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The SACI/EXERN project in Brazil: An analytical case study

by
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Joao Batista A. Oliveira

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Preface

A study of the SACI/EXERN⁽¹⁾ project in Brazil could have been undertaken for a number of reasons. It is of interest to those concerned with the planning, development and utilization of satellite technologies, particularly for educational purposes. It has significance for educators in its attempt to use modern forms of mass communication to reach pupils and teachers in remote or underprivileged areas. It is of importance to educational technologists in its efforts to integrate various educational and technological components into a coherent system. It attempted to apply evaluation techniques to a pilot project in an innovative field.

Its appearance in this Unesco series stems from another perspective: that of communication planning. In this new field of inquiry, there is a considerable dearth of published materials, especially case studies, which describe planning and organizational processes, especially for new or pilot projects. The case of SACI/EXERN is of significance because it attempted to pilot, experimentally, longer-range plans for satellite development, by using terrestrial television transmissions to gain experience of a number of managerial problems.

In this context, therefore, the educational aspects of the experiment are not highlighted, beyond what is necessary to illustrate the conception and execution of the project; more emphasis is laid upon those aspects of the experience which have implications for communication planning processes in general.

Project SACI in Brazil had the long-range purpose of being a nation-wide, satellite-based, tele-education system. It was born at a time when the promise of technology and the need for widespread education were both stressed. SACI began its experimental stage, called EXERN, in the State of Rio Grande do Norte, in north-east Brazil, 1,500 miles away from SACI headquarters in Sao Paulo State.

EXERN used terrestrial transmission to reach the 500 experimental schools. Fourteen per cent of the State's students were in EXERN schools in grades 1-3. In addition to the students, the untrained teachers were the second target group. Transmissions were both by radio and television;

some schools got one, some schools got both. Broadcasts were 15 minutes per day for the students, and 30 minutes per day for the teachers during the two experimental years of 1973 and 1974.

The original goal of EXERN was to demonstrate the cost-effectiveness of media-based and satellite-provided education, so that the nation-wide SACI project could proceed. SACI was launched, financed and managed by INPE, the Brazilian Space Institute. Several of INPE's characteristics and organizational routines were inevitably reflected in the project, and a most interesting and innovative feature was the adoption of systems management and engineering principles as the planning methodology.

This case study is a chronicle of shifting goals. In spite of the adherence to systems principles in organizational and logistical matters, this rigour did not extend to the pedagogical or evaluation aspects of EXERN. To illustrate: a good deal of the pedagogical burden of teaching students was laid on a 15-minute daily broadcast that was too brief to bear the instructional expectations many people had of it. The evaluation system did not employ people with a great deal of experience nor did it insist on closely supervised systems of data collection. This may have reflected the absence of any real need to justify the EXERN project in terms of its original cost-effectiveness goal due to shifting priorities. The decision-makers at INPE who controlled the SACI/EXERN projects were not educators. Given the internal composition of the SACI leadership team and the shifting external political forces, the main goal that evolved was to have the project run smoothly. Questions about what the project was accomplishing - when it was running smoothly - became secondary, at best.

The SACI/EXERN project nevertheless contains lessons on organization, particularly for large projects. With SACI headquarters in Sao Jose dos Campos, 1,500 miles from the project

(1) SACI stands for Sistema Avancado de Comunicacoes Interdisciplinares (Advanced System of Interdisciplinary Communications). EXERN stands for Experimento Educacional do Rio Grande do Norte (Educational Experiment in Rio Grande do Norte).

site in Rio Grande do Norte, the experiment overcame problems of production, transport, and supervision in ways that should be studied by similar projects. Another important outcome of the experiment was the establishment of a Master's programme in educational technology for the training of project personnel and others.

The integration of all the elements of an educational technology system - the educational elements and the technological elements - is the major legacy of the EXERN experiment. The project continues now, beyond its experimental phase, and has been transferred to the administrative control of the State of Rio Grande do Norte. The broader SACI goal - a national satellite for educational use - has been deflected. Other national agencies, with agendas of their own, have entered the

discussion on satellites. While the acquisition of a domestic satellite has all but been decided upon, the use of the satellite will stress telecommunications and commercial applications, with a less central role, if any, for education, unlike original SACI plans which gave education a central position.

The opinions and judgements in this study are those of the authors: they do not reflect those of persons who collaborated with them, nor do they necessarily reflect the position of Unesco. The present analysis does not attempt to be a final or comprehensive judgement on SACI. Rather it represents, in a summary form, the authors' views on a complex project, from which they believe many lessons can be shared with evaluators, planners and organizational analysts in Brazil and in other countries.

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To thank all the people directly contacted in interviews, meetings and visits would make too extensive a list to be inserted here: their names are listed in Appendix B. In particular, however, the collaboration of Dr. Vathsala Stone, Dr. John Stone and Dr. Arnon de Andrade was instrumental for the collection of data, documents and a free

flow of information. Mr. Peter Boynton of the Academy for Educational Development in Washington, D.C., gave helpful advice throughout the writing of this manuscript. Dr. Clifford Block of the United States Agency for International Development, Washington, D.C., both suggested the original idea for the case study and supported the work in its initial phase. Finally, the study would certainly be incomplete without the collaboration of Dr. Fernando de Mendonça, former Director of INPE and creator of SACI.

Both authors have been involved indirectly in various ways with SACI. Emile McAnany participated in the ASCEND project at Stanford University and visited the SACI project on several occasions. Joao Oliveira was the head of PRONTEL in 1973-1974 and in this role he represented the Ministry of Education in contacts with SACI.

Section I

Historical Background

A. INTRODUCTION

Project SACI⁽¹⁾ was conceived and proposed at a time when two important lines of thought were heavily influencing the way of thinking about development and education. On one side, there was an enormous faith in the potential contribution of technology to the solution of social problems. On the other, the values and priorities attached to schooling and the improvement of educational opportunities favoured enormous efforts throughout the world.

On the international scene, universal primary education was being promoted by authoritative agencies like Unesco, while, at the same time, sophisticated technologies were presented as an alternative way for underdeveloped countries to skip steps in their efforts towards development (and development was mainly conceived as industrialization). Associated with these trends was the fact that the mere act of acquiring or developing some technologies, like a satellite, were conceived as a matter of prestige.

During this period also, new theoretical and methodological planning tools were being introduced: economic theories related to the value of human capital; new planning theories backed by sophisticated methodologies, like forecasting techniques, systems planning, and mathematical models; and new educational technologies, such as educational television and programmed instruction. Most of these ideas and instruments were disseminated through training institutes and development agencies, and it is not surprising that they were adopted by the planning élites of some countries.

It is within this general background that the ASCEND report was prepared, and SACI's original plan was heavily based upon it.

B. THE ASCEND REPORT

ASCEND stands for Advanced System of Communications and Education in National Development, and the ASCEND report (ASCEND, 1967) was the product of a multidisciplinary class held in the Stanford Engineering School in 1967. The report included an analysis of satellite potential for education

and telecommunication in three countries, Brazil, India, and Indonesia, along with a system design for the space and ground segments. These were costed for the three target countries, and comparisons were made for delivery of similar services through terrestrial microwave.

The impact that the ASCEND report was to have in India and Brazil may be explained by the presence of two dynamic and far-seeing individuals who were founders of the first two space research centres to be created in developing countries. Both Vikram Sarabai of India and Fernando de Mendonça of Brazil used the study to strengthen their cases for the planning of a domestic satellite. What ASCEND did was to provide estimates of educational need and estimated cost figures, as well as a design configuration to what had been, up to that time, only a very general hope in the minds of different educators and development planners.

C. THE BRAZILIAN SITUATION

The period in which the SACI project was being conceived and launched, 1967 to 1974, coincides with the development of what became known as the "Brazilian miracle", a period of accelerated economic growth and industrialization throughout the country. It was also a period in which the Federal Government centralized most of the economic activities, including the planning capability, thus reducing and inhibiting the individual expression of the various States.

At the time that SACI was being developed, a few other significant communication and education projects were being launched in Brazil, such as the educational television in Sao Paulo, the University Channel in Recife, the Telescola project in Maranhao, and the educational radio in Bahia and

(1) A saci is a type of elf or leprechaun in Brazilian folklore. He is a black, one-legged, pipe-smoking character who rides the wind and is known to perform mischievous pranks. He is used as the project symbol with which the children can identify, and he appears in the introduction to all the SACI TV programmes.

Rio Grande do Sul. In fact, since the early 1960s there had been some activities, including some attempts of co-ordination. A stronger emphasis on the establishment of co-ordinating agencies and policy planning was visible through the creation of the SATE project (Advanced System of Educational Technology) in the Ministry of Planning; the Fundacao Centro Brasileria de TV Educativa; and, in 1972, the Brazilian Tele-Education Co-ordination Agency (Programa Nacional de Teleducacao, PRONTEL). All these projects, which were starting at about the same time, had similar problems, though different scopes. SACI was very distinct in the sense that it was presented as a highly technical, well planned project to be heavily financed, with a strong research orientation, and aimed, in a future stage, at a national clientele. The other projects were generally aimed at a local or state clientele, were poorly subsidized, and were heavily involved with implementation and not with planning. The future development of these other projects and of the co-ordination attempts were to be important for a later assessment of SACI's results.

D. ORIGINAL PLANS FOR SACI

The original proposal of the SACI project was published as an internal document of INPE⁽¹⁾ (the National Institute for Space Research) in 1968. It was never presented as a proposal from INPE to the Brazilian authorities, even though, as will be seen later, it has often been understood as such.

INPE was a very active institution which had been developing several space activities in the mid-sixties. It acted simultaneously as an inter-ministerial commission in charge of developing policy and as a research and development agency. During the planning stages of SACI, INPE was also involved in other activities less directly relevant to space science, such as economic planning, systems analysis, computer science and its applications. There were also some groups interested in the substantive aspects of applied satellite technologies other than education, such as agriculture and community development.

The plans for the SACI project evolved in parallel or as a consequence of several other developments. Internally, INPE was trying to learn from experience in the fields of satellites and education and, for that reason, it has to use its planning exercises as learning tools. Moreover, satellite technology and its associated costs were evolving at a rapid pace at that time. The idea of direct reception itself was in search of a cost/effective correspondent in the real world of hardware. At the same time, NASA was trying to set up its own programme of space research using satellites and both the Brazilian and the Indian programmes became, to a certain extent, interconnected and dependent upon some outside decisions,

particularly in terms of timing. Finally, and not least important, INPE was starting to develop and train its own groups, particularly in the field of education. If it was relatively difficult to find people in Brazil who were competent and could easily be integrated into the new project, the novelty of the task and the nature of the INPE organization made the initial training and socialization of the education staff a very complicated process.

Some progress in terms of economic, technical and educational planning is clearly seen in the basic planning documents as they appear in successive years: LA FE-75, in 1968; LA FE-109, in 1970; and LA FE-165, which detailed the educational project, in 1971.

In its first version (1968), the SACI project discussed the advantages of a high-powered satellite with three TV channels, allocated to education, which could be launched within five years, depending on further technological advances and adequate financial support. The project, directly based on the ASCEND report, both in content, goals and methodologies, anticipated that, for the entire country, it would need 152,000 direct reception TV sets, 12 retransmitters and 48,000 regular reception sets.

For this coverage, the project intended to offer, throughout the country, TV and radio programmes for the four grades of the primary school system, plus accompanying materials. It was also within the project's scope, using the same infrastructure, to train the inadequately qualified and uncertified teachers who characterized most of the Brazilian teaching force, particularly in the rural areas. The justification of the project would be found in the extreme inefficiency of the primary-school system of the country, with its high attrition rates, high rates of drop-outs, unqualified and uncertified teachers, irrelevant curricula and the like. In the rural areas, in particular, the situation was apparently worsened due to the lack of school buildings, distance from the children's homes and the difficulties associated with the size of the country and inaccessibility of many locations. The problem was visible and big enough to attract attention, and this was certainly very well known and strategically selected by INPE as the substantive justification for the project.

As far as the pedagogical characteristics of the project are concerned, there were also some innovations, besides the idea of TV broadcasts via satellite. The project anticipated the possibility of using constant feedback for students, through the use of programmed instruction materials plus a computerized marking system. It was also meant to be an educational experiment and, for that reason, as it will be discussed later in detail, it planned to investigate the relative

(1) More details about INPE can be found in the section on Overall Administration (Section III E).

effectiveness of the various media used and the costs associated with each alternative. It was also meant as an experiment in large-scale mass media education.

The SACI project was proposed as a three-phase experiment:

Phase 1 was an experimental satellite link between Stanford University and INPE, utilizing the ATS-3 for the transmission of slow scan images, televised classes and exchange of technical documents.

Phase 2 was the educational experiment in Rio Grande do Norte (EXERN), which would use about 500 experimental schools and the ATS-6 when it would be available, possibly in 1972.

Phase 3 was a national satellite used primarily for educational programmes, with secondary uses for telecommunications.

The main argument for such a broad and innovative plan was in the realm of cost/effectiveness. The preliminary data used in the planning studies, based on estimates of costs and assuming a fairly broad national coverage, were highly favourable for the technological option, *vis-à-vis* the traditional ways of schooling and terrestrial transmission of educational TV. An additional argument advanced by the project was in terms of time: since universal primary education was a requirement of the National Constitution and a matter of governmental prestige, the satellite-based option was the only one able to offer quickly a high level of uniform basic education for the entire country.

The preliminary planning documents of SACI had also anticipated some political difficulties in terms of social costs: a threat to the autonomy of the individual States in educational matters and to the conservative reactions of classroom teachers. However, none of these documents analysed such drawbacks in a profound and serious way.

To understand the role, meaning and importance of these planning documents is, in part, to understand the struggle for survival and implementation of SACI. We hope that this story will be better understood by the end of the present study. It is very important to say, however, that from INPE's perspective, the planning documents, and the one titled LAFE-75 in particular, were to be taken as planning exercises and preliminary proposals for discussion and not as a first draft of a serious project of satellite-based educational TV for the entire country. Lack of debate over the documents made it possible, as will become clearer later on, for them to become the philosophical and technical basis of subsequent proposals

and plans. These proposals were not from INPE to the authorities in charge of educational policy: they were, in fact, internal working documents from INPE. Sometimes they were meant by INPE as informal proposals. From the Ministry of Education perspective, however, these "dry-runs" were frequently perceived as final plans, concrete proposals or even as direct provocations and unauthorized interference in educational matters.

The three phases of SACI outlined above did not all take place as proposed:

Phase 1 did not go so far as it was originally intended to. A few transmissions were broadcast from Stanford University, and this small exercise was considered by INPE engineers as enough to prove the technical feasibility of the utilization of satellites.

Phase 3, the national educational satellite, was never more than an idea within SACI, as it was never officially presented to or considered so by governmental agencies. Though the idea of having a domestic satellite promoted by INPE was under consideration by federal authorities, the project of a direct reception satellite primarily allocated to education was not. We will return later to this point.

Phase 2, a pilot educational project to test the feasibility and cost/effectiveness of education projects utilizing educational media, is the focus of this study. This project, called EXERN, did not, however, make use of satellites as planned. Instead, it utilized regular microwave TV transmission facilities, as well as conventional radio broadcasts. An experimental connection with the ATS-6 was tested for a few weeks, in 1975, but that was not a regular part of EXERN.

In the present report, we concentrate our analysis on EXERN. However, the relation between EXERN and the idea of SACI has to be kept in mind. Otherwise, the sophisticated planning and managerial instruments mobilized would seem meaningless and totally inappropriate. To understand EXERN as an isolated project would be nonsense, as it was meant to be a feasibility field study for a broader national operation. The fact that SACI was never realized nationally has left EXERN over-equipped in terms of planning and management operations. The interplay between the implementation of EXERN and the idea of SACI will be an important element for the understanding of the present study and of the role of planning in the context of the project.

