, and recording of the actual level of effort associated with a given activity, usually expressed in a quantitative or qualitative manner (number of patients treated)
Performance goal/objective: a specified target level of program performance, expressed in tangible, measurable, and objective terms, against which actual achievement can be compared and analyzed (x treatment type given to y patients in n years)
Performance indicator: a particular attribute, value, or characteristic used to serve as a reference point and to measure whether or not a performance goal/objective is being achieved when the performance goal is not self-measuring
Agency: executive organ defined by the legislation
Program activity: a specific activity or project listed in program and financing schedules of the US Government annual budget
Performance budgeting: a means to explicitly link expected results with expenditures submitted in an agency's budget or alternative levels of spending that may be negotiated

Source: Based on the GPRA, Title 31, Chapter 11, 1115 [1].

needed, and monitoring/evaluation processes to be adopted. The second part summarized the ARS strategic plan itself: outcomes, general/specific goals, respective program activities, and performance measures. Linkages between strategic plan and annual performance plan were named and distributed according to five outcomes established by the REE mission area in the USDA: (1) highly competitive agricultural system in the global economy, (2) safe and secure food and fiber system, (3) healthy and a well-nourished population, (4) greater harmony between agriculture and environment, (5) enhanced economic opportunities and quality of life for all Americans, especially farmers, rural population, and communities. Next, the ARS annual performance plan was elaborated, including the selection of ARS specific annual goals

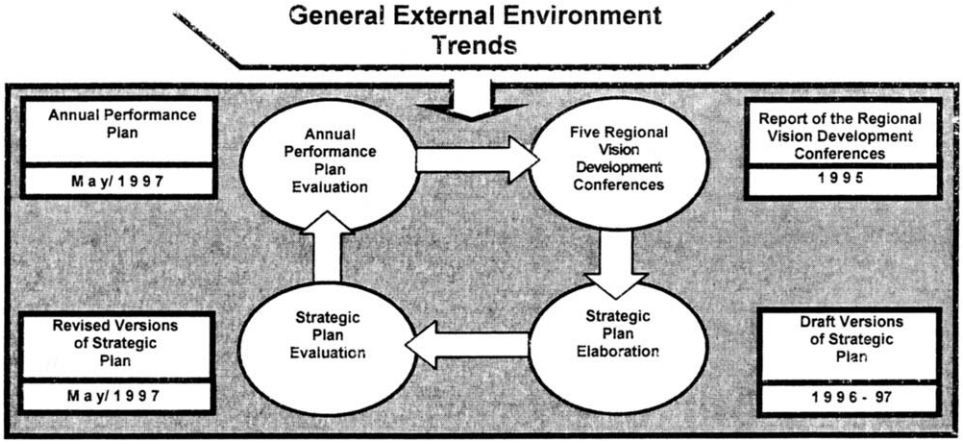

Fig. 1. ARS: Synthesis of the strategic process adopted and corresponding products, 1994–1997.

and the use of qualitative performance indicators in substitution of quantitative ones according to GPRA.

In brief, the US management oriented by outcomes causes ARS to establish its strategic path — mission, vision, values, and guiding principles — detailed by information collected in the visionary conferences and oriented by specific ARS statutory attributions in the hierarchy of the Executive Branch — the USDA/REE. Following the same reasoning, the ARS strategic goals were identified and allocated by each REE outcome. The material collected in the visionary conferences guided ARS internal research programs adjustments. The progress towards these strategic goals will be identified by a set of annual performance goals (detailed in the annual performance plan) to be described in the annual performance report, approved previously by Congress and by OMB.

3. Brazil: the Embrapa

In an effort to set the comparison between these R&D organizations, this section has a similar organization to those utilized in Section 2. Created in 1973, Embrapa has stood out as a public organization of excellence in R&D, achieved by solid investments in human resources, capable not only of promoting advances in the frontier of knowledge applied to agribusiness, but also of solving the problems relevant to the models of Brazilian agricultural development. In order to continue this pursuit and reach higher levels of efficacy and efficiency, it was necessary to construct an Embrapa for the 21st century. That is, Embrapa has to take a strategic position profoundly in tune with external environment needs but without losing sight of the advances of new S&T paradigms, such as biotechnology and technology of information and communication.

