A SYSTEMS ANALYSIS OF A
MEXICAN EDUCATIONAL SYSTEM:
TELESECONDAÍA

by

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ABSTRACT

A SYSTEMS ANALYSIS OF A MEXICAN EDUCATIONAL SYSTEM: TELESECUNDARIA

Jaime Rodolfo Palavicini Espoenda

The objective of this thesis is to understand and to improve the current functioning and structure of the Mexican Telesecundaria through Systems Analysis and Cybernetics. Malfunctionings within this system have been identified at both operational and structural levels, which are currently adversely affecting the students' learning and performance. In order to overcome such problems, the system has been analyzed in a holistic way, including the interrelationship between the system and its environment. Several changes and innovations have been proposed in order to maximize the system's operation and effectiveness (e.g., the introduction of several control systems and a 'feedback network', the introduction of a more extensive and adequate training service for teachers, the use of a more rural-oriented curriculum, the use of other broadcasting facilities, and the ongoing planning and evaluation process). New objectives have also been brought into the scope of this system, since several negative secondary effects of the system's output are affecting both students and the rural communities in which they live. Finally, two models of the systems have been compared in order to show the difference between its current structure and functioning and the improved model of a 'viable system' proposed in this work.
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>CHAPTER I: HISTORICAL REVIEW</strong></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Structure of the Mexican Educational System</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>The Beginnings of the Mexican Telesecundaria</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Other Mexican Instructional Technology Projects</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Radioprimaria</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Mass Media vs. Direct Education Program</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Plan Puebla</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Radio Huayacacotla</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Tarahumara Radio Schools</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Conclusions</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td><strong>CHAPTER II: WHY SYSTEMS ANALYSIS?</strong></td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The Purpose of Systems Analysis</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>The Use of Cybernetics</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Steps for Analyzing a System</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td><strong>CHAPTER III: THE SYSTEM: CURRENT CONDITION.</strong></td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>The System's Objective</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>The System's Structure</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Management Subsystem</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>-Teaching Subsystem</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Production/Transmission Subsystem</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>-Coordination and Supervision Subsystem</td>
<td>43</td>
</tr>
<tr>
<td>Page</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation Subsystem:</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Student Subsystem:</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Environment:</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Complexity:</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Uncertainty:</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Change:</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Functioning: Activities and Management:</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Target Audience: Characteristics:</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Models of the System's Current Structure and Performance:</td>
<td>64</td>
<td></td>
</tr>
</tbody>
</table>

**CHAPTER IV: ANALYZING AND IMPROVING TELESECUNDARIA AS A VIABLE SYSTEM:**

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Problem:</td>
</tr>
<tr>
<td>Analyzing and Improving the Structure of Telesecundaria:</td>
</tr>
<tr>
<td>The Management of Telesecundaria:</td>
</tr>
<tr>
<td>Introducing a Control Subsystem:</td>
</tr>
<tr>
<td>Control within the Management Subsystem:</td>
</tr>
<tr>
<td>Control within the Teaching Subsystem:</td>
</tr>
<tr>
<td>Control within the Production/Transmission Subsystem:</td>
</tr>
<tr>
<td>Control within the Supervision Subsystem:</td>
</tr>
<tr>
<td>Control within the Evaluation Subsystem:</td>
</tr>
<tr>
<td>The Importance of Feedback:</td>
</tr>
<tr>
<td>Analyzing and Improving the Functions of Telesecundaria:</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Model of the Current Structure of Telesecundaria</td>
</tr>
<tr>
<td>2</td>
<td>Current Functions of Telesecundaria</td>
</tr>
<tr>
<td>3</td>
<td>Design of a Control Subsystem for Telesecundaria</td>
</tr>
<tr>
<td>4</td>
<td>Control Within the Management Subsystem of Telesecundaria</td>
</tr>
<tr>
<td>5</td>
<td>Control Within the Teaching Subsystem of Telesecundaria</td>
</tr>
<tr>
<td>6</td>
<td>Control Within the Production/Transmission Subsystem of Telesecundaria</td>
</tr>
<tr>
<td>7</td>
<td>Control Within the Supervision Subsystem of Telesecundaria</td>
</tr>
<tr>
<td>8</td>
<td>Control Within the Evaluation Subsystem of Telesecundaria</td>
</tr>
<tr>
<td>9</td>
<td>The Use of Feedback Within Telesecundaria</td>
</tr>
<tr>
<td>10</td>
<td>Proposed Viable System of Telesecundaria</td>
</tr>
<tr>
<td>11</td>
<td>Two Different Perspectives Within the Viable System</td>
</tr>
<tr>
<td>12</td>
<td>Proposed Functioning of the Viable System</td>
</tr>
<tr>
<td>13</td>
<td>Three Recursions of the Viable System</td>
</tr>
<tr>
<td>Table</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Table 1.</td>
<td>Telesecundaria Subjects by Grade</td>
</tr>
<tr>
<td>Table 2.</td>
<td>Student Enrollment in Telesecundaria</td>
</tr>
</tbody>
</table>
Nuestro país afronta muchos problemas; pero acaso el más importante radique aún en la urgencia de acelerar su progreso merced a la educación.