Section II

Project site of EXERN: Rio Grande Do Norte

A. BACKGROUND

Brazil is a federated republic consisting of 22 States, 4 Territories, and a Federal District which is the seat of government. The country has the approximate size of the United States (excluding Alaska), and a population of over 110 million inhabitants, with an annual birth rate close to 2.8 per cent. The country has a wealth of varied natural resources, some of strategic importance.

During the last three decades, Brazil has stepped up its transition towards becoming a modern and sophisticated industrial nation. On the economic scene, the inflow of foreign capital is still considered of vital importance to the short- and long-term difficulties associated with the balance of trade and the heavy financing of government-sponsored projects. Moreover, inflation has been a persistent problem associated with this strategy of development. These two problems, foreign debt and inflation, are associated with economic dependency on external forces, and they substantially reflect the inroads of multinational companies. Though the per capita income reached about US \$800 in 1973, there are enormous differences in income, and the country still has some zones of very extreme poverty, comparable to the situations in the poorest countries. The rural zones in general, and the north (the Amazon Basin) and the north-west in particular, are very poor indeed.

The educational sector reflects the socio-economic reality. In the late sixties, the schooling opportunities were far from the idea of universal primary education; and the rural areas were in the worst situation. The efficiency of the school system was low; typical problems were the enormous distances, shortage of trained teachers, over 50 per cent attrition rates in the first grade, one-room schools in rural zones, widespread adult illiteracy, lack of adequate funding and resources, and other difficulties well known to developing countries. The size of the country, the lack of adequate communications networks, and the potential economies of scale - these characteristics of the situation made the idea of a uniform mass education satellite programme worth considering.

B. EXERN AND SACI

As was explained earlier, the original idea of INPE was eventually to have a domestic satellite for direct reception in schools; a preliminary plan was conceived for a nation-wide educational programme for teacher training and primary education. This was project SACI.

Since the decision about the satellite would take a few years, a pilot project was planned for the State of Rio Grande do Norte (RGN), with the original intention of using ATS-6 for one year. Delayed decisions, different timing, and other complications prompted INPE to go ahead and implement the project using regular radio and TV broadcast facilities. The pilot project was EXERN.

The State of RGN was chosen by INPE as the site of the experiment for a series of reasons. The preliminary feasibility studies, which appear to have considered other alternative sites, argued that RGN was typical of the poorest States of the country, due to its socio-economic situation as well as to its physical and geographical characteristics. It has coastal zones, arid zones in the north-east, and agricultural zones. If the project could work in such difficult and adverse conditions, it could probably work in the other States. The evidence from the feasibility studies does not, however, seem totally convincing. It is difficult to show that RGN is typical of the poorest States in Brazil. A better explanation of why RGN was chosen for the site of SACI lay in INPE's having a rocket launching site in the State, through which it was possible to develop connections with the local community.

SACI, therefore, is the national in-school satellite-based television project that has yet to materialize. EXERN is its pilot project that did materialize, in one State, through TV and radio, but without the satellite link. Some of the planning for SACI ended up serving EXERN. We sometimes use the term SACI/EXERN to refer to the common efforts that went into both. We have tried to be precise in using EXERN to refer to the pilot project itself, and SACI to refer to the long-range national project.

EXERN began as an experiment in November 1972, though planning and some production activities dated from 1970. It continued to 1975 as an experiment. Though the experiment ended, EXERN did not. It continues with some changes, as will be noted. INPE ran EXERN during the experimental stage; the State of Rio Grande do Norte ran it thereafter.

C. THE SOCIO-ECONOMIC CONTEXT OF RGN

There are a few planning documents from INPE and from the State Secretariat of Education in RGN which served as the basis for the early planning of EXERN. Some data is available that gives background information on the educational situation of RGN in 1970, when EXERN was about to start. Much less information is available for subsequent years; in general, we have extrapolated on 1970 data, which were based on the National Census.

The relative inaccuracy and distortion of the available information does not preclude a fairly precise view of the poor situation in which RGN was - and still is - in terms of economic and educational development.

Rio Grande do Norte extends over 53,015 square kilometres, with a population of about 1,600,000 according to the 1970 Census. It is situated in the north-east part of the country; its relative participation in the national economy was about 0.83 per cent, while the north-east as a whole had an 11.06 per cent share. The main economic activity is agriculture and mining, while the principal local barriers to development are drought and insufficient infrastructure of roads, storehouses, and qualified human resources.

The income differentials in RGN are striking, as is the case of Brazil in general. There are no adequate statistics, but, for instance, the minimum wage in 1976 was about 544 cruzeiros a month, about US \$46. Teachers, in general, receive much less than the minimum wage. Some of them work two shifts. A very common pattern is to teach in a State class in the morning and in a municipal class in the afternoon. At the other extreme, a privileged class, including upper-middle class qualified white-collar workers in government agencies, receive from 10 to 20 times the value of the minimum wage, and benefit from abundant cheap labour, thus increasing income differentials and making their lives look luxurious if seen, for instance, from a middle-class European perspective.

D. CHARACTERISTICS OF RGN'S EDUCATIONAL SYSTEM

In general, the educational situation of RGN, particularly by the late sixties and early seventies when SACI was being planned, was very problematic as

far as quality and quantity of both resources and results were concerned. A massive effort towards upgrading teacher training, while supporting teachers in the classroom with technologies like radio, TV, or teachers' guides, could constitute a significant contribution to ameliorating the prevailing conditions. Though EXERN was not specifically designed for RGN, but meant to be a field experiment for a more ambitious national programme (SACI), the problems it aimed to solve were serious ones, both for RGN and for the country in general.

As is the pattern in Brazil, there are four main types of school in RGN according to financing patterns: federal, State, municipal, and private. In principle, the federal government is in charge of financing higher education, with little or no direct participation on the other levels, except in terms of co-ordination. There are eight years of so-called fundamental school which (prior to the new national law of 1972) were divided into two segments: the primary and the "ginasio", each segment having four years. Secondary school goes from three to four years; the "normal school", which is the qualification mechanism for primary-school teachers, is one type of secondary school. Students enter school at seven years of age.

Although the States are primarily responsible for secondary education and the "ginasio", many States, like RGN, still play a very important role in the "primary". The municipios, or townships, are partly responsible for the "primary", and their schools are generally concentrated in rural areas and called municipal schools.

Since the SACI/EXERN project was focused on teacher training and primary-school education (grades 1-4), the information presented below will be concentrated on those aspects. Table 1 gives some data on the general situation of primary education in RGN in 1970, when EXERN was being planned, and illustrates the extreme difference between urban and rural schools. For example, only about 3 per cent of certified teachers were in rural primary schools though these enrolled about 44 per cent of students.

The great majority of the non-certified teachers do not have the primary-school diploma. Teacher certification is given after the eleventh year of school. The urban schools generally operate on a double- or triple-shift basis since there are only four hours of class per day. About 70 per cent of the 3,903 schools are financed by the municipios, and the others are virtually all under the responsibility of the State. There were about 200 private schools in 1970, mostly in the capital and other big cities.

Table 2 presents the typical educational pyramid existing in most States of Brazil, as reflected in the case of RGN for the distribution of enrolments. If one measures the lack of productivity by the repetition rates, in the RGN the

TABLE 1

Primary education in RGN, 1970

	Urban	%	Rural	%	Total
Schools	871	22.31	3,032	77.68	3,903
Classrooms	2,114	40.92	3,052	59.07	5,166
Enrolments	123,983	55.61	98,956	44.38	222,939
Certified teachers	1,842	97.30	51	2.70	1,893
Non-certified teachers	2,245	39.17	3,486	60.82	5,731

Source: ASP/SEEC/MEC-1970, p. 33

TABLE 2

1970 distribution of primary enrolments in RGN

Grade	No. of students	%
1	124,226	55.72
2	38,952	17.47
3	28,792	12.91
4	18,404	8.25

Source: ASP/SEEC/MEC-1970, p. 58

distortion is at an extreme: 70 per cent of the first graders repeat or drop out after failing, and only about 10 per cent reach the fourth grade.

Being a poor State, RGN could not invest enough resources to reverse these trends in any significant way. Financial statements from the State show that educational expenditures, in fact, went down from 20 to 14 per cent of the overall expenditures in the period from 1970 to 1974. Though this 14 per cent represents a heavy burden on the State, these are extremely scarce resources which are barely sufficient to cope with the payroll of already insufficient and poorly paid teachers.

For those reasons, and also due to the

centralization of financial and planning resources within the central government, federal projects in education and other areas were generally welcomed by the States as a means of getting additional funds. Moreover, as was stated earlier, this was a time when education and schooling were highly valued, and both the federal and state governments were developing several different educational projects and campaigns, at various levels and for various clientele. Many States were implementing such new projects, and RGN was particularly receptive to a number of federal projects.

What the plan was for EXERN will be detailed in the following section.

Section III

Plans for the EXERN experiment

A. GOALS

Before stating the goals of EXERN in more specific ways, there are some considerations and qualifications which deserve more careful analysis. SACI/EXERN went through a series of historical phases: general global planning 1968-1972; planning and implementation of the "pilot" phase 1972-1974; post-experiment operation under INPE and RGN education authorities; RGN local operation 1976-present. Goals obviously change over time and under different administrative control. The project was originally conceived as a cost-effective use of satellites to solve problems of basic education in Brazil. Later it was implemented as a feasibility study of media-based mass education in RGN. Its plans did not coincide exactly with results as subsequent sections of this paper will show.

A variety of institutions and people have benefited from SACI. Each group, including ourselves as evaluators and organizational analysts, would stress different goals for the project, for a variety of reasons.

First, the officially stated goals of SACI/EXERN, if taken as the focus for our analysis, would severely restrict the scope of the study. These goals represent different priorities and they have changed over time, according to the circumstances, accomplishments and clientele to which the planning documents were addressed.

Second, there is also the time perspective. The field work for the present study was conducted in July 1977, two and a half years after the official end of the pilot project. It is very tempting to attribute intentions, goals, or motives from a "post-facto" perspective, but this historical view would probably convey the impression of more rationality than an organized and complex activity like SACI could have had in operation.

Third, appraising the project according to certain goals, whether established by the project

or by the analysis is necessarily a limited and partial perspective. True goals only exist in the eye of the beholder. Selecting some goals will certainly favour conclusions about the overall effectiveness of the project. What are goals for some people may be only means for others.

Without attempting to solve this issue of perspectives, we have selected a few activities and effects that seemed most salient, according to both projects' results and our own interpretations, and we have called them "goals". We have divided our focus in terms of the educational goals of EXERN, the project support goals and institutional goals. Whether or not these goals were "intentional" will not be discussed here. Finally, it must be said that our choice of goals as a framework for the project's planning assessment was also limited by the availability of data already collected by INPE and SITERN (new name for EXERN) as well as the time constraints of our field work.

1. Educational goals

Exern had two stated pedagogical goals: teacher training and student education. Table 3 illustrates the organization and timetable for implementing these two goals. The pedagogical results collected during the 1972-1974 period should have served as the basis for the overall evaluation of the main EXERN goal, feasibility of a media-based mass education programme. Table 4 gives an idea of the scope of the project, providing an estimate of the number of schools involved, with the media used and the sources of electricity. The unusually large sample of this pilot project was justified as a minimum for the study of a variety of aspects of the experiment: logistics, implementation, and technical aspects of a mass education project. The activities were divided into missions (a systems analysis term for the different stages of the project activity), the odd ones referring to activities aimed at teachers, and the even ones for students.

TABLE 3
SACI/EXERN timetable⁽¹⁾

		Planned	Implemented
Mission I ⁽²⁾	Teacher training ⁽³⁾ (up to primary-school level) ⁽⁴⁾	1972	1972/1973
Mission II	First graders - TV Second graders - Radio	1973	1973
Mission III	Teacher training (up to fundamental school level)	1974	1974
	First and second graders - TV	1974	1974
	Second and third graders - Radio	1974	1974

Source: INPE-445-LAFE Projeto SACI-Planejamento final para missoes III e IV. June 1974, Annex 5, p. 7. Also interviews for the last column.

Notes

- (1) There were four other missions planned for 1975 and 1976. These missions were dropped, but Missions II and IV were repeated in 1975 and 1976 under the responsibility of SEC-RN, the State Secretariat of Education, with the assistance of INPE.
- (2) There have been a few training courses for supervisors and other people in charge of implementation. These were mostly one-week courses, repeated once a year.
- (3) Teachers received either radio or TV broadcasts, according to their experimental group. Besides specific contents, there were pedagogic lessons.

TABLE 4
Experimental schools, according to regional centre, media, and availability of electricity in 1977

Logistics Centre	Electricity			Batteries			Total
	Radio	TV	TV & Radio ⁽¹⁾	Radio	TV	TV & Radio	
I	-	19	-		13	-	32
II	-	15	-	23	38	-	76
III	-	56	7	40	64	9	176
IV	5	24	4	105	30	5	173
TOTAL	5	114	11	168	145	14	457 ⁽²⁾

Source: Logistics Sector, Quadro (demonstrativo dos escolas com e sem energia), 11 May 1977.

Notes

- (1) Some schools had more than one classroom, with different grades.
- (2) Data for 1977. During the experimental phase, the number varied around 500 schools, but the pattern was the same.

Teacher programmes were to be broadcast daily for one hour over a nine-month period for each mission. These programmes were supposed to qualify teachers to pass the State equivalence examinations, according to their prior level of schooling (primary, secondary, or normal school). Printed materials were available for exercises and individual learning. The students would receive a 15-minute daily broadcast during regular school hours, in addition to the regular school programme activities.

From the start, and throughout the project, cost-effectiveness was proposed as the main goal and criterion of feasibility. Data on teacher and student learning and teacher and student acceptance, community involvement, and differential effectiveness of media were also proposed as indicators. Later in the report, we will examine some of the data which have been collected and analysed in relation to this goal of cost-effectiveness.

2. Project support goals

How did the plan for project structure work? This is an important question in the appraisal of planning and implementation in a project of this size and scope. A few important aspects of the project planning and implementation have been singled out for analysis under project support goals: use of the systems approach for project planning and management; implementation goals, particularly production, broadcasting, reception, and supervision; logistical operations in the large and inhospitable interior of RGN; research and evaluation plans; personnel recruiting, training, and utilization; and control and communication systems. Information about these goals is of both a quantitative and qualitative nature but it provides the international community with an idea of how plans and implementation sometimes coincide and more often diverge in large-scale projects.

3. Institutional goals

There are in addition to the institutional goals mentioned above important institutional outcomes related to EXERN, some of which, like the Master's Programme in Educational Technology, were not foreseen in the earlier plans. We shall mention four such unplanned outcomes:

(a) A specific outgrowth of EXERN was the creation of the graduate programme in educational technology, serving initially as an internal training device. Had SACI been implemented, this programme could have been a major support to such national expansion. Nevertheless, the accomplishments and merits of the programme will be examined, and implications drawn in terms of its impact on EXERN.

(b) The Economically Viable Communities (Comunidades Economicamente Viaveis, or CEV) was an experimental project conceived parallel to SACI,

regarding another possible utilization of the satellite. Small-scale try-outs were implemented using SACI's materials, and these activities were also important as additional demonstrations of possible satellite applications, in this case to rural village development.

(c) The University TV in Natal was another unplanned outcome. As a result of the project's needs, and in the absence of a direct reception satellite for the broadcasts, EXERN installed an entire TV network, including production, broadcasting, and transmitting facilities covered by the project. This network was donated to the Federal University of RGN, which operated it for its own purposes in addition to supporting EXERN's operations. The growth of this system is an important contribution of EXERN to RGN.