In addition to relatively long S&T planning horizons, Embrapa external contexts were becoming more complex, acting and interfering in a set of interconnected factors from varied orders of relevance and hierarchy. Thus, to respond to key questions mentioned in Section 1, it would not be enough for Embrapa to extrapolate the past successes to the future nor to rely on intuition to produce science and transform it into outcomes that met emerging demands of R&D clientele (in particular) and of society (in general). As summarized in Ref. [10], this process started in 1989, taking a new approach to planning activities. Embrapa assumed a proactive position and used the technique of alternative scenarios in order to incorporate uncertainties and discontinuities of the external environment into its institutional proposal of the future, broadening the information for decision-making. Based on alternative scenario inputs, the strategic planning process was selected aiming at (a) propitiating the joint participation of the external clientele and employees in the formulation of long-term strategic plans — Embrapa as a whole (PDE) and decentralized research units (PDU) — and (b) orienting necessary institutional and organizational adjustments. In this process of changes, a logical coherence was maintained. Actions were outlined with the broad participation of external and internal environments, general concepts and methodologies were developed and adapted to specific situations, common language of communication and integration was created/internalized between components, and accumulated experience was utilized to

process improvements on an incremental basis. Furthermore, the utilization of norms, following precepts of total quality, was incorporated into Embrapa routines.

As represented graphically in Fig. 2, Embrapa's first step taken in 1989 was to construct the vision of the future, based on a multidisciplinary internal group, supervised by a specialized external advisory group from University of São Paulo. Alternative scenarios of agricultural research for the next decade were constructed [11,12], allowing the development of a strategic role to be played by Embrapa in light of the *spectrum* of possible futures. In this process, 10 critical factors from external environment were selected and hierarchized, expressed graphically in the form of a "tree of interactions." The basic factor selected was the growing importance of society in the definition of the research agenda. Among other factors, there were others included: agricultural consumer demand shifts, emergence of new S&T paradigms, emphasis on environmental sustainability, pressure to regulate intellectual property and to privatize agribusiness technology, and intense competition for allocating public resources to economic and social sectors.

In 1991, a strategic planning process was adopted [13] and a program of internal implementation was conceived [14,15]. Firstly, a team of about 30 researchers was trained and a manual of strategic planning produced to orientate the elaboration of decentralized units' strategic plans under external advisory supervision. Secondly, this manual was used as reference to start a strategic planning process in all Embrapa decentralized research units, through a series of regional seminars, under the responsibility of the group initially formed and the participation of employees from each unit, totaling about 120 researchers and managers. Finally, trainees began to coordinate the formulation of the PDU from their own units.

In 1992, when the initial versions of the PDU were concluded, a national meeting took place for adjustments in terms of Embrapa as a whole. Criteria for reformulation of the institutional model were decided and the bases for a new model of research programming structured. There followed (a) adjustments made in a second version of the strategic plans (PDU and PDE) and (b) a series of evaluation workshops of these plans by means of external

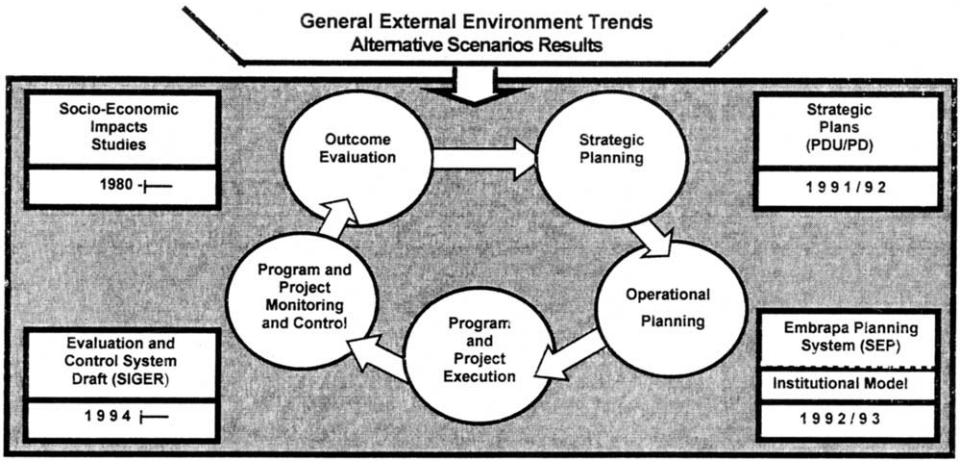

Fig. 2. Embrapa: Synthesis of the strategic process and corresponding products, 1989–1997.

missions, both at the level of decentralized units and Embrapa headquarters. Critical revisions done, strategic plans were finished, and the so-called strategic projects were identified and developed, aiming at providing an initial leverage for changes needed [16].