El árbol de la independencia y de la justicia, que nuestros predecesores plantaron heroicamente, no dará todos los frutos que apetecemos si no lo cuidan, con capacidad laboriosa, las nuevas generaciones de mexicanos. De ahí el interés primordial que hemos concedido a la educación del pueblo. De ahí los sacrificios que nos hemos impuesto para dar a cada región del país mayor cantidad de escuelas, para formar—en número creciente—a sus profesores, y para asegurar a cada maestro un salario más decoroso y mejores prestaciones sociales de toda índole...

"Agua y Escuela" es el grito que más he oído a lo largo de mis viajes por los caminos de nuestra Patria. Si, agua para los cuerpos, sedientos y valerosos. Y escuela para las mentes, ávidas y expectantes. Pero, en uno y en otro caso, importa mucho la calidad de lo que ofrecemos. Que el agua lleve siempre salud, que su potabilidad sea un hecho cierto. Y que la escuela lleve alegría, conciencia cívica, respeto para los valores culturales y aptitud de trabajo útil y productivo.

Adolfo López Mateos
President of Mexico (1959-64)
INTRODUCTION

Mexico is a country in which inadequate opportunities for education have been a chronic problem. Two factors have contributed to this problem in the past and are currently affecting education, namely, the lack of economic resources, and the scarcity of both teachers and schools. Elementary and secondary schooling in particular suffer the consequences of these lacks.

The Mexican government has implemented numerous programs to deal more effectively with such problems. One such program, implemented by the Federal government through the Mexican Secretariat of Public Education (Secretaría de Educación Pública) and the General Direction of Audiovisual Education (Dirección General de Educación Audiovisual), is TELESECUNDARIA. This distant study project has great possibilities for the use of television within the secondary school system as a means of instruction, since this medium can reach thousands of students simultaneously throughout the country, and its operating costs are much lower than those of the traditional secondary school system (Direct Education). Telesecundaria is addressed mainly to all those young people living in the rural areas of Mexico who, for whatever reason, cannot attend classes in the traditional secondary school system.

In 1966, Telesecundaria was tested in a pilot study; the experiment was deemed a success by Federal authorities. The following year, the system began broadcasting its television lessons to seventh grade students dispersed throughout eight states. Ten months later, Telesecundaria expanded and then broadcasting to eighth and ninth grades, respectively, began.
Although Telesecundaria has proven to be a very cost-effective system (Mayo, et al., 1973), research shows that this system contains various anomalies and malfunctionings in both its structure and operation that in fact jeopardize the learning process and achievement of those whom the system serves (Mayo, 1973; Mayo et al., 1973; Mayo & Klees, 1974; Jamison, et al., 1976; Wells, 1976; Tiffin, 1978; and Klees, 1979).

Among the most important features that threaten both the efficiency and effectiveness of the system are: the lack of an internal management division in the system; a lack of supervision at the various levels; a lack of evaluation and planning; a lack of training of its human resources; a lack of adequate economic support on the part of the Federal government; the negative secondary effects of the system's performance upon its target audience; a lack of quality in the production of its television lessons; the migration of its students to the already overcrowded Mexican cities; and the inefficiency of the system in attempting to help close, as much as possible, the social and economic gaps between urban and rural students, among others.

Therefore, this study is addressed to the analysis and correction of such malfunctionings in order to improve both the efficiency and effectiveness of Telesecundaria for the benefit of its students, as well as for the development of the Mexican countryside. However, for this analysis and improvement to become effective, I have decided to use general systems theory, systems analysis, and cybernetics as means through which an improved model of the system will be obtained.

Needless to say, many of the corrections and adjustments that have been made to Telesecundaria are based on the work and theories of several
authors concerned with areas such as educational technology,
communications, cybernetics, education, management science, and others.

The structure and body of this thesis are developed in five
main chapters. The first chapter provides a short historical review of
the structure of the Mexican educational system, the beginnings of
the Mexican Telesecundaria program, and the beginnings of other Mexican
instructional technology projects as well. This will help the reader
see the context in which the system functions.

In the second chapter, entitled "Why Systems Analysis", I deal with
the importance of systems analysis and cybernetics in the study of highly
complex systems, and their relevance and usefulness in the analysis and
improvement of Telesecundaria. Finally, I explain the steps for analyzing
a system given by several authors dealing either directly or indirectly
with systems analysis, and on which the analysis and improvement of
Telesecundaria is based. These authors include: Hare (1967), Checkland
(1972), Mayo, et al. (1973), and Schoderbek, et al. (1975). At the end
of this chapter, I present a list of steps based on the work of these
authors.

The third chapter contains a description of the present structure,
performance, and results of Telesecundaria, including the characteristics
of its target audience and the communities in which they live. For
explanatory purposes, at the end of this chapter I include a model of
the current structure and performance of the system.