(d) Another important unwritten goal of INPE was to make a case for a domestic satellite. EXERN was a pilot study, the results of which would have contributed an important argument in favour of a domestic satellite had the satellite been used to any great extent. Though preliminary studies and the project's initial stated goals proposed the launching of a direct-reception domestic satellite primarily for educational uses, external conditions changed during the operation of EXERN. It became clear, very soon, that although a domestic satellite would eventually be adopted, education would not play a significant role either in the decision to adopt it, or in its utilization. The contributions of EXERN to the adoption of the satellite are no less important than EXERN's direct contribution to the examination of alternative educational technologies.

B. PLANNED PROJECT COMPONENTS: PROGRAMMING, PRODUCTION, AND BROADCASTING

1. Introduction

The original plans for SACI called for a comparison between costs and effectiveness of two main treatments: radio- and TV-based educational programmes, both for teacher training and formal primary education and traditional face-to-face classroom training.

The teacher-training programme had two objectives: first, to improve the general educational level of teachers by upgrading their knowledge of academic subjects and enabling them to pass the special certification examinations held by the State; and second, to give them special teaching skills directly related to the operations of SACI. At this time, a few conventional and media-based teacher-training programmes were already being used in Brazil. It was also a general assumption, within the small community of people involved in educational media, that in the coming years great developments would be made

in their field. Mostly for those reasons, INPE did not originally intend to have a production centre of its own. Instead, it planned to buy available programmes or to promote in other projects the development of specific programmes suited to INPE's objectives. Some of the existing programmes were, in fact, acquired and used. But INPE did not succeed in its negotiations with the two major educational TV centres, so it had to prepare itself for a major production and instructional development effort.

2. Teacher training: Missions I and III

The general goal of Missions I and III was to upgrade teachers to the primary and secondary levels of education, corresponding to the first four or the first eight years of education, respectively. The contents were set by the State, since teachers were supposed to take special examinations held by the State. In fact, INPE was able to use off-the-shelf programmes from other projects in Mission III and its own production was limited to pedagogical and psychological subject-matter. There was nothing particularly innovative about these programmes in terms of content or format, but they did try to translate into easier terms the regular curriculum taught in teacher-training schools. Printed materials with exercises and other individual activities were sent to teachers. Table 5 presents the overall planned production for both teachers and students.

The teacher-training programme was not intended only for the teachers in EXERN schools but for all teachers in RGN. But a few problems occurred. Some teachers had already attained the primary level of education, so that they were not supposed to enrol in Mission I, but some of them did anyway. Some SACI teachers quit the schools and did not follow the teacher-training programme. Due to the timing of the examinations which was independent of the timing of the programme, some teachers took the examination and abandoned the course.

Staff from SACI, interviewed in July 1977, reported that a dramatic proposal for a major change in the orientation of the teacher-training programme had been proposed after a visit to RGN in 1973 clearly showed that the rhythm of presentation of lectures and the level of difficulty were well above the learning capabilities of teachers. The change, however, was not implemented as teacher training ceased to be a priority for EXERN and it was then decided not to go on with Missions V and VII for teacher training. Thus the goal of using media for in-service instruction of teachers encountered problems though it was implemented in its first two stages.

3. Students: Missions II and IV - Contents and format

As we see from Table 5, Mission II produced TV

programmes for first-graders and radio programmes for second-graders. Mission IV included TV programmes for grades one and two, and radio programmes for grades two and three. Production started in 1972; Mission II was implemented in 1973, while Mission IV started in 1974.

EXERN did not attempt to innovate in terms of "instructional contents". The official curriculum adopted throughout the State was used, though in a reduced form since the production staff at INPE felt that the official curriculum was unrealistically overburdened.

Unlike many other mass media projects in education, EXERN did not replace much teacher instruction by media. It was decided early that each grade could only have 15 minutes of either radio or TV broadcast every day. Reasons for this seem to include: the limited availability of satellite time and expansion plans for the entire range of eight grades that would cause scheduling problems in different time zones in the country. However, these reasons would not have been enough to explain the decision. Recent interviews with curriculum personnel still leave us with no clear rationale for this restrictive decision. Economic problems and lack of time for production seem to be an attractive alternative hypothesis.

In any case, given the 15 minutes per grade, curriculum specialists decided, after a series of pre-tests, to produce what seems to be a basic motivational programme, integrating and relating the various subject-matters. A Sesame Street-type modularized format was adopted for the programme. It consisted of a number of units (modules) varying from 30 seconds to four minutes.

There were big differences between the radio and TV programmes. Radio did not allow such "modularization". Programmes followed what the staff called the "language of the medium". Different types of appeals, sketches, dialogues, and exploration of the theme were made. Both media had permanent characters, like an elf (SACI), a lunatic type who taught mathematics, and so on. The programmes were conceived by different teams, with no close contact, although they had the same objectives.

4. Production planning and organization

(a) Physical facilities

Since media production was not in the original plans of SACI/EXERN, and certainly because of its secondary importance in terms of INPE's objectives, the provisions made for production were rather haphazard. One of INPE's buildings was entirely devoted to the project, and several other scattered facilities were used by interdisciplinary teams. When the need came, a radio and a TV studio were adapted within existing facilities. The radio studio was a small, simple room, minimally furnished with standard Brazilian-made

TABLE 5

Radio, television, and print materials
for the four EXERN missions⁽¹⁾

Purpose of missions	Mission I For non-credited teachers in grades 1-4 January- November 1973	Mission II TV series for first grade. Radio series for second grade, March- November 1973	Mission III For non-credited teachers in grades 5-8, January- November 1974	Mission IV ⁽²⁾ TV series for second grade. Radio for third grade	Total programmes produced
TV programmes	488 programmes 15 mins. each 2/day; 10/week	150 programmes 15 mins. each 1/day; 5/week (divided into 673 modules)	63 programmes ⁽³⁾ 390 programmes 15-20 mins. each 2/day; 10/week	150 programmes 15 mins. each 1/day; 5/week (786 modules)	1,241
Radio programmes	488 programmes 15 mins. each 2/day; 10/week	150 programmes 15 mins. each 1/day; 5/week (385 modules)	63 programmes 390 programmes 15-20 mins. 2/day; 10/week	150 programmes 15 mins. each 1/day; 5/week (639 modules)	1,241
Printed materials	488 (printed) booklets	300 teacher guides; 12 read- ing texts for students	63 + 390 printed booklets	300 teachers' guides	1,541

Notes

(1) Adapted from Table III.1 (INPE 863, pp.11,13).

(2) Mission II programming for first and second grade was also repeated.

(3) 63 programmes on teaching methods, others from supplementary course, Channel 2, Sao Paulo.

equipment. The TV studio was a room 25 metres square. The sound isolation, just to give an idea of the simplicity of the studio, was made with egg boxes. The programmes were produced on a one-inch, Brazilian-made tape recorder. No further details are necessary to characterize the fact that by any national or international standards, the production facilities were at a very minimum level of sophistication. Due to the complexity in programming and the need for editing, programmes were transferred to a two-inch tape, edited and retaped on one-inch tapes. This operation was performed under a contract with the Educational TV Station of Sao Paulo, 50 miles away. The reader should realize also that the production site, INPE headquarters in Sao Paulo State, was 1,500 miles from the implementation site in RGN. We shall return to this point in later sections.

(b) The systems approach

In the early seventies instructional design was not well developed in Brazil; traditional techniques of curriculum planning and development were followed. The few people aware of new techniques were either

being trained - particularly in the United States - or were working in other institutions. The localization, hiring policies, and specific interests of the project made it even more difficult to hire these rare specialists.

By contrast, the idea of systems analysis, systems planning, and systems engineering, both for planning and administration, was the accepted institutional doctrine and practice at INPE. The early formulation of SACI itself is totally presented in a systems language. For a new project in search of an original language, nothing could be better than the adoption of a systematic approach and this is exactly what INPE managed to do. A few staff were sent for training in the United States; several foreign experts who were concerned with some aspect of the systems approach in education were brought in.

A tight coupling between the managerial and the technical approaches was thus obtained. Behavioural objectives, deadlines, flow charts, formative evaluation, cost effectiveness, rational plans - these are some examples of the language of planning at INPE headquarters. The practical consequences of such language was not felt in the

project site far to the north. It is fair to say that the managerial and planning techniques using systems concepts were far more developed in the space engineering field than its counterpart in education. What actually happened was that there was a greater coincidence in language and format than in actual practice. Moreover, with a heavy emphasis on planning and a belief in a rational model of management and education, the systems approach put a greater emphasis on planning than on implementation. Difficulties with evaluation feedback mechanisms, which will be discussed later, contributed further to limit the educational impact of the systems approach. But even with these limitations, this was a serious attempt to apply the systems concept to educational and communication planning in all its various aspects.

(c) Teams and operations

The format, composition, and function of production teams varied somewhat during the life of the project. At some point, however, a certain model of organization became characteristic of the system. Under a central manager and some foreign staff, there were a few distinct stages of production. First, the general guidelines were established by the educational planning and analysis group; then the several subgroups of subject-matter curriculum specialists would specify objectives and prepare test items (in the case of teacher materials); production teams were then mobilized, according to the medium used - radio, TV, or printed materials.

The operation of the teams was very difficult in the beginning, and most of the staff was made up of inexperienced college graduates. Media producers, in particular, were neither interested nor aware of systems concepts or pedagogical aims. The common task facing the group, however, and a pressure to produce contributed to the search for innovative organizational arrangements and programme formats (e. g., the modules described earlier). A common orientation started to develop, and the creation of a graduate programme of educational technology within INPE contributed further to build the teams' common language and perspective.

The operation was heavily constrained by a series of problems: chronic shortages of resources; limitations of studio facilities; initial lack of integration within the various stages of instructional design; sometimes contradictory advice from consultants; extremely difficult working conditions in terms of time and controls; administrative limitations, such as those regarding use of studios during lunch and other hours; and, finally, but very important, pressure, criticism, and interference from outside agencies. Despite the difficulties, a significant amount of production was accomplished in terms of radio, TV, printed materials, and tests, and the implementation in RGN

was never impaired by programmes not delivered on time in the two years of the pilot project, 1972-1974.

As a part of the systems concept, formative evaluation of materials was planned, but only limited application was made. An external validation of materials was tried with a sample of students in poor schools located close to Sao Jose dos Campos. Another source of feedback which is reported to have contributed significantly to important changes in contents, language, rhythm of presentation, and even tone of the programmes was a field trip that most of the curriculum and production people undertook together. These visits, in addition to the monthly reports sent from the supervisors, were the major feedback received for the production of the new materials. No revision was possible in the programmes already made up to that point, but the new programmes for 1974 benefited from the new insights gained.

(d) Production personnel and training

During the peak of production, the teams directly involved were composed of: 5 educational and planning analysts, 28 curriculum development specialists, 45 staff specialists and operators involved in actual production and personnel training. Most personnel had at least an undergraduate university degree, and various short-term training sessions were conducted in the early stages of EXERN. The main training for media production came from CEDO (now British Council) specialists from the United Kingdom. Training activities were related to programmed instruction skills, production techniques, evaluation, systems analysis, and the like. A small number of staff were sent for graduate training in educational technology abroad, but by 1973, most of the college-level specialists were enrolled in the Master's Programme in Educational Technology begun at INPE.

(e) Broadcasting

The EXERN project produced most of its own educational materials at the studio and workshops at Sao Jose dos Campos from 1972 to 1974. For Mission III, however, 390 15-minute TV and 390 15-minute radio segments were borrowed from the educational channel in Sao Paulo (Channel 2). The total output of radio, TV, and printed material for the four missions has been provided in Table 5.

Original plans called for the utilization of the satellite for broadcasting during a one-year period. Those plans were later discarded, and INPE installed and implemented a complete network of production, broadcasting, and transmitting facilities in the State of Rio Grande do Norte. This complex, called TV-Universitaria do RGN,

was donated to the local university. It was composed of a small, but well-equipped production studio, located within the university in Natal. The duplication of production facilities in RGN and at INPE headquarters is less irrational than it seems. RGN facilities were to carry on later planned missions for EXERN which were never implemented.

These facilities were co-ordinated by the local INPE representative, who was also the local manager of SACI. The personnel involved in the activities were partly from the University and partly from SACI/EXERN since the University did produce and broadcast other programmes. Maintenance and repair work of the facilities were done by the general manager and the chief engineer, since there was no other qualified manpower to do so.

The television programmes were broadcast on a State-wide system controlled by the Federal University of Rio Grande do Norte. There are three transmitters in the system (see Figure 1): one 2 kW transmitter in Natal, one 2 kW transmitter in the middle of the State in Faria de Santana, and a third 35 watt transmitter in the north-west in Mossoro. Signal coverage was adequate for the schools in the experiment, but did not include schools from the south-west and north coastal sections of the State.

Radio programmes were broadcast from three private transmitters belonging to the Rural Assistance Service (a Catholic Church organization). These were medium-wave, 1 kW stations located in Natal, Caico (south), and Mossoro (north-west). Figure 1 provides a map of RGN with the location of the six radio and television transmitters used in the EXERN experiment from 1973-1976.

There is one thing to note with regard to the amount of broadcast materials for the experiment. While teachers received two 15-minute programmes per day either by radio or television (one at the beginning, the other at the end of the school day), students only received one 15-minute broadcast per day (either of television or radio).⁽¹⁾

The subject-matters covered in the programmes for teachers were: Portuguese, mathematics, science, social studies, moral and civics, and educational methods. Those for students were: Portuguese, mathematics, physical and biological science, social studies, moral and civics, and arts.

C. IMPLEMENTATION OF PROJECT PLANS

1. Introduction

As mentioned before, EXERN was implemented in Rio Grande do Norte. It is important to understand the project's operation there. A local manager was in charge of operations, which included broadcasting of the TV programmes, distribution of the radio programmes to the broadcasting stations involved, distribution of teacher-training and other materials,

installation and physical maintenance of the antenna, TV sets, radio sets, and batteries, as well as transportation and management of the supervisory functions.

The next three sections will consider the most salient aspects of the reception, supervision, and logistics functions.