A vision of the future, strategic plans, and institutional and programmatic models reformulated would still not be enough for Embrapa to attain a major strategic goal — qualitative leap in R&D — selected as basic to the hierarchy of other goals [17]. With this objective, key questions mentioned in the introduction would need to be broken down so that conditions of an efficient, effective, and a quality R&D program model be established, transforming vision into action. In other words, it was necessary to connect strategic to operational levels, answering specific questions: "What is important for research and to whom should it be directed?" "How to allocate the scarce resources available?" Therefore, the revision of the Embrapa R&D model (so-called Embrapa Planning System, SEP) would need to confront R&D supply and demand in a prospective and systemic vision of agribusiness, aiming at determining priorities, allocating resources, and channeling installed (and to be installed) technical competence and capacity adjusted to solve Brazilian agribusiness relevant problems.

The SEP was outlined in 1992 [18], signaling its orientation by R&D demands [19–21]. In addition to emphasizing the focus on systems analysis [22] and total quality products and management [23,24], this system favored the execution of projects with a multidisciplinary character [25] and partnerships [26]. In the dynamic of SEP, three processes were clearly differentiated: (1) identification/prioritization of R&D demands, (2) proposition/analysis/selection of R&D projects, and (3) execution/monitoring/evaluation of R&D projects and programs [27], in addition to socioeconomic impact evaluations traditionally performed by Embrapa since the 1980s [28]. In brief, the fundamental difference between Embrapa clientele needs (R&D demands), projects (R&D supply), technologies/products/services generated (R&D outputs), and effective socioeconomic results (outcomes) was signaled in this reformulated R&D model. Considering that criteria for prioritizing R&D demands identified were directly related to strategic goals, as expressed by the Embrapa strategic plan (PDE), the essential link was established between Embrapa outputs and expected outcomes demanded by R&D final clientele — the Brazilian society, in general, and agribusiness sector, in particular. Thus, the first cycle of strategic and operational dimensions closed when SEP was implemented and an monitoring/evaluation system delineated to offer subsidies for decision-making and feedback. In dealing with a process in continuous improvement, the experience gained by Embrapa in this first cycle has been used to refine further processes and results, attained in a transparent and participative approach.

4. Comparative analysis

Considering the preceding, it became clear that in essence similar strategic positions were adopted by ARS and Embrapa in response to those key questions mentioned. Though these public R&D organizations had different orientations — ARS, following GPRA and Embrapa on its own initiative — both reached similar general findings. Firstly, it was emphasized the

need to have a prospective vision and systemic approach to identify technological and nontechnological factors that affect the evolution of R&D applied to agribusiness and not exclusively to agricultural producers. Secondly, it incentivated the development of participative processes for planning and management activities with outcomes oriented by agribusiness demands of the R&D clientele.

As in ARS, Embrapa took the initiative to develop processes that allowed a shift in planning and management focus from "means" to "ends." Despite the use of particular terminologies, their meanings were similar. What ARS defined as "outcomes" and corresponding "general and specific goals," Embrapa called "strategic objectives" at strategic level (PDE/PDU) and "R&D demands" at operational level of programs/projects (SEP), interconnecting these levels by a set of criteria previously defined. The Embrapa technologies/products/services, attained via projects/programs, corresponded to the definition of "outputs" for the ARS. The ARS "performance goals and objectives" were represented in SEP by "research program goals" (R&D macrohierarchical level) and by "research project goals" (R&D microlevel). At the time of the visit to ARS, the qualitative type of indicator was selected as a measure "performance goals" described in the ARS annual performance plan, despite being mandatory the use of quantitative indicators. Unless not justified or approved by the OMB, this GPRA general rule should be adapted to the specificities of R&D executive branch agencies, like the ARS, in contrast with other public providers, such as police departments or public health services, considering that some GPRA pilot experiences like The National Science Foundation and The Army Research Laboratory decided to combine qualitative and quantitative performance indicators according to the agency type of R&D situation.