2. Reception

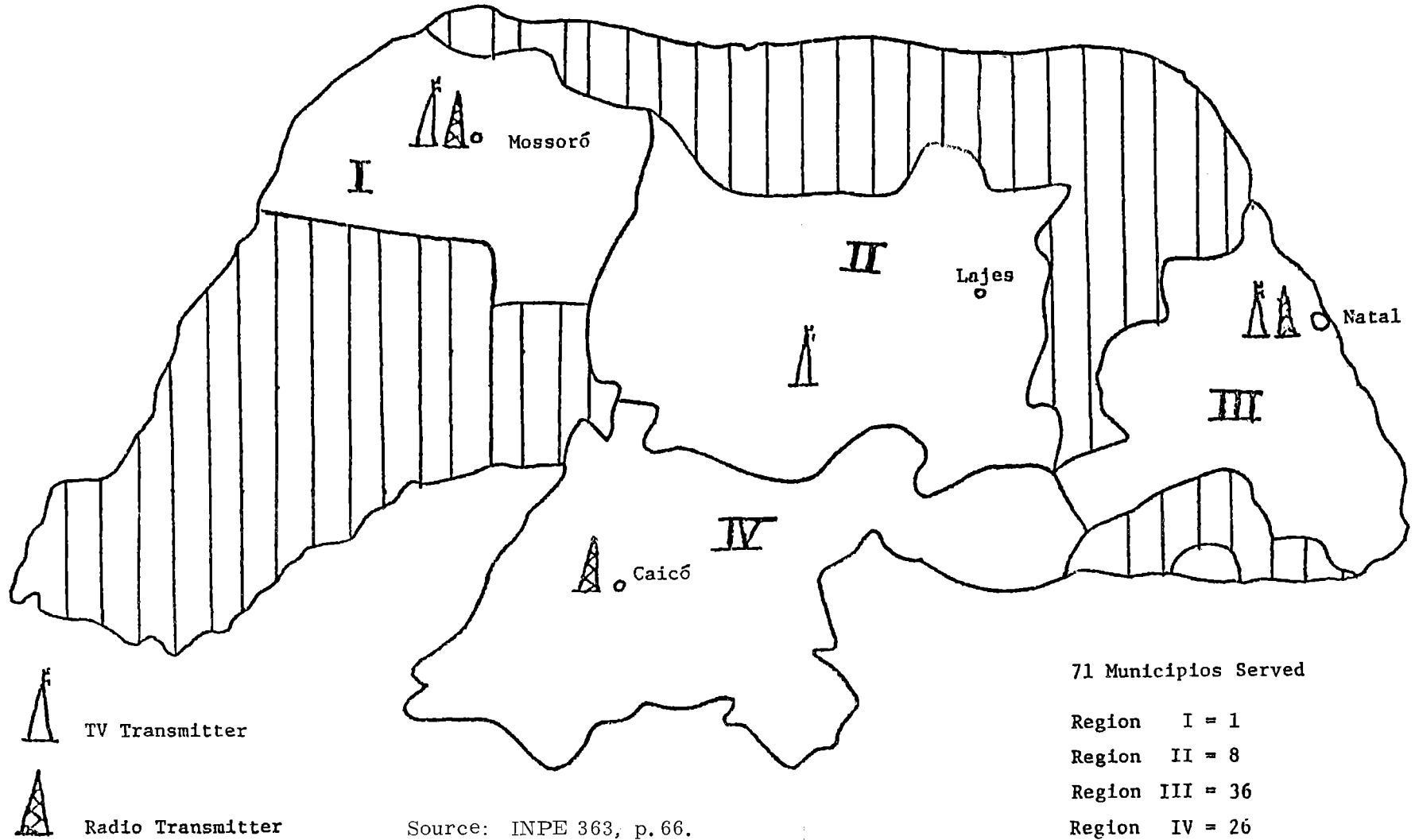
EXERN programmes were received in both radio and television schools, with both kinds of schools receiving accompanying printed materials. These materials were for teachers, not students, and were similar, but not identical, for both radio and television. There were 218 TV schools and 235 radio schools in 1973. As we indicated in Figure 1 below, these schools were divided into four administrative regions and were distributed throughout most of the State except the south-west and the northern coast region. The smallest administrative subdivision in the State is the municipio, or township, of which there were 71 included in the experiment, one in Region One, eight in Region Two, 36 in Region Three, and 26 in Region Four. The experiment provided each school with either a television or a radio set, and in addition provided a maintenance service that did bimonthly recharging of TV batteries for schools without electricity (about 70 per cent in 1977), as well as carrying out other maintenance on receivers as needed.

The reception situation varied from school to school, depending on whether more than one grade was in a single room. Statistics are not available on how often first and second, or second and third grades were together, but it is estimated that about thirty-four students were in each experimental EXERN class in 1974, with variations in urban and rural areas (cf. Appendix A). If classes had only a single room for two or perhaps even three grades, then one can imagine that reception conditions were not ideal with a large number of children in one classroom where perhaps half the students were not the intended audience. But such crowded conditions are not atypical of any rural school system in the Third World.

(1) In comparison with other educational technology projects, EXERN produced an average amount of broadcast material each year, though we must remember that number of people, budgets, and experience, not to say programme quality, may vary from project to project. If we take the combined output of Missions I and II in 1973, we get a total of 160 hours of television and 160 hours of radio. El Salvador produced slightly more TV in its first years but no radio. Mexico, in Radio Primaria and Telesecundaria, produced many more hours of both radio and TV, but the Ivory Coast produced considerably fewer. All in all, the quantitative output was quite impressive.

FIGURE 1

Map of Rio Grande do Norte with regional centres
and radio and television transmitters



The usual kind of (battery-operated) television set for classrooms was a 15-inch Philco black-and-white set produced in Brazil. In 1977, there were 159 (56 per cent) TV sets operated with batteries.

3. Supervision

Supervision is often a crucial component in media education systems. Not only must teachers be helped to adapt to new and sometimes threatening conditions, but they also must be persuaded to participate fully in the experiment if real effects are to be found in the treatment groups. A special system of supervision was created for the 500 schools that began to participate in the EXERN experiment in 1973. In that school year, fifteen supervisors from among the 56 in the State primary system were trained to make monthly visits to all EXERN schools. Their duties included the following: (1) to provide counsel for teachers who were following the teacher-training course by radio or television (Mission I); (2) to give pedagogical advice to teachers working with first- and second-grade students using radio or television (Mission II); (3) to give tests for teachers in Mission I; and (4) to report back any immediate problems about equipment to the logistics department.

The supervising system ran into problems in the first year of EXERN, not untypical of many innovative systems. Supervisors were direct employees of the State Secretariat of Education and received their regular salaries, but they were asked to work in a new and much more demanding situation without extra pay.

Supervision can be much more demanding in an experimental setting like that of EXERN, when innovations not only demand a great deal of adaptation by teachers, but a great deal more pedagogical counselling by supervisors. When El Salvador introduced ITV into its system in 1968, one of the early major problems was with supervisors (Mayo et al., 1976). Problems are especially acute when some supervisors, as was the case in EXERN, are asked to do a great deal more work than their colleagues who are inspecting the non-experimental schools. The level of demand on supervision is greatly increased in a project like EXERN. Not only are they expected to visit the schools once a month, but also to carry out duties important for the success of the whole project. If the number of school visits is the same for a regular supervisor, the urgency of fulfilling the duty is far less great and transportation being what it is in rural areas, visits are probably made much less often than is called for in official plans.

Another major problem at the beginning was that supervisors were expected to visit 33 schools once a month, but were not given transportation to do so. In 1974, EXERN decided to hire sixteen supervisors with exclusive duties for EXERN schools and salaries were increased. The transportation problem was solved by having the four

jeeps from the logistics and maintenance section co-ordinate closely with supervisors, picking them up in the regional centres and leaving them in a prefecture (county seat) where a jeep from the prefecture would drop them at each school. This arrangement worked well in 1974, but it was abandoned when the experiment officially ended in 1975. As a consequence, supervisors again reverted to the regular State system, and the special supervision envisioned by EXERN did very poorly. By 1976, the State had agreed to take over EXERN, and the local director of EXERN supervision began to create a functional group of special EXERN supervisors within the system; this has continued in 1977.

4. Logistics

Running a programme in about 500 schools, the majority of them without electricity, with poor road conditions, without an intra-State telephone system - all this is quite a challenge, apart from specific teaching difficulties. In order to cope with such a challenge, the local administration put heavy emphasis on the physical aspects of the implementation.

The logistics system of EXERN was organized around the main office, with four regional centres in the interior (see Figure 1). These centres were in charge of distribution of printed materials, transportation of supervisors to and from schools, replacement of batteries and damaged TV or radio sets, and minor repairs on antennas or tuning of TV sets. The regular operation of each centre consisted in visiting each school once a month to carry out these duties. The jeeps also stopped in the sub-centres⁽¹⁾ in order to pick up batteries to be recharged, and deliver fresh ones. Recharge was generally needed every 15 days. The teacher could take the batteries to the sub-centre and back to the school. But sometimes this was a difficult task, especially when distances are large and batteries weigh about 25 pounds.

The jeep crew was composed of a driver, a blue-collar assistant, and a supervisor. Jeeps were always full of TV sets, batteries, small tools, and printed materials as well as tests and questionnaires on some occasions. Each regional centre had a jeep which was used through the pilot project and which was still in use in 1977!

(1) The sub-centre was basically a room, generally at the local city hall, where batteries and other SACI materials and messages were left. These sub-centres were not staffed, though some places had personnel who provided services such as transportation of teachers, delivery of batteries, etc. Conditions varied from village to village. There were 60 such locations in the experiment, or approximately one in each rural municipio.

The central office was in charge of the operation of the university TV channel, which was primarily used for the EXERN project. It also controlled the flow of radio tapes from INPE to the broadcasting stations.

Training courses were prepared and implemented for the several functions related to the operation of the TV channel and to the repair of TV sets. Most of the trained personnel are still with the project.

The logistics system was primarily involved with the operation of the project; originally it had no relation to the pedagogical aspects of the operation. By 1974, however, it did start to collect some data on the pedagogic results of the project, through the efforts of the technical staff in charge of monitoring the supervisory group.

D. EVALUATION PLANS

Evaluations often reflect the goals and planning of the agency sponsoring the evaluation. Early in the development of INPE's EXERN experiment (November 1971), INPE planners outlined a number of evaluation objectives; they remained the basis of the evaluation efforts throughout INPE's involvement in the project.⁽¹⁾ These main evaluation objectives were as follows:

- verify the effectiveness/efficiency of both technology systems (radio and television);
- do this for each subject-matter in the primary curriculum;
- verify the achievement of the behavioural objectives in terms of their learning and retention in comparison with students in traditional instructional systems;
- do this also for teachers in Missions I and III (but not in comparison with other teachers taught in traditional ways);
- compare results of drop-outs, repetition, and pass-through for EXERN and traditional systems;
- verify the efficiency of the supervision system in terms of its objectives of inspection, counselling, and evaluation;
- verify the effectiveness/efficiency of the tele-education system overall;
- verify the cost-effectiveness of the tele-education system in comparison with the traditional system;
- verify the receptiveness to the new system among teachers and students and among educational authorities and community leaders.

One of the problems that plagued INPE's attempt to evaluate EXERN was the change in personnel in the evaluation positions and their lack of evaluation experience. Another problem concerned the abstract design of the evaluation that had very little to do with formative questions. Some foreign consultants also had greater interest in research questions than in practical evaluation problems. By 1975, when the evaluation reports should have been completed, there was another proposal for an

evaluation design to analyse the data that had been collected during the two experimental years. By July of 1977, when we visited INPE, we discovered that relatively little had been published of the evaluation studies, but that some were in preparation.

E. OVERALL ADMINISTRATION

1. Introduction

In the present section we shall concentrate on a few items essential to an understanding of the decisions, orientations, and major outcomes of the project.

2. INPE

INPE was created as an inter-ministerial agency in charge of policy-making and space research. As its research capabilities developed, external events were limiting its policy-making functions. Among those factors were the creation and development of a Ministry of Communications in the late sixties; the creation of the Inter-Ministerial Brazilian Space Commission (Comissao Brasileira de Atividades Espaciais, or COBAE) in charge of policy-making and monitoring of space activities; the incipient space activities of other government agencies, particularly the Air Force; and the increasing control of INPE's own activities by the National Research Council, to which it was administratively responsible.

In the late 1960s, INPE was becoming more respected by showing its capacity to manage a number of projects in diverse fields of space, planning, engineering, etc. It was on the basis of this reputation that it could launch a project like SACTI in 1968. It was realistic at the time to assume that INPE would be influential in the decision to acquire a domestic satellite, which was an indirect assumption of SACTI. Few could anticipate that in the early 1970s it could lose much of its political power.

In this complex scene of shifting centres of power and decision-making, personalities sometimes play decisive roles. In the case of INPE, the charismatic leadership of the Director, Dr. Mendonça, was instrumental in protecting and expanding the activities under way. This factor was also important in the channelling of resources to the institution throughout the development of the EXERN project, but there were

(1) It should be noted that, although INPE officially signed the agreement to hand over EXERN to the State of Rio Grande do Norte in July 1975, the evaluation reports were projected to be finished late in 1977 and early in 1978. INPE's support for this work stopped at the end of 1977.

limits to the impact of even so strong a personality as Mendonça's.

3. Administrative structure and decision-making process

As was previously said, SACI was one of several projects managed by INPE in the early 1970s. Education, in particular, was a priority for INPE in so far as it could contribute to the legitimacy of the claim for a national satellite. As a technical activity, it was extraneous to INPE in general and to the main core of managers and specialists who held more important management positions at the institution. This context explains, to a great extent, the structure given to the SACI project as well as the decision-making process under which it operated.

The operation of any project, particularly of the duration and complexity of SACI, has to live with periodic changes of priorities, problems and people. Different uncertainties appear at different times. Novel issues are confronted at different occasions. People become more or less important and visible according to the times, issues and their personal priorities. It is natural, then, that the structure of the project and the conditions for its operation within INPE have changed

over time. The planning phase required one set of people and channels; production of programmes, another; implementation put new challenges to the administration; interfaces with several governmental agencies forced other types of issues and priorities, and required internal structures to absorb the impact of such relationships; finally, and not least important, internal pressures from other groups fighting for the same budget certainly caused certain impacts upon the project's structure. We shall concentrate our description and analysis on the 1973/1974 period, though we cannot totally disregard the past environment and the future activities of the programme as a whole.

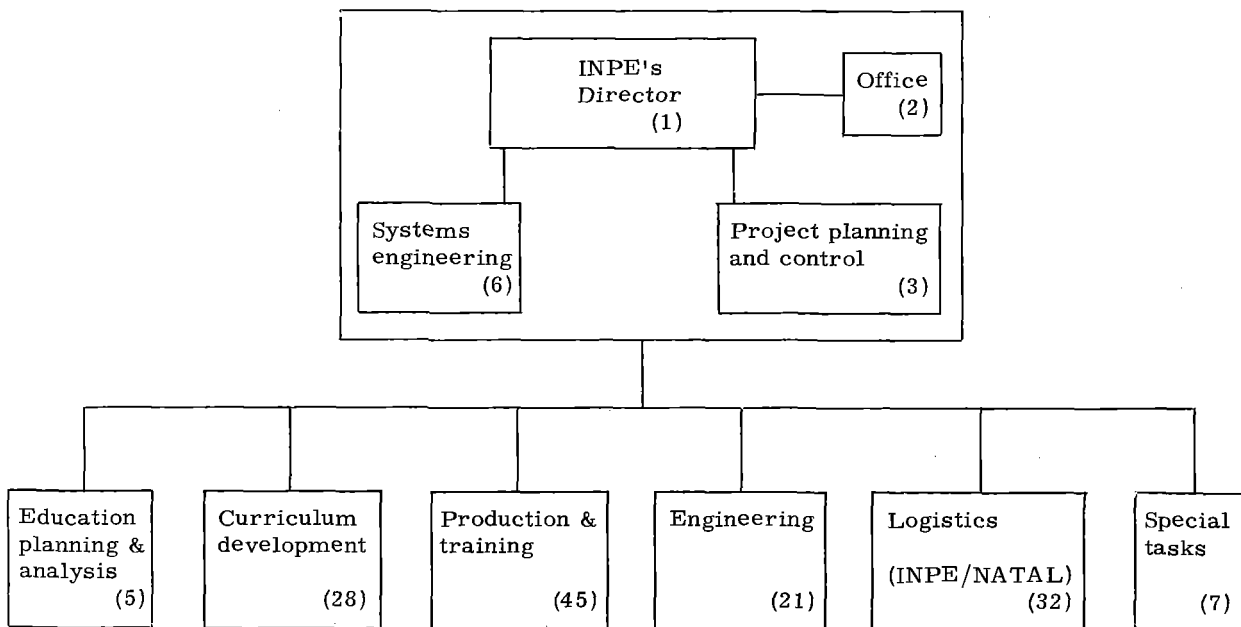
Figure 2 presents the official organizational chart of the SACI project during the year of 1973. This is a typical year in the sense that all activities were under way: some planning was still being undertaken, and much development and implementation was going on.

As can be immediately observed, INPE's Director is presented as the head of the whole project, though, in fact, there was a project manager formally appointed. This circumstance points, at the same time, to the importance of the project to INPE's Director, as well as to the relatively minor role of the project manager which is not even mentioned in the Chart.

FIGURE 2

Project SACI, organizational chart and personnel, August 1973

Total: 150 including non-technical personnel. Numbers indicate personnel allocated in each function.