In general, some similar generic characteristics of the ARS and Embrapa process of changes can be indicated: (a) prospective analysis of external environment, (b) strategic planning as the methodology of reference, (c) strategic plans aligned with the needs of external environment and major objectives of society, (d) R&D program, searching for outcomes, in agreement with the organization strategic direction, (e) performance indicators for monitoring and evaluation of progress in activities, and (f) having R&D outputs oriented by outcomes expected by society.

In contrast, some specific differences between agencies can be highlighted, in addition to those referring to the greater amount of financial resources allocated to the ARS for the initial implementation of the GPRA if compared to those spent by Embrapa. In relation to external environment analysis, Embrapa utilized a forecasting technique — alternative scenarios — while the ARS adopted another approach — consultative conferences with the external environment representatives. Advantages and disadvantages of both procedures are raised in the literature but do not require a discussion here [29]. However, in Embrapa, the technique of alternative scenarios, though applied with adaptations to available resources, propitiated the identification of main critical external factors affecting Brazilian agricultural research. Probably, the consultancy experience and the internal group inter and multidisciplinary formed allowed it to overcome the financial constrains and to have better chances to foresee various facets of possible future contexts. In contrast, the group responsible for this task at ARS showed great objectivity in managing, systematizing, and gathering disperse informa-

tion collected at five regional conferences. But Embrapa, in adopting the use of alternative scenarios and forming a work team, propitiated conditions for internalizing more profoundly the necessity to implement internal changes to face external challenges.

This prospective vision constituted the spark to implement the process of strategic planning with greater participation, involvement, and compromise of Embrapa's internal and external environments. In contrast, after regional round conferences, the ARS strategic plan drafts were elaborated by an internal group that placed it in the ARS website, employee telecast, and mail consultations for review and comments. But once more, the contents of ARS and the Embrapa strategic plans were similar. For example, the ARS guiding principles and values, expressed in the ARS strategic plan, were almost the same as the guidelines listed in Embrapa's strategic plan, including the terminology used — like excellence, partnership, systems focus, interdisciplinary teams, or information system. In the mission and strategic objectives, there were also similar elements in both organizations, such as the search for efficiency, social equity; natural resources, and environmental sustainability as well as the quality of agricultural products. Though these outcomes are generic and universally desired by all human beings in all societies, their specification in the strategic plans propitiated an opportunity to make them even clearer, giving greater sense of direction to the daily routine efforts of each public organization employee. As a result, there were increased possibilities of reducing "losses" (costs), increasing "benefits" (revenues), or both — translated into maximization of efficiency — without losing track of efficacy in achieving desired outcomes. In Embrapa's case, this fact made it possible to revise and expand the concept of R&D excellence, since the apparent conflict between efficiency and efficacy will disappear (or means and ends) when the strategic agency objectives are linked to government final set of desired socioeconomic outcomes.

In relation to other specific procedures, the ARS took a different approach to formulate its general strategic plan, which comprised all its R&D center activities. In contrast, Embrapa offered the opportunity to its 40 R&D centers, spread all over Brazil, to formulate their own strategic plans, which were adjusted at a national seminar. This difference can be explained by the fact that, according to GPRA, strategic plans were mandatory only for agencies. Therefore, this rule was applied to the case of ARS as a whole and not its individual R&D centers. At Embrapa, the decision of formulating strategic plans for all research centers (PDU) individually, together with Embrapa strategic plan at the corporative level, was taken after detecting a strong external tendency in favor of the decentralization/autonomy of the agricultural research system. Hovewer, this trend was counterbalanced by having strategic research center plans (PDU) formulated, based on a common mission and strategic objectives, as expressed in the Embrapa strategic plan (PDE) as a whole.

Another relevant difference was that the ARS had to present the annual performance plan and strategic plan at the same date (September 1997), following GPRA legal instructions. At Embrapa, this relationship between strategic and operational dimensions was established indirectly and a posteriori. To systematize this process, a specific methodology was developed by Embrapa, satisfying particular requirements of its R&D center classification (product, ecoregion/forestry, thematic, and support services) as well as of the SNPA (National System of Agricultural Research) organizations, coordinated by Embrapa. The

main product was to perform studies of agribusiness R&D demands, based on a systemic approach, prospective vision, and segmented clientele in the agribusiness markets [19,20]. As a result, a systematic tool was created, capable of promoting strong connections between researchers (R&D supply) and clientele (R&D demand), on a regular basis [30,31]. In contrast, this type of procedure seems to be diffused at ARS and could be explained by the preexisting high degree of democratization of the US society and its traditional mechanisms of communication available. The very existence of the GPRA reflects the power of the US Congress to guide and control the use of public funds in the search for desired outcomes in benefit of this society, similar to the behavior of shareholders in the search for profits in private corporations.