Source: INPE-445-LAFE Annex 1, pp. 17, 48-52.

Organizational charts cannot tell about actual operations and people's characteristics; none the less, they constitute a very important aspect of organizational structures. INPE's Director, Dr. Mendonça, was indeed a charismatic leader, with most of the characteristics typically indicative of the style. Among his main responsibilities, besides the overall running of the project, there were specific prerogatives such as decisions about the project goals, funding, resource allocation, personnel (including recruitment, dismissal, salaries, status, promotion, travel authorization, scholarships and graduate training abroad). He was personally involved with a number of other SACI activities: external relations, report revision and approval (in each case), participation in every committee of the graduate programme (thesis committees). He was in direct daily contact with the regional manager of the project in Natal. Moreover, he also exercised strong direct personal leadership and authority over most of the foreign consultants, whom he hired directly, as well as over many staff members.

Whether or not a charismatic style of leadership fits within a systems structure is an interesting theme for organizational analysts; in the case of SACI, there were obvious inconsistencies in the system approach in terms of problem finding, search for alternatives and use of evaluation feedback, which were partially hindered by this managerial style. In a later section we shall comment further upon the positive aspects of the project's leadership, as well as on some of the difficulties it has raised.

The role of the project manager is not explicit, as we have said, and Figure 2 does not even present it as a formal organizational function. However, the project always had a formally appointed manager, although his functions and priorities varied over time. There were four managers between the project's beginning and its being handed over to the educational State authorities of Rio Grande do Norte in 1976. We had extensive contacts with all but one of them. It seems that one of the main tasks of the project manager, as was to be expected, was to get the several groups to work together. This was no small task, particularly given the constraints of time, shortage of money, and the obtrusive managerial style of the institution. Bypassing official channels to see the Director was the rule, rather than the exception. Groups had different status, with a clear predominance of the engineers, systems analysts and planners; foreigners had special status, salaries and access to superior personnel. Otherwise relatively strict rules were used. So, particularly at certain periods of the project's life, the main role of the project manager was that of a tension-reliever, in order to accommodate the requirements and rules from above and the demands and feelings from below.

Another characteristic of all but one of the

managers was the concern with local matters: most of their time and priorities were concentrated around the co-ordination of production and the running of operations in Sao Jose dos Campos. Very few direct relations with the actual field operations in RGN occurred. Field implementation was not a priority task for them, either because that was the regional manager's task or because they chose not to make it a priority. Moreover, the project was conceived in an environment in which planning was highly valued. The tasks left for implementation, though of a difficult nature in terms of physical and geographic constraints, had little intellectual appeal. While it is clear that an internal role of leadership and interconnection of the several working groups was the main task of project managers, the life of the project and most of the key decisions about it were out of their direct control.

As can be observed in Figure 2, the teams in charge of systems engineering and project planning and control had a special status, which is correctly illustrated. Those two upper boxes, particularly the systems engineering group, were not only in charge of overall planning and co-ordination, but also the vital links between SACI and other projects and activities going on at INPE. It was through their influence, in particular, that INPE's rules, procedures, routines, norms and values were transferred to the SACI project. Of particular importance is the introduction of the system's approach, of which they were the guardians and teachers. As a consequence, these two groups, even though they were relatively safe from the uncertainties and difficulties characteristic of production and implementation, managed to maintain a position of high prestige, status, leadership, power and overall influence.

One or two examples of such a state of affairs can be found in the relative importance that plans and control instruments acquired. As we point out elsewhere, the number of documents produced by SACI is impressive compared to any other project in this field, in Brazil or elsewhere. Some of the documents were used as control mechanisms, as will be seen in the next section. Others were used as responses to environmental pressure, mostly from the Ministry of Education. Independently of their actual operational value, plans played a very important role in the project's life and survival, and they were strategically used by INPE in order to accommodate the internal and external criticisms of the project. Most importantly (and regardless of their degree of contact with reality) plans and written documents created by different groups consistently contributed to the impression of rationality, order and objectivity. They also served to remind everybody of the sense of mission.

4. Control and communication

The matrix structure is, by itself, a structure of control and communication. In the disciplinary groups, control is typically of the professional type, and codes and standards of behaviour are common to the members of each discipline, in addition to the specific rules of each organization. In the project groups, the control is handed over to the project manager, who represents central administration as far as authority is concerned. In the case of SACI, in particular, there was a great deal of overlap, in so far as central administration kept many functions typically delegated to project managers. As a consequence, fewer upward and downward communication channels were required for information and control.

Plans and charts were the main technical mechanisms of control, both for quality and quantity of work. SACI operated under a very rigid timetable. Programmes had to be broadcast according to a rigid time schedule, and production teams were always running close to deadlines. The bulk of the production effort, during 1973 and 1974, was done almost simultaneously with broadcasting. It meant an average daily production of 30 minutes of TV and radio programmes, besides the preparation of teacher-training materials. This is not a small burden, if one considers the technology and strategy employed, the limitation of the studios and equipment, and the complex instructional design procedures used.

Every sub-group had clearly defined tasks and relatively clearly defined standards and formats for their output. A group leader for each subject-matter, and then at a higher level for each production "theme", was in charge of revisions and clearances. The process was repeated downwards to the final production and technical evaluation of each programme and text. Lack of time was the main constraint on the implementation of other evaluation procedures and technical control mechanisms devised in the original plans.

If the control of production and implementation was relatively rigid, professionally managed, and very well illustrated by the huge flow charts and control charts displayed on the walls of the Project Planning and Control Unit, the same was not true of the general evaluation and research activities that were planned. At different points in time, evaluation plans were made, but with no contact with the real world and the actual operations of the project. The reasons for such behaviour will be analysed in the fourth part of the present study, but they are related in general, to the difficulties with keeping up with the daily demands of production and implementation and fighting for the survival of the project with the outside world.

Communication was a corollary of the control mechanisms. So the interference of the General Director was quickly and directly felt, since he could communicate directly and personally with

the units or persons involved. Technical operations were handled by explicit rules and routines widely disseminated even though there was a great deal of conflict among members with very different orientation and training. But the graduate training programme in educational technology helped to ease the communication conflicts between group members at a technical level. Plans and reports, which were abundant, also worked as communication devices, though their internal effect was less than their volume might suggest. Many documents were written as a record of meetings, planning or evaluation sections, and, as such, could not be very useful for daily operations. The meetings that preceded their elaboration, however, and the data gathering exercises and activities for this purpose certainly contributed important inputs at different levels of the project.

For communications between headquarters and field, several mechanisms were utilized, with varying degrees of success. A two-way radio system was used daily, between São Jose dos Campos and Natal, and the several INPE groups could talk directly with the project manager in Natal. A few trips to RGN were also made, mostly by senior staff members. During the interval between the production of programmes for 1973/1974, each production team visited the schools in RGN during a two-week period, and this activity was reported as a most valuable experience. A monthly report was also sent from Natal to INPE headquarters, containing a summary of the supervisors' meetings. Data on logistics and daily operations were mostly rapidly given and utilized by management; technical data on student learning and evaluation were least in demand and lagged far behind in usefulness.

5. Personnel

Most members of the staff (see Figure 2 above for quantitative information) were college graduates (over 60 per cent) in such fields as education, communications, and specific school subject-matters.

Total numbers shown in Figure 2 also include other professionals from the various other INPE groups which interfaced with SACI, most of whom had graduate degrees in engineering, economics, or systems analysis. They were not full-time workers on the SACI project.

A couple of SACI staff members were sent to the United States for graduate training in the field of educational technology. As they returned with M.A. and Ph.D. degrees, and with the help of foreign consultants, INPE started its own graduate programme in educational technology, and most of SACI's staff were eventually enrolled as students in the new programme, on a part-time basis. These consultants were regular INPE employees, and the majority of them stayed from one to two years in the project.

Salaries were generally good for college graduates, in terms of the market. This means that they would get a better salary at INPE than as regular secondary-school teachers, though good professionals could eventually fare better if they would work in specialized firms. Salaries were not so competitive for graduate level personnel, particularly Master's degree holders, given the favourable conditions of the market and the newness of such specialities.

Turnover in SACI was not very high. Most people did not leave the project before the end of 1974. The graduate programme was a factor which helped to keep the people at the institution.

Besides the personnel involved in production and implementation, almost 500 teachers and fifteen supervisors were directly involved in classroom activities. During the experimental phase, EXERN was totally administered by INPE with no direct involvement from the State Secretariat of Education in RGN. However, no special salaries or benefits were given to participating teachers. (Supervisors were given a salary bonus during 1974.) As observed in Section II, teacher salaries were very low by any standards, and turnover has always been very high.

F. RELATIONS WITH OTHER ORGANIZATIONS

The need for interaction with other groups was a consequence of the project's scope as well as of the dimension and visibility acquired through time. The issue of satellites was also a contributing factor in exposing INPE and EXERN to public discussion.

In the present section we will concentrate our attention on the most important relationships with outside groups.

1. The Regional Office in RGN

INPE had had several space-related activities in RGN for several years before SACI started; the main operations during the 1972-1974 period were the utilization of the rocket-launching base operated by the Air Force at Barreira do Inferno in Natal, and the running of INPE's computing facilities located at the Federal University of RGN. Under a contract, INPE provided the University and a few other clients with some services since this was the only computer available in the city for some time.

The local representative of INPE was also in charge of EXERN's implementation. He was directly responsible to INPE's Director, though direct contacts with SACI's staff were not unusual. His main responsibilities regarding EXERN's implementation involved frequent dealings with the University, the State Secretariat of Education, the supervisors, and the committee in which the project was going to be implemented, as well as supervision of the logistics operation.

2. The University

Given its prior experience in Natal, it was not difficult for INPE to set up an agreement with the University regarding the installation and operation of a TV broadcasting system to be donated by INPE to the University, even though this system was operated by INPE. Other than this, the University did not have much say in the project's operation, though it acted, through its Rector, as an important additional source of legitimization for the project, both locally and with federal authorities.

3. The State Secretariat of Education

A general agreement was reached with the Secretariat - whose head at that time was a former INPE staff member - on the implementation of the project. The details were left to be worked out between the staffs of the two institutions.

Since the beginning of INPE's activities in RGN for the educational diagnosis, and particularly when EXERN was about to start, a resentment developed between the two staffs. There were several rational and emotional issues involved here. From INPE's viewpoint, the main preoccupation was to implement a "pure" experiment with a minimum contact with a traditionally "backward, slow moving, poorly staffed and inefficient" educational system. From the Secretariat staff's side, a sense of helplessness, rejection and inferiority was most visible. This relationship was further complicated by the new educational law which was being implemented at that time, according to which some changes were to be introduced in the curriculum; the State Education Board would have to approve the curricula used. Though INPE did not change the existing curriculum prior to the reform, it did alter the amount of material to be taught, and it interfered with schedules and supervisory duties, etc. Agreements were reached, however. These human problems certainly interfered with supervision and other aspects of the implementation, though they did not prevent a rather free action on the project's part.

The effects of these frictions on teachers are not clear, but apparently they were not visibly affected. The project has always had the official political backing of the State Secretary and his successors.

4. The community

Throughout the development of SACI, and even before, INPE had positive contacts with the communities where the project was implemented, particularly in two important ways. One was through television, since it was being introduced in most villages for the first time. Having a TV set was a matter of prestige for many communities,

even when the use of the sets was rigidly controlled in order to serve the project's needs. In a few cases, the use of radio interfered negatively. In the schools in which there were two experimental classes, one with radio and another with TV, the radio was sometimes seen as "punishment". In other cases, a general negative reaction against radio was noticed since the preliminary studies in 1972. In the past, radio had been used in a church-sponsored social reform movement, and its use in SACI sometimes prompted negative reaction from the most conservative citizens and officials.

The second positive contact of INPE with the communities was of a political nature. Some mayors, newly elected shortly after SACI had begun operations, wanted to remove some teachers, a prerogative of mayors in rural areas. In most cases, INPE's efforts were able to convince the mayors of the meaning of the project, the investment in teacher training, etc. In other cases, prestige mattered more, and the teachers were removed.⁽¹⁾

5. Relationships with federal authorities and the educational community

SACI was proposed at a time when large projects were being started in various other fields. Though it is likely that INPE would have considered the possibility of actual implementation of SACI being managed by other agencies, the politico-administrative circumstances led it to become a strong and relatively solitary advocate of the project. The magnitude of EXERN was not the main point discussed in the relationships with federal authorities; EXERN was perceived most of the time as the pilot project of SACI, a challenging national educational satellite idea pushed by the Space Agency.

The Office of the Ministry of Education and his Secretary-General reacted mainly to the prospects of such an enterprise, more than to the actual experiment in RGN itself. That was a natural reaction, considering the fact that another federal agency was making major plans for education in the country. Naturally, some officials at the Ministry of Education felt threatened. Moreover, because of the personalities involved, all very achievement-oriented officials from a similar military background, there was bound to be intense competition. SACI needed legitimacy and support; and, in the beginning, INPE was alone in advocating the educational satellite. The Ministry had no firm policy concerning tele-education, much less one on satellites. Moreover, the proposed costs of the preliminary studies were generally considered extremely high, unrealistic in terms of funding possibilities and probably underestimated. Some vocal groups with connections with the Ministry of Communications opposed the idea of the satellite itself on the grounds of technical difficulties and the excellence, adequacy, and

priority of extending the terrestrial option.⁽²⁾

Within a generally hostile climate - there were exceptions to this and official relationships none the less continued - INPE decided to proceed with EXERN, while general discussions about the satellite went on. The Space Agency controlled its own budget, and the relationship with RGN was enough as a starting point.

Though an official attitude of wait and see was characteristic of the Ministry of Education, the negative feelings and doubts were transmitted down the hierarchy. In 1972, an Agency for Tele-Education (Programa Nacional de Teleducacao, or PRONTEL) was created by the Ministry, and eventually SACI came formally under its "co-ordination" range, loosely as these powers were defined. PRONTEL's role was basically to spell

(1) In some villages, the TV set was kept by the teacher in his home, which could serve as a school also. When this teacher was an active opponent of the mayor, prestige was incompatible with giving such a privilege to the teacher. Particularly in very poor areas, this control of teachers is one of the few powers left to the mayors.

(2) COBAE, the Brazilian Interministerial Space Commission, and the Ministry of Communications were the decision-makers in discussions about a national satellite. A satellite primarily for education was never seriously discussed outside INPE and a few strong opposing groups within the Ministry of Education and the Ministry of Communications. Indeed, the proposal for a direct reception educational satellite has always been essentially an INPE idea. The lack of convincing technical and economic studies and the lack of experience with tele-education were the main contrary arguments of a controversy unofficially held backstage, under a heavy emotional tone. One could say that the decision-making process, in this case, was the arena for several outcomes other than a decision: there were discussions about relative status, rights, perspectives, educational ideologies, and the like, with marginal impact on the actual decision outcomes. The counter-pressure was exercised mostly through some international organizations and by sellers of equipment. The official discussions about satellite policy, however, had been conducted by COBAE since its creation in 1972, and despite the news from the national and international press, and the information given by vested interest groups, only a recommendation to have a communications satellite had been formulated by 1974, with no precise dates suggested for its implementation. There was no special provision for educational uses, though the possibility was not excluded, and the actual technical configurations were not firmly decided.

out the Ministry's scepticism about the use of a satellite for education, and to insist on reliable cost-effectiveness data as promised by EXERN's documents. The National Educational Research Institute of the Ministry of Education was also authorized to conduct the evaluation of the adequacy of the contents of the TV and radio programmes. These relationships did not evolve without tensions, and attempts at objectivity and mutual understanding were doomed to failure. Although progress was made, and eventually some forms of co-operative action were established between these agencies and INPE, institutional relations were never very good.

As the idea of an educational satellite was discarded, with the pilot project about to finish, and in the face of many other priorities, an eventual agreement was reached regarding the transfer of project responsibility to the local educational authorities. Financing from the Ministry of Education was then granted to the project, for the first time, in 1975. It took about two years, until the end of 1976, for this transfer to be fully accomplished.

As part of internal reallocation of priorities in INPE, and also as a result of these general pressures from the world of education, the Master's degree programme was phased out. Some material and human resources went to the Federal University of Rio Grande do Norte, where a similar programme was due to start by mid-1977.

6. Institutional relationships

Before becoming an Institute, INPE was called CNAE (Comisao Nacional de Atividades Espaciais), an inter-ministerial committee directly responsive to the office of the President of the Republic, under the umbrella of the National Research Council. When SACI was first proposed, in 1968, INPE had both visibility and status.

In the early 1970s, INPE came under increasing budgetary and administrative control by the National Research Council, and by 1972, with the creation of COBAE, it had lost most of its policy-making powers. The Director's prestige, however, backed by that of the Institute, was enough to guarantee a few more years of influence of INPE in the policy-making process. Nevertheless, in the absence of a clear endorsement of SACI from the Ministry of Education, INPE's Director experienced increasing difficulties in justifying to the Research Council the resources allocated to SACI. ⁽¹⁾

(1) Until mid-1977, there were still a few persons hired by INPE for the evaluations of SACI. Though the formal attachment of these people was through the graduate programme, it is clear that INPE did not entirely abandon the project, and was still interested in collecting evidence about educational results.

Section IV

Project results: Difference between plans and outcomes

A. CONTRAST BETWEEN EVALUATION PLANS AND OUTCOMES

In planning communication and education projects, a major role is frequently given to evaluation. Such was the case of EXERN where the general cost-effectiveness of a mass media-based project was to be demonstrated. The results were promised for 1975, soon after the end of the first four missions in late 1974. By mid-1977 little or no evaluation results were available though a good deal of data had been collected. What happened to the elaborate experimental plans? A few words cannot suggest the complicated reasons for failure but some of the problems were as follows:

(1) little or no major pedagogical effect could be readily expected from only 15 minutes of media exposure each day;

(2) the size of the project helped test technical feasibility but made measurement of effects on learning difficult because schools were spread widely in isolated rural areas and the evaluation staff remained in INPE headquarters, far from the implementation site;

(3) staff changes over time changed evaluation plans and collection of data;

(4) since data had to be collected by relatively untrained people, tests were poorly administered and results were unreliable even when they were collected;

(5) project priorities changed over time, and EXERN later came to be seen more as a test of technical implementation of aspects of the project and not so much as a more cost-effective way to teach rural children than the traditional classroom methods.

B. EDUCATIONAL PLANS AND RESULTS

1. The production of instructional materials

EXERN generally can be credited for following its planned production and broadcast schedule for the experimental years 1973-1974. Programmes were produced on time and reached most classrooms on

schedule. The logistics operation also functioned quite well. What did not operate so well were the supervision and evaluation sections, as we have already explained. Since no final evaluation results were available by mid-1977 only some indicators of educational results are available and there is no easy way to attribute lack of results to weaknesses in operational functions, such as supervision. Thus, this brief reporting of outcomes and of costs is done to indicate as far as possible the achievement of educational (as opposed to operational) goals.

2. Educational results

The number of students originally planned for in the first year of EXERN was 16,000 in first grade with TV, and 6,000 in second with radio (INPE 363-RI/130, 1973, pp.107-108), but the figures were somewhat lower than that. In Table 6 we find estimates of student enrolments for 1973 through 1976. The table shows that the enrolment remained about the same during the first four years of the experiment, with a slight dip in 1974. Even though below estimated numbers, the figures indicate that EXERN was a large educational experiment that achieved many of its operational goals.

TABLE 6

Enrolment in EXERN for grades 1-3
from 1973 to 1976

Grade	1973	1974	1975	1976
1	9,137	6,152	7,427	7,636
2	4,327	3,802	5,334	5,657
3	-	1,629	1,055	1,296
Totals	13,464	11,583	13,816	14,590

Source: Stone (1976). Data for 1975 and 1976 were obtained from Mr. Joao Rodrigues (SITERN) and Mr. Adauto Motta (INPE-Natal).

The enrolment under State Secretariat funding in the public school system of RGN for 1975 and 1976 was about 100,000 students, making the EXERN students about 14 per cent of that system. The number of schools reached by EXERN during 1975 was 681 (282 State schools and 399 Municipal; 188 urban and 483 rural). In 1976, this number was reduced to 438 (156 State and 288 Municipal; 89 urban and 349 rural). Estimates for 1977 were that about 15,000 students were enrolled in 463 schools, which shows minor changes from the figures for 1976.

Another set of data available on student results is from an M.A. thesis by the present head of the Evaluation/Supervision Section of EXERN, Margarida Camara. The questions that she asked were three comparative ones: did EXERN students attend class more regularly than those in traditional schools? Did they drop out less? Are they more likely to enrol in the subsequent grade? She was able to do her study with a sample of 262 schools from both the traditional and EXERN systems (131 each), and a student sample of 3,556 in EXERN and 3,535 in traditional schools. The study only included first grade students during the 1974 school year. The results show no significant differences in attendance rates for the year (taken on a month-by-month basis). Camara found a difference in the "waste" (failure and general drop-outs) in favour of EXERN over the traditional system by 39 per cent vs. 46 per cent. She also found that EXERN had a 57 per cent matriculation in second grade, while the traditional system only enrolled 50 per cent of first graders in the following grade.

A second area of educational results is teacher enrolment and efficiency in Missions I and III in 1973 and 1974. Here the data were much more sketchy. According to INPE sources, there were 1,116 teachers enrolled in Mission I, the one-year equivalency training by radio and television for teachers with less than a fourth grade education. Although about 790 teachers were known to have finished the course, there was no way of tracing the percentage of those who passed the State controlled "supletivo" examination and were upgraded by the State. Assuming 790 to be also the number of those being accredited, the most optimistic case, the promotion rate was 71 per cent. The second year, Mission III, put emphasis on the second four years of the new primary school, grades 5-8, and used mostly programmes for the old supplementary education known as "ginasio" made by Channel 2 in Sao Paulo. No results of promotion are available.

There were in mid-1977 no final evaluation results on teacher or student learning achievement. Given the problem with measurement and data collection, we cannot be optimistic that results will be very illuminating in any case.

Among EXERN evaluation goals were some measures of receptivity to innovation. This was

an attempt by INPE staff with a foreign consultant to measure the impact of an educational innovation like TV or radio on the attitudes of students, teachers and community members. The theory was that such an innovation could have important results on how teachers and students interacted in the learning process and even how innovative the community was regarding other modernizing changes. This was the only major data-gathering effort that was not left to relatively untrained supervisors. A group of interviewers was well trained and a representative sample of SACI schools drawn. The result, however, was again of problematic value for the project itself because the results by mid-1977 only indicate what supervisors had reported earlier - that teachers and communities like TV but think less of radio.

A final word needs to be added about formative evaluation. This is an important, but often neglected, area of evaluation, especially in educational technology projects. Some minimal validation was done on materials developed at INPE, but no serious formative evaluation was planned for the field. Supervisors were to create a feedback system, but the tasks they were asked to do proved to be beyond their capacity, as testing results indicate. Through the last years of the project (1975-1977), the supervision section had adjusted to its limitations and devoted most of its energies to making the project work better by providing with data those who had begun to manage the project from Natal and not from Sao Jose dos Campos, 1,500 miles away.

3. The costs of EXERN

In its early planning documents, SACI was presented as a possible cost-effective alternative for the problems of primary education and teacher training in Brazil. At that time, SACI was planned for the entire country, and EXERN would be just the experimental phase of a more extended project. For that reason, it would be unfair to allocate all planning and start-up costs of SACI to the relatively small project of EXERN, in RGN, particularly when one considers all the studies and activities related to the satellite.

Change in policy and scope may explain the relative lack of detailed studies on the costs of the project, as well as the absence of discussions about the financing of it. Within the available data, including the limited information the authors were able to collect for the present study, it is possible to present a summary of EXERN total costs, based on Stone's (1976) figures (Table 7).

It is important to say that these costs were paid by INPE, with no significant amount of foreign financing. The figures include the costs of the graduate programme of education, which can be considered an integral part of SACI.

1. Cost/student/year

The average number of students per year was about 12,600 for the period 1973-1975, which gives a cost/student/year of US \$31, according to Stone (op. cit., pp. 62-68). It must be noted, however, that this is an "add-on" value. Since the unit cost for the conventional system was estimated to be about US \$27, when SACI's \$31 is added on, we get a total unit cost of US \$58 per student per year. SACI costs might be a little overestimated, not only

because they include all the start-up costs, but also because they include 1975 estimates. However, it is possible that the costs of the regular school system are higher than the US \$27 figure used, because the figure took into account only recurrent expenditures incurred by the State. It is unequivocal, however, that EXERN cost at least 100 per cent more than regular schooling. For this amount the direct benefit received was 15 minutes of radio or TV, plus a teacher trained and supervised within the system principles.

TABLE 7
EXERN costs⁽¹⁾

	Total ⁽²⁾	Annualized costs		
		5%	10%	15%
FC ⁽³⁾	3,800,000	600,000	742,800	885,700
VC ⁽⁴⁾	100,000	22,500	25,800	30,000
VR ⁽⁵⁾	514,000	171,400	171,400	171,400
	4,414,000 ⁽⁶⁾	793,900	940,000	1,087,100
50 per cent of annual cost ⁽⁷⁾		396,950		

Notes

- (1) From project planning to the end of 1974, when production of Missions I to IV was finished. It also includes planned cost in 1975.
- (2) Original figures were in cruzeiros. On the average, one dollar was equivalent to 7 cruzeiros in 1974.
- (3) Fixed capital costs (FC). Includes buildings and installations, furniture and equipment, start-up costs, and programme production. There were two main objectives: teacher-training and student programmes. Based on his observations and analysis, Stone proposed that the costs could be equally divided between these two activities.
- (4) Variable capital costs (VC). Includes reception costs such as TV and radio receivers, antennas and batteries, besides maintenance facilities and vehicles.
- (5) Variable recurrent costs (VR): printed materials, operating costs in Rio Grande do Norte, including supervision, transmission, supplies, and contracts.
- (6) Of the total expenditure, approximately 60 per cent went to production (40 per cent being for personnel alone); 7 per cent to transmission, 5 per cent to reception and 28 per cent for start-up costs. (op. cit., p. 138, Table 34.)
- (7) This 50 per cent implies that only half of the project's expenditures were more directly related to the educational (vs. satellite) segment of the project.

Data for 1975 and beyond were available only for expenditures in Rio Grande do Norte. This means that the costs incurred by INPE for the graduate programme in education, some of the costs of assistance and training to the project in RGN, and for research and evaluation costs, were not considered.

Table 8 combines annualized fixed capital costs plus the variable costs incurred by local sources after 1975.

Taking the data presented in Table 8, and assuming an average attendance rate of 15,000 students per year in those years (1975-1977), the add-on cost of SACI for this three-year period would be of about US \$52 per student per year. This increase in costs, at a time in which virtually

no production was being done, might reflect inefficiencies related to the difficulties faced during the transition of the project from INPE to CETERN, as will be described below.

2. Teacher-training costs

Missions I and III reached about 2,400 teachers. It was expected that an additional 3,000 teachers would be enrolled in 1975, but the training programme was discontinued by 1975. Stone (1976) estimates the cost of teacher training at US \$185 per teacher per year, under the assumption that training would last for three years. Comparing these costs with the alternative costs of regular schooling, and assuming additional enrolments of teachers, teacher training under EXERN could

TABLE 8
Costs of SACI since 1975

	1975	1976	1977	1978
FC ⁽¹⁾	300,000	300,000	300,000	(estimated
VC + VR ⁽²⁾	162,500	450,000	870,000	total only)
Total	462,500	750,000	1,170,000	1,821,000 ⁽³⁾
				Current US \$ ⁽⁴⁾

Notes

- (1) Fifty per cent of annualized costs, since teacher training was discontinued. See Table 7.
- (2) Costs incurred by INPE, Federal University of Rio Grande do Norte, and State Secretariat of Education. The costs for the operation of the TV for SACI were estimated as 30 per cent of overall costs with TV. Up to 1976, INPE financed over 50 per cent. From 1977 on, the State and other Federal sources were supposed to finance the project. Source: Relatorio Interno do INPE, by Aduato Motta, 1975/1976.
- (3) Estimates given by Mr. Joao Rodrigues, from CETERN.
- (4) Dollars were estimated at 8 and 11 cruzeiros for 1975 and 1976, respectively. In 1977 and 1978, the value was calculated at 14 cruzeiros per dollar.

TABLE 9
Performance data for students in the first grade, 1975: EXERN and conventional

	EXERN (3,556)		Conventional (3,535)	
	#	%	#	%
Automatic promotion	1109	31	1098	31
Recuperation	1450	41	1444	41
Promotion after recuperation	959	27	791	22
Total promotion	2068	58	1889	53
Failure	1111	31	1226	35
Partial transfer	90	3	97	3
General transfer	129	4	148	4
Partial drop-out	287	8	323	9
General drop-out	291	8	386	11
Matriculation in the 2nd grade	2025	57	1775	50

Source: Stone (1976), based on Camara's (1975) data.

have proved a cost-effective alternative, as suggested by Stone's dissertation.

3. Costs and effectiveness

Camara (1975) has provided some comparative data for EXERN and the conventional system, regarding drop-out and failure rates.

Table 9 presents the general results of her study, with data available for only the first graders in the year 1974.

Table 9 shows a small advantage of 7 per cent for EXERN regarding waste (failure + general drop-out = 46 per cent for the conventional system, vs. 39 per cent for EXERN). The rate of total promotion is also greater, mostly when post-remedial instruction results are incorporated (58 per cent for EXERN vs. 53 per cent for conventional). Lack of comparative data in other years plus the difficulties in interpreting the

meaning of "waste" for previous years - those figures do not include drop-outs between academic years - make it difficult to provide further information on productivity.

C. OPERATIONS: HOW THE SYSTEM WORKED

It is well beyond the scope of the present study to evaluate management actions and styles per se. In the subsequent paragraphs, we want to re-analyse some important and selected aspects of the administrative life of SACI, and reflect about possible lessons to be learned from this experience. For that purpose, we will have to rely on information which goes beyond the data presented in the previous sections, and, with the benefit of the time perspective, we shall certainly introduce alternative ways of thinking which were unavailable at the time when SACI was conceived. None

the less the exercise may be important as it leads us to a contemporary understanding of a past experience. This is probably the situation in which many project managers may find themselves now, and this is, perhaps, a valid way of learning from other experiences.

1. The systems approach

If the systems approach starts to look outdated nowadays, it certainly was a great and fascinating administrative tool in the mid-sixties and early seventies. It promised to overcome most of the limitations of available planning and managerial instruments, and its broad frame of reference was adequate to the gigantic scope of many technological and social projects undertaken at that period, in Brazil and elsewhere.

The main tenets of the systems approach to management, educational planning and instructional design were formally applied, with varying degrees of implementation and success, to the SACI project. There were many concerns with analysis of alternatives in terms of costs and benefits; much concern with goal specification and subdivision into tasks; interfaces and interrelationships between tasks and people were carefully attended to and spelled out, at the various levels of the operation; evaluation, monitoring and feedback were important components of plans and administrative units in charge of such matters. At the managerial level, the systems philosophy was mostly reflected by the matrix-type organizational design adopted. The more explicit and visible aspects of this approach were also transparent in the concern with the use of charts, maps, planning instruments, schemes, work flows and indicators of decision points. Those signs permeated both the macro-administrative aspects of the institution and the technical development of the pedagogic planning tasks.