Some other differences between the ARS and Embrapa can also be pinpointed, such as: (a) legal document deadlines by ARS, which was not the case at Embrapa; (b) Embrapa's strategic and operational systems were explicitly linked and adapted to SNPA specific conditions, which in the ARS were still open to discussion at the time of the visit; (c) Embrapa gained incremental experience from implementation of its processes of internal changes without having the legal support a legal instrument as the GPRA, like ARS. In addition, there was a close link between GPRA and CFO. This allows the integration of planning level (GPRA) and monitoring/control of public resources level (CFO), submitting the release of the budget for the fulfillment of annual performance goals related to strategic goals and expected outcomes. At Embrapa, this connection was not fully exercised in 1997, since the instruments for control of public finances were not yet adapted to a planning process oriented by outcomes (as is starting in Brazilian Federal Government Four-Year Plan — PPA of 2000).

The last similarity refers to the coordination of the processes given to government employees. At ARS, this procedure was mandatory by GPRA and the advisory role played by a consultant appointed by the US Congress. At Embrapa, an internal group made use of a consultancy in different conditions. The emphasis was given to the participative collaboration, presuming that all aid from external specialists is necessary but never enough to solve an organization's internal problems. At Embrapa, the role attributed to the external consultancy was to help clarify problems that Embrapa had in a latent stage and never bring readymade answers. Finally, it is necessary to stress that this comparison of strategic planning experiences at ARS and Embrapa was applied only until June 1997 and it intended to be a start to the discussion of the role played by public R&D organizations geared to agribusiness.

5. Final considerations

From what has been presented comparing two public organizations exclusively dedicated to R&D applied to agribusiness, the importance of participative processes became clear because they favor holistic and multidisciplinary solutions to problems, within a prospective and systemic vision, especially when key questions must be answered: "What are the S&T needs in the future?" "How to prepare to meet them?" "What is important to research and for whom?" "How to allocate scarce public resources available?" Answering these kinds of

questions becomes essential for public R&D organizations in global economies and intense democratization of information and power. Investments involved may be apparently high, risky, and long to mature. However, their benefits may go beyond the intended initial goals, since they have solidified bases for organization continuous renewal. Just as biodiversity guarantees solutions for the problems of preservation of species and control of pests or insects, diseases, and even biotechnology itself, it also provides conditions for sustainability of R&D organizations over time. This final goal is achieved by the renewed *equilibrium* between ends and means in the search for outcomes (or effective results), which are both shared by the representatives of internal and external environments.

The use of tools and methodologies that helps to acquire this holistic and participative vision of desired future — such as alternative scenarios, strategic planning, and the like — are necessary to unleash processes of changes, but they alone will never be enough to guarantee that these changes occur and be translated into effective results. To have a project for the future, to create competencies, and have credibility (accountability) to guarantee it are basic and indispensable assumptions. To establish strategies for implementing planned actions is the next step. Nevertheless, what makes it possible to convert vision into action, forming an integrated *continuum* is the shift in the logic of understanding the reality. To understand that the strategic responsibility of S&T in promoting competitiveness, efficiency, quality, and sustainability of resources and the environment within a systemic and prospective vision of agribusiness as a whole is not an end in itself. It is a means to promote higher levels of national development and welfare of society and of its citizens.

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Antonio de Freitas Filho is a senior researcher and the Underchief of the Department of Strategic Management (SEA) at Embrapa Headquarters. He has an MSc in Agricultural Planning.

Maria Lúcia D'Apice Paez is a senior researcher at the Department of Strategic Management at Embrapa Headquarters. She has PhD in Agricultural and Resource Economics and postdoctorate in Economics.

Wenceslau J. Goedert is a former senior researcher and head of the Department of R&D at Embrapa Headquarters. He is currently a full professor at the Department of Soil Sciences at the University of Brasília. He has a PhD in Soil Science.