It was natural to expect that the systems approach would not be fully implemented, due to a variety of constraints: inappropriateness, lack of adequate expertise with the techniques embodied in the concept, lack of experience with the approach, inconsistencies and challenges from reality and the like. The strong rationality of the planning process and the faith in the system methodology are likely to have contributed to the relative lack of involvement and problem-solving during the implementation phases of EXERN. The adoption of a centre-periphery model of organizational learning can explain, to a great extent, the difficulties with the evaluation of the project and the specific substantive cares that an educational intervention would have required, and were not met by EXERN.

These difficulties in the planning and implementation process, however, can neither be fully attributed to the choice of a planning or administrative philosophy nor to the qualifications of the people involved. Quite the contrary. Natural difficulties would arise, regardless of the methodology,

though it is possible to state that more field-oriented practices would certainly have contributed to a smoother operation and a more significant educational intervention in the case of EXERN. EXERN, however, was not the main preoccupation of INPE, and this fact has to be taken into account. Moreover, natural difficulties arising from the backward situation of teachers, teaching and students in the State of RGN cannot be underestimated, and those who have been involved in implementing projects at this level might recognize some of the obstacles encountered by EXERN during its execution.

2. Symbolic value of administrative acts

Looking at INPE as a whole, and at EXERN in particular, it is probably fair to say that planning and managing the project according to a very rational and systematic approach was a serious commitment. This intention, however, should not be taken too seriously, as far as all administrative actions were concerned. Regardless of the prevailing belief system, most of the plans and documents produced, as well as the talks and exaggerated preoccupation with evaluation, were used as shields to protect SACI from the uncertainties and criticisms of the outside world. At some point in time the project acquired its own personality, and it was important to build up an internal belief system strong enough to keep things moving at a fast pace. The same was necessary to convince the outside world of the consistency, logic and persistence of the ideal embodied by the project. Those functions may well explain this aspect of organizational behaviour, regardless of the intrinsic merits of the planning and evaluation documents.

As a whole, EXERN was implemented, and there are important implicit merits in this fact by itself. Whether or not it was due to the management approach adopted cannot be easily concluded. Let us concentrate, however, on a few interesting shortcomings of the planning and administrative process in order to derive possible learning material for future undertakings.

The adoption of a systems approach for planning and development of the project was not a rational, on-the-spot decision of INPE, given the nature and complexity of the educational component. It was rather a reflection of the administrative practices and routines of the broader parent institution. By a coincidence - which may or not be considered as fortunate - the educational practices then embodied under the concept of educational technology were also adopting the same language and a few common techniques advanced by the systems approach. This coincidence certainly contributed to making communications easier between the project and INPE, though it would not be unfair to suggest that in many cases it was more a verbal convergence than a practical one.

Beside its not being a rational decision, the adoption of a systems framework for the development of projects of this nature may not always be the best technique. For SACI as a whole, a complex technique and methodology capable of handling very complicated interactions would probably be required, and, in that case, the systems approach would be a strong candidate. However, and using the benefit of ten years of distance, when one analyses the former SACI plans, one is struck with the simplicity of the alternatives considered and the heroic assumptions behind the project. Even in 1968, to think about a national primary education system, almost uniform for the entire country, including the State capitals and big cities where a relatively reasonable school system was in operation, could be considered as the height of political naïveté. In terms of the satellite components and the availability of low cost direct-reception antennas, the project was based on very weak probabilities which did in fact materialize only in the mid-seventies, in India. Moreover, and as a limitation in the adoption of a systems view of the world, the look for alternatives was rather limited. Finally, the use of the benefit of the doubt worked in favour of the cost analyses made. If these criticisms are valid for the plans for SACI, which never materialized, further complications arose when the same approach was used for EXERN. The practices adopted by INPE in the administration of this project, the need to sell the project to higher authorities, and even to defend it from sharp criticism of the hostile outside world were certainly some of the factors which contributed to the maintenance of this special style of planning, managing and reporting about the project. Plans and evaluative documents became formal, defensive, in some aspects, and not always very pertinent to actual operations. However, the specific situation of RGN, in terms of its educational problems and needs certainly required more fine-grained analysis and involvement than could possibly have been undertaken by INPE.

3. The human side

3.1 Leadership

We have already referred to the charismatic style of leadership characteristic of INPE's Director. Whether or not charisma is positive or necessary is beside the point. The fact is that for major changes and radical new ideas, a strong leadership is essential, and EXERN benefited a great deal from Dr. Mendonça's commitment to the project throughout its duration. The price to be paid may be considered as too high for some organizational members or outside critics of the project; in the case of EXERN, however, this difference meant the alternative between surviving or not.

Whether or not INPE would have been able to carry the idea of the national satellite and the

national educational project further is mere speculation. However, in order to carry on such a project, or even elicit strong reactions and activity from the educational sector about important schooling problems in Brazilian society, Dr. Mendonça's style was certainly an asset.

3.2 Technical staff

SACI, and EXERN as well, had to meet very high standards of quality and performance, according to the original ideas stated in the plans. Televised classes, instruction, computer-marked tests, formative and summative evaluation plans, research design, these were some of the important activities planned, most of which required sophisticated techniques which were new to most of the people involved in the project. These technical complexities were added to the intrinsic difficulties of implementing a large-scale educational project in a severely depressed area.

Recruiting policies, limited personnel plans and pay schedules, formalism in the evaluation of new staff and the geographic location of INPE, were among the factors contributing to the limited pool of competence that INPE was initially able to attract. In addition, due to the lack of experienced national professionals in some of those areas, the project had to hire foreign experts. Some of them, as we saw earlier, were not fit for the tasks or for the environment, and the costs and benefits of the process are a matter of serious doubt. SACI made intensive use of forging consultants from the early stages of planning for the satellite up to 1974. These consultants, however, were hired as regular full-time employees of INPE, and none of them were members of international organizations. Most of them were university professors from the United States of America. Difficulties in recruiting, selecting and adapting the foreigners to the project might have led to a less than optimal utilization of their abilities. The impressions collected during our interviews and a written report by Garcia (1974) suggest that the language barriers, the inadequate fitting of some consultants to the project's profile and needs, the enormous wage differences and the inconsistencies between theories and approaches used were some of the factors that must be taken into account. From the impressions collected, it seems that the most important contribution of consultants was the creation and development of the graduate programme in educational technology. According to some critics, consultants also contributed, in a more negative way, to reinforcing certain grandiose ideas which were not quite adequate to the problems faced by the project and the national staff members.

4. Logistics

Careful records of operations were kept in the logistics centre in Natal for managerial purposes.

Among other interesting features, these records show how such a large system could be implemented in a relatively economical and effective way.

In all, nine people, including drivers, maintenance and repair specialists, and storekeepers were responsible for the entire operation in RGN. This included the distribution of teachers' guides, tests, and questionnaires; daily visits to the sub-centres; and repair and maintenance of almost 500 radio and TV sets, antennas, and studio equipment.

One jeep was allocated to each of the four regional centres, and a visit was paid to each village twice a month for the purpose of replacing batteries and broken TV sets, local repair of antennas and sets, and transport of supervisors. A tight maintenance schedule was observed for the jeeps, which are still in operation.

Up to 1975, records show that the system operated with an almost perfect level of performance, and no complaints are registered about transmission, lack of TV sets, or the like. After 1975, when the transition started, and equipment began to age, problems increased.

Regarding TV repair, the records show that sets were repaired mostly by substitution of tubes and transistors, with an average of one repair for each TV set every two years. The radio sets did not present major problems either.

Though there is no interest in showing specific figures about the number of actions taken, kilometres travelled, or booklets distributed, it must be said that in light of the size of the State, the number of schools and the novelty of the tele-education system for all the persons involved, the results obtained and the very low level of complaints from teachers are effective proof of a well-operated logistics system.

The most visible results of the project, which is directly related to the original SACI proposal, were undoubtedly the implementation of EXERN and the takeover of the ongoing activities by the local authorities in RGN (see below). In the process of implementing EXERN, as was seen before, several difficulties were faced and overcome in matters related to financing and political affairs. The financing was borne by INPE, which managed to obtain substantial resources from various sources, particularly the National Research Council. At one point, SACI represented over 20 per cent of INPE's budget; only commitment to the project could explain such priority within a space research agency. The enormous political pressures and difficulties, though not completely overcome, did not diminish INPE's determination to go ahead, even when the political costs could damage the whole Institute, and not just the EXERN project.

D. SOME UNPLANNED OUTCOMES

Of EXERN's educational effects on students and teachers we have spoken above; but there are, in

addition, in projects of the scope and size of SACI/EXERN other important effects that are often unplanned. We have already spoken about one important effect, the Master's Programme in Educational Technology. We need to focus briefly on three other areas where SACI/EXERN had some impact.

1. Natal television channel

The educational television stations in Brazil that seem to have served the largest regular audience are those that are closely tied to at least one concrete educational project. The work of educational television in São Luis, Maranhão, and more recently that in Fortaleza, Ceará, are examples of this. The creation of the EXERN project in RGN helped create a new educational station at the Federal University in Natal and give it an impetus in its early years. Now that RGN has taken over EXERN and is producing programmes locally and the University is beginning the M. A. Programme in Educational Technology, we can expect an even more useful role for the television station in Natal.

2. The economically active community

This was a three-stage effort to create tele-clubs for farmers at some EXERN TV schools. Presented as an idea in 1970 by SACI, it was tried in a few places in 1971. With positive results from the beginning, a second trial was made in 1973 with 20 experimental TV programmes (15 minutes each) on agriculture, health, etc. Again, this trial, according to written INPE reports, brought good response from rural adult audiences. A third stage was created at the beginning of 1975, when a 16-part telenovela was presented on rural themes. A local organization in RGN, the Regional University Centre for Training and Community Action of the Federal University (Centro Regional Universitario de Treinamento e Acao Comunitaria, or CRUTAC) sent some of their members to train at INPE at the beginning of 1975 with a special emphasis on using television for rural community development. With the move of EXERN to the University where CRUTAC is located, we would expect that this beginning contact could continue, and that EXERN could use its television to reinforce rural development efforts of a number of public and private organizations in the State.

3. Towards a domestic satellite

It is difficult to trace the long and complex history of the domestic satellite debate in Brazil. Several things are clear, however, from many points of view, Brazil has the conditions recommending the purchase of a domestic satellite system. Dr. Mendonça was an early advocate of a satellite. The present economic situation in the country has made a postponement necessary on the final decision to purchase a domestic satellite, but it was quite

clear when we were conducting field work in July 1977, that Brazil would purchase one probably by 1980 or 1981. It was also clear that this satellite would be for telecommunication purposes only, since the Ministry of Education did not consider the cost of sharing the satellite (price \$25 million for one channel) was worth it. How the SACI/EXERN history influenced the present situation is not easy to say, but it seems clear that early SACI plans were not simply (although undoubtedly partly) to promote the purchase of a satellite. Dr. Mendonça did not abandon EXERN once it became clear that a satellite would form only a minor part of the experiment. INPE was responsible, through SACI, for introducing to public debate many of the potential areas for social applications of satellites and for beginning the feasibility studies that will be basic to a final specification of a domestic satellite configuration.

E. THE FINAL UNEXPECTED OUTCOME: TRANSFER TO THE STATE OF RGN

At some point during the project's life, it became clear that EXERN, from INPE's viewpoint, would be of interest only in so far as cost-effectiveness and impact data would generate a better bargaining position for the existence of a mass tele-education project in Brazil. It is also reasonable to infer from the interviews and documents that, as a space agency, INPE was convinced of the possible good uses of satellites for education and other social use, though its main interest was in the idea of the satellite as such.

According to the revised plans, the pilot project was to finish by 1974. A satellite could be available, and then a direct expansion and funding for SACI would come. Other individual States could start using the programmes that RGN used. When the several indicators showed that neither a satellite nor a direct expansion would occur, and given the pressure from the State and Federal educational agencies, a plan for the take-over by the State was agreed upon among interested parties.

Difficulties for absorption of all the responsibilities by the State prevented an abrupt take-over. It took two years, 1975 and 1976, for the transition to be completed. During these two years, the project's operations suffered from many problems but the activities went on, and about the same number of schools and students were participating. Most of the transfer problems were associated with dual command, lack of defined areas of responsibility, lack of funds, and old tapes. A

significant difficulty was the previous antagonistic climate between INPE and the staff at the State Secretariat of Education. Most of the effort was directed towards overcoming human problems. The financing for those years came from INPE and the Ministry of Education through PRONTEL, which was in charge of mediating the transfer.

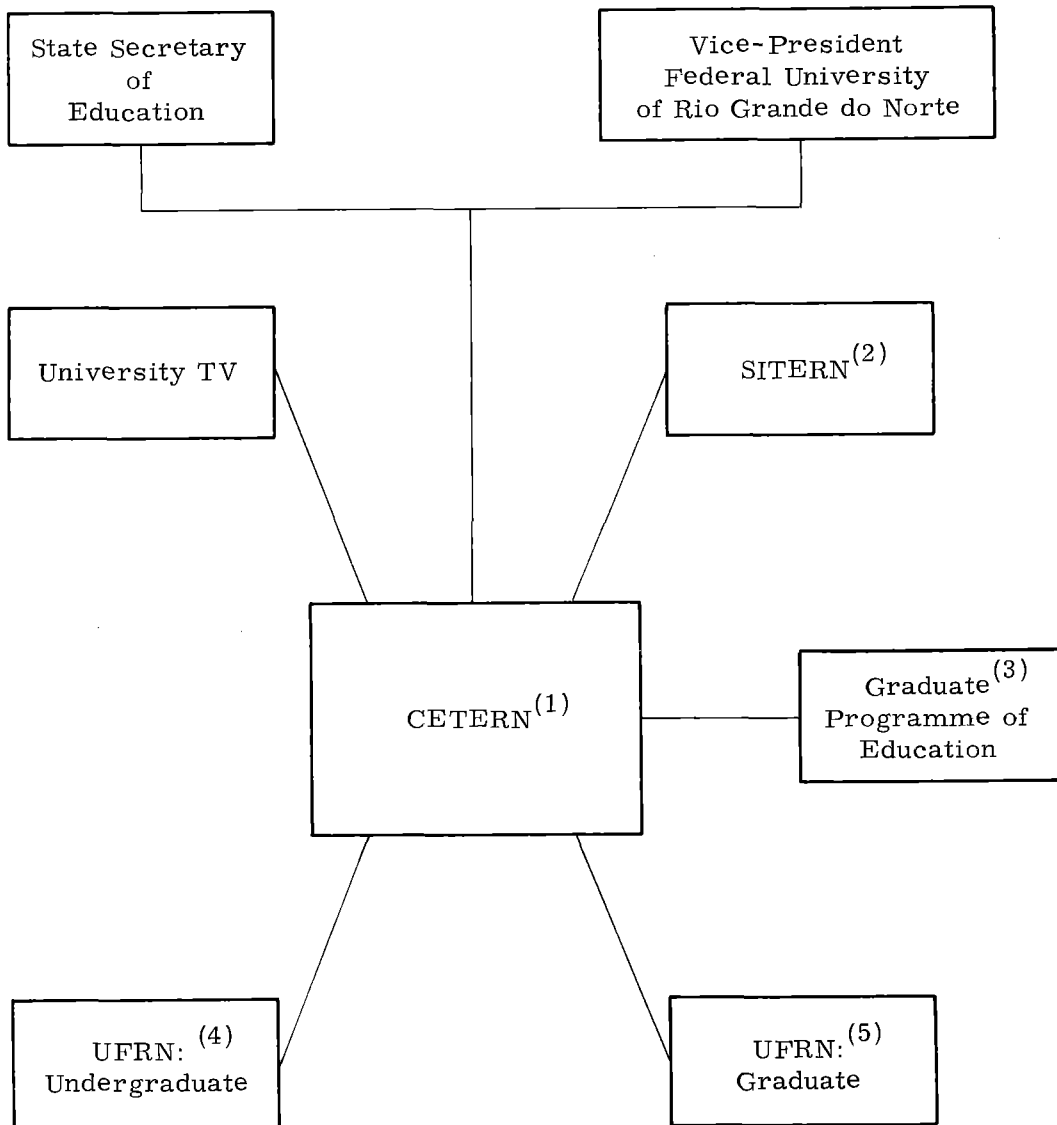
During the transition, INPE was working on training and building up a team at RGN in order to enable the State to perform all the operations previously under the responsibility of the Institute, such as programming, producing, managing the system, and operating the TV channel. This was the first time that a comprehensive training programme of this kind was carried out for the project. The transfer also implied a complicated inter-institutional transfer of ownership of equipment and the construction and adaptation of new facilities for the University TV channel.

At the same time, the two main local agencies involved, the University and the State Secretariat of Education, created a common agency, the Centre for Educational Technology of RGN (Centro de Tecnologia Educacional de Rio Grande do Norte, or CETERN) not only to absorb the EXERN project, but also to be responsible for other tele-education activities of the University and new projects of the State. Figure 3 illustrates the new institutional arrangement and its main relationships.

The unquestionable success of this transfer operation - despite the common problems and difficulties faced - is seen by the fact that the project was not interrupted, and new activities went on. The organizational chart illustrated by Figure 4 shows the complexity of the new agency, as well as its similarities with the former organizational chart of SACI. Its functioning as an institution is visibly influenced by the structural and operational patterns practised at INPE. The quality of personnel and the local physical conditions are not as good as at Sao Jose, making necessary a few compromises, according to the new managers.

This is certainly one of few projects in the area of tele-education which has been transferred from one agency to another without losing its identity. On the contrary, SACI's philosophy is quite visible in the new activities of CETERN, which include an expansion of EXERN to rural areas (about 1,500 schools and 40,000 students are the targets for the coming year), production of new programmes for more advanced school grades, teacher training, and several activities connected with the graduate programme in education at the local university. These projects are funded by the State, the University, and several Federal agencies.

FIGURE 3
Organization of CETERN

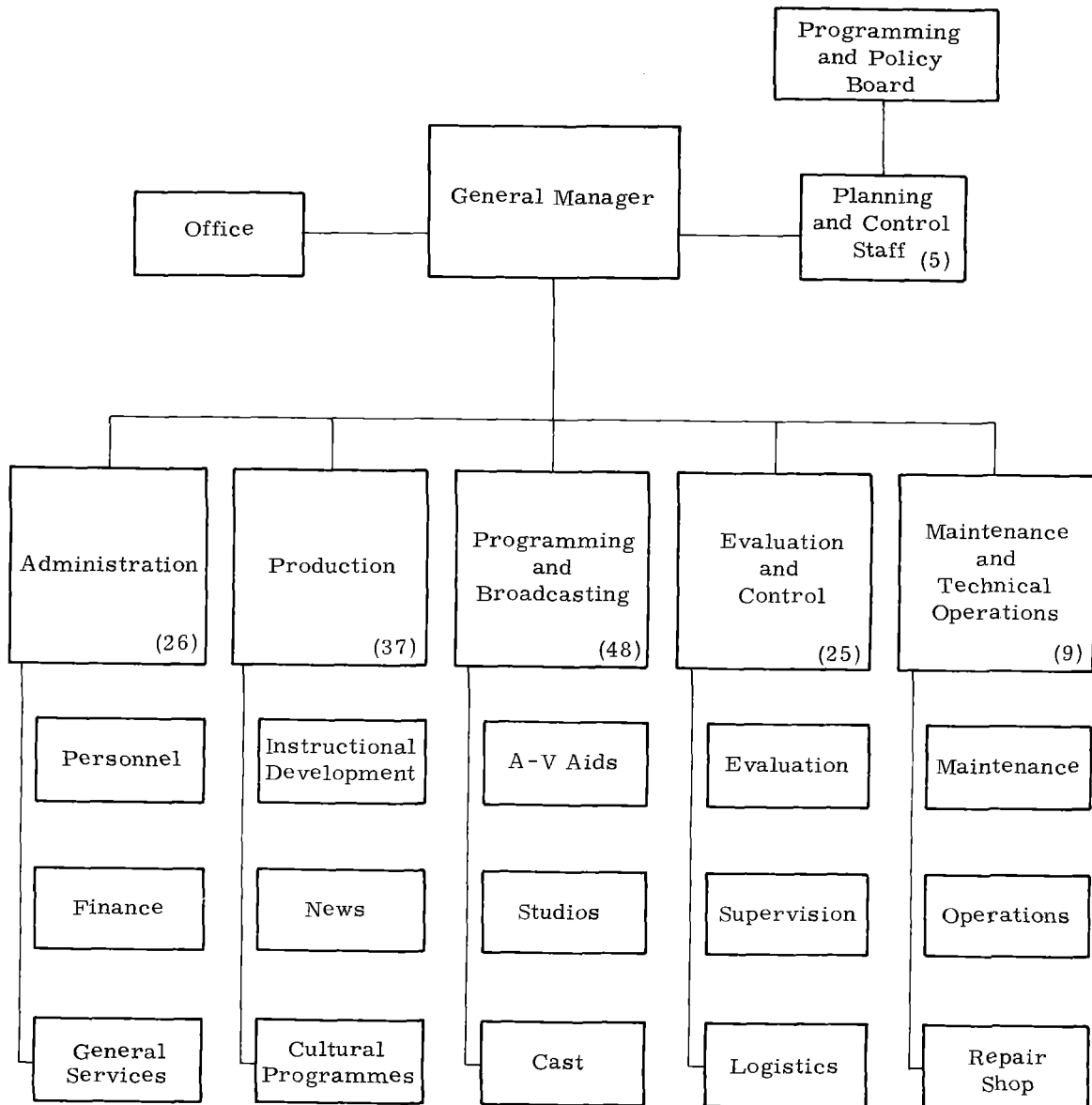


Source: CETERN, Office of the Director, July 1977.

- (1) CETERN: Centro de Tecnologia Educacional do Rio Grande do Norte (RGN's Centre for Educational Technology) created and maintained by the State Secretary of Education and the Federal University of Rio Grande do Norte (UFRN).
- (2) SITERN: State Secretary of Education Office for Educational Technology. So far it is the same as CETERN.
- (3) (4) (5) Specific service missions of CETERN within the Federal University of RGN.

FIGURE 4

CETERN's organizational chart and personnel⁽¹⁾



(1) In July 1977 there were 151 persons, 50 per cent paid by the University and 50 per cent by the State Secretary. The General Manager reports directly to the University, the State Secretary and to the Board, where both are represented.

Section V

Conclusions

A. PLANNED OUTCOMES VS. RESULTS

There was a basic assumption in the planning of EXERN that was not carefully analysed in the early stages of the project: that it could expand educational opportunity and reduce costs in comparison with the traditional system. As it turned out, the media did not increase enrolments in rural areas and the cost of the system was an add-on to regular schooling. It suffered from being too much of a simple demonstration of feasibility and not enough of an educational experiment aimed at changing the educational process.

Was SACI expensive? It is very difficult to compare the project with other tele-education activities going on at the same time since each project has distinctive features and operations. However, if one considers the add-on cost of the system *vis-a-vis* the conventional schools, it seems to be very high if compared to projects like the one in Maranhao (Arena, Jamison, Oliveira, and Orivel, 1977) and the national radio broadcasts of project Minerva (Orivel and Oliveira, in press). The high costs of planning and administration of the SACI project would be more acceptable if the original expanded version had been implemented, and in a broader perspective, they can probably be discounted in general as R&D costs for educational technology in Brazil. There are also other benefits associated with SACI, such as the graduate students. The cost of their training cannot be easily separated from the overall project costs. No new graduate programme could have cost less, given the marginal costs of adding the M.A. programme to other activities of INPE and SACI.

Long-term effects of SACI will be visible in Rio Grande do Norte for a long time to come; among them are the new educational technology network (Sistema de Tecnologia Educacional do RGN, or SITERN), the University television station, and the pre-conditions for the new graduate programme in the form of trained teaching personnel. Very few projects can claim such continuity, and it becomes very clear in this case that the development of human resources was an intentional priority which led to such results. It is also obvious that active response, motivation, and

initiative from local authorities contributed to such developments.

SACI was also innovative in terms of educational research and management, as it introduced, for the first time in the country, ideas such as educational R&D, systems techniques for planning, new production approaches, extensive documentation of the projects' decisions, activities and materials, and the preoccupation with cost-effectiveness. These approaches and techniques have been disseminated throughout the educational community; they have evidently contributed to an increased sophistication in the analytical and planning skills of the policy-making agencies involved. The adoption of such approaches and techniques are evident and irreversible contributions to the progress in the thinking and planning of tele-education in Brazil.

B. LESSONS

1. The first major lesson from the case is that planning and outcomes do not often coincide. Although careful planning is critical to implementing a project that can endure, the planned benefits may not be realized, yet the actual outcomes, often unplanned, are sometimes of benefit to society in unforeseen ways. Benefit/cost analysis often is too closely tied to original plans to take account of unexpected outcomes. These, of course, can be negative as well as positive and the planner can learn from the mistakes of others.

2. Another major lesson from SACI is the need to balance administrative priorities as related to the three distinct aspects of management: problem-finding, problem-solving, and implementation. Problem-solving regarding EXERN was reasonably well handled, given the outstanding staff of analytically minded engineers and planners in INPE and SACI. The missing controls regarding detailed cost and effectiveness, as pointed out earlier, may be more due to structural factors than to the mere lack of adequate personnel or high turnover of the evaluation leadership. Interdisciplinary teams are seldom mobilized in projects of such a nature, and much has been learned in the development of SACI about the need not only for interdisciplinarity, but a workable formula for

their collaboration. Problem-finding and implementation, it was argued, have not received as much attention.

3. There is an important lesson to be learnt from the argument about the cost-effectiveness of a direct-reception satellite for tele-education like that proposed in SACI. There were many interests to be served in the proposal of a national educational satellite like SACI, and it is obvious that ultimately SACI did not receive support from either the education or communication establishments, nor even from the presumably innovative groups in tele-education. Even if INPE had been able to produce convincing cost-effectiveness figures in EXERN, this was not likely to change essentially political and personal stands taken by many of the actors. Proving the effectiveness of a technology system like EXERN would have also demonstrated the inefficiency and cost of the conventional educational system and was not likely to please or persuade educational authorities. It is possible, then, that INPE's Director realized this political fact of life early in the project, and therefore saw no merit in pushing for such kinds of proof. Alternatively, he could have concluded that the project, in its pilot phase, would not yield cost-effective results, and therefore did not push for evaluation results.

4. The remarkable visibility, efforts, and outcomes of SACI were certainly the product of an era of great hope and faith in technology and central planning, not to speak of education itself. However, these factors should not prevent us from recognizing the important role played by the personal characteristics of INPE's Director. In an environment as uncertain and complex as that of education, especially where technology is concerned, the implementation of innovations may often rely heavily on the leadership that brings it forward, and SACI is one additional example of this phenomenon.

5. There is in the story of INPE a lesson about shifts in political power and the interpretation of motivation in any political activity. INPE and Dr. Mendonça have been judged harshly by some, positively by others. We need, from this point in time, to see the effects and not try to reconstruct motivation. INPE progressively lost its decision-making control over the years 1968 to 1972. At the end of the sixties, INPE had built up a capacity and a reputation for innovative activity in a number of areas, and it was a realistic possibility that it could influence a presidential decision on a satellite. By 1972-1973, however, it had become the target of increasing criticism

and its earlier flexibility was greatly curtailed. An important historical question to be raised pertains to INPE's motivation in SACI: as a space agency, back in the sixties, was INPE primarily concerned with having a satellite and only secondarily with its social implications, or vice versa? In other words, was INPE really committed to the social benefits of satellites in the fields of education, health, and community development, or was education chosen as a vehicle that would eventually allow INPE to accomplish its primary goal as a space agency of promoting a domestic satellite? As we have suggested in the section on goals, this motivational attribution is not very helpful for administrative and organizational analysis, but it is certainly interesting for history. There is little evidence for either hypothesis, though advocates for both sides abound. On the one side, INPE invested more than a reasonable amount of resources in non-space research concerned with social applications of satellite technologies. The inefficiencies of the educational bureaucracies at the time, even at the Federal level, and the expanding powers of central planning agencies made it feasible for the space agency to move into those new and unconventional territories. The international atmosphere of interest reflected by the impact of the ASCEND report would constitute important international support. But emphasis at INPE was changed when reality showed the difficulties in the educational arena.

The actual decision-making process and feasibility studies presented by INPE and the Ministry of Communications, and analysed by COBAE, suggest that the second hypothesis might be closer to reality, i. e., the priority of education. Negotiations and planning efforts were initiated in the early seventies, but these did not stress the idea of a direct-reception satellite. Also, the records show that the Ministry of Education did not put much emphasis on gaining access to a future domestic satellite. INPE played a very important role in these negotiations, and it continued important research on satellites and satellite utilization.

In sum, the SACI project was an important issue in the development of tele-education activities in Brazil. While this area is not a high priority in the educational plans, it has experienced some important developments in the last ten years. For those who believe in the importance of alternative ideas, experimentation, and learning from the events of history, the EXERN/SACI project represents an important development and an accumulated body of knowledge and experience of considerable merit.

Appendix A Participation in EXERN - 1974

Total schools	509
Total teachers ⁽¹⁾	1,326
Total Mission IV students: ⁽²⁾	
TV, first series	7,260
TV, second series	3,638
Radio, first series	2,982
Radio, second series	2,223
Classes:	
Morning	214
Afternoon	295

Source: Natal Supervision Office, 28 February 1975.

(1) Teachers/class: $\frac{+}{-}$ 12.

(2) Students/class: $\frac{+}{-}$ 34.

Appendix B

Interviews for case study

The following people were interviewed specifically for the purposes of the present study (institution for identification purposes, only).

Luis Antonio Souza Lima Macedo, PRONTEL (Head)
Homero de Oliveira, PRONTEL
Wilson Brandao, PRONTEL
Ary Barbosa Kahl, FINEP
Sr. Mesquita, INPE
Nelson Jesus Parada, INPE (Director)
Vathsala Stone, INPE-SACI
John Stone (Former INPE-SACI)
Maria Tereza Dejuste de Paula, INPE-SACI
Zoe Guimaraes Costa, INPE-SACI
Marlene Cachute Paradella, INPE-SACI
Olivar Maximino Mattia, INPE-SACI
Maria de Lourdes Neves de Oliveira, INPE-SACI
Gloria Cardoso Bertti, INPE-SACI
Neusa Maria Dias Bicudo, INPE-DACI
Lubnen Mussi, INPE-SACI
Laymert Garcia dos Santos, Fundaçao Getulio Vargas, Sao Paulo

Joao Faustino, State Secretary of Education (Head)
Staff of Planning Office, State Secretary of Education
Arnon de Andrade, SITERN (Head)
Joao Baptista Campagnoli, SITERN
Joao Rodriques, SITERN
Margarida Camara, SITERN
Head and Staff, Logistics Office, SITERN
Marco Antonio, Dean of Graduate Education, Federal University of RGN
Adauto Motta, INPE (Local Manager)
Head and Staff, Project Logos, RGN
Alfred Ravelli, USAID
Marco Antonio Rodriques Dias, Vice-Rector, University of Brasilia
Jose Luis Braga (former INPE-SACI)
Lourenco Nassib Chehab, Vice-Secretary General, Ministry of Communications
Fernando de Mendonça (former Director of INPE)
Jose Manoel de Macedo Costa, ABT (Executive Secretary)

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