The fourth chapter of this work might be considered the most important,
since it is there that a systems analysis of the Telesecundaria system is
presented, and also where I design and introduce several cybernetic
mechanisms. The chapter begins with a statement of the problem. Then
follow two sections. The first section deals with the analysis and redesign of the present structure of Telesecundaria in order to improve its efficiency. This can be at least partially accomplished by the introduction of an internal management division into the system, the introduction of several control subsystems and a major regulator, and finally the introduction of a "feedback network". The second section of this chapter deals with the analysis and improvement of the system's functioning or operation. Increased effectiveness will be obtained by widening the scope of the system through the readjustment of its objectives and thus the consideration of more, important, variables. After that, I propose the establishment of a new training program and center which will be mainly addressed to the training of teleteachers, coordinators, supervisors, directors, and producers. The transmission/production subsystem of Telesecundaria will be improved through the use of Channel 13's facilities as well as through the use of video-recording. Furthermore, both the supervision and evaluation subsystems of the system will also be improved and partially redesigned in their structure by, first, the allocation of more supervisors throughout the 16 states in which Telesecundaria operates, and, second, by the introduction of new objectives and procedures within the evaluation subsystem that will lead it to widen its task and thus to evaluate not only student performance and achievement, but also the secondary effects of the system upon both the target audience and the various local communities as well. Finally, I make some predictions about the future performance of the system if changes and innovations are implemented. For explanatory purposes, an improved model of Telesecundaria is given at the end of this chapter.
In the fifth chapter, I present several considerations related to the implementation of all of the proposed changes and innovations. Among what I consider to be the most important aspects of this implementation process are: the structure, the resources, and the socio-cultural aspects of Telesecundaria, combined with an analysis of the population growth problem. In the last section of this chapter I propose the "keystone" of the entire process: the continuous evaluation and planning of the system's operation, structure, and outcomes.

Finally, Chapter VI presents conclusions and final considerations. It is hoped that this work will help the Federal government, the Secretariat of Public Education, teachers, coordinators, directors, supervisors and other people involved in the project to achieve an even higher level of performance. However, primary concern in this work has undoubtedly been for the thousands of young rural students who see in education a means to improve their lives and their country. This thesis has been written with their benefit as the primary purpose in mind.
"To everything there is a season;
A time to get and a time to lose;
A time to keep and a time to cast away;
A time to keep silence, and a time
to speak."

Ecclesiastes
CHAPTER I
HISTORICAL REVIEW

In order to understand how an educational system functions, we have to take a look at the whole system in which this particular system is immersed and in which it operates in a continuous exchange of information and resources with the other systems in the environment that surrounds it. Hence, in order to understand and analyze Telesecundaria, first we have to take a look at the Mexican educational system in which this system is located.

In this first chapter, the structure of the Mexican educational system, the beginnings of the Mexican Telesecundaria program, and the nature of other Mexican instructional technology projects will be given in a short historical review which is intended to provide the reader with necessary background. This will enable him/her to better understand the environment of Telesecundaria as well as the system itself.

Structure of the Mexican Educational System

Since 1921, the Federal government, through the Secretariat of Public Education (SEP), has been the dominant force in Mexican education. The Secretariat of Public Education is made up of a vast network of Federal schools of all types and levels, from elementary to university level. These Federal schools are located throughout Mexico. In every state, public schools have to follow the curriculum, textbooks, objectives, and guidelines that the SEP has prepared and distributed for them to use, especially at the elementary and secondary levels. The SEP also controls many private schools; therefore, these schools are also required to follow
Federal guidelines regarding curriculum and standards.

In Mexico, education at different levels is structured as follows:

a) Elementary School: 6 years (1st to 6th grades);
b) Secondary School: 3 years (7th to 9th grades);
c) Bachillerato/Preparatoria: 3 years (10th to 12th grades);
d) Normal School: 4 years after secondary school, and instead of Bachillerato/Preparatoria. The Normal School prepares students to become teachers at the elementary level or even at the kindergarten level.

e) University: Normally, a student can obtain a Licenciatura (B.A., B.Sc., L.L.L., B.B.A.; etc.) in 4 or 5 years, but there are fields like medicine in which the student has to take courses for a period of 6 or 7 years before obtaining a degree.

f) Graduate Studies: This scholastic level is for all those students who have already finished their Licenciatura, and who want to specialize in one area of study. Maestrias y Doctorados (Masters and Doctorates) belong to this level. In Mexico, a student can obtain a Masters degree in one and a half years or in two years. A Ph.D. or doctoral degree usually takes two further years.

1 Although the Bachillerato/Preparatoria level consists of 3 years, there are many schools located in different states which provide only 2 years (10th and 11th grades) before a student enters university.
Mexico, like many other developing countries, has a high demand for student enrollment at the elementary and secondary levels. From 1970 to 1971, there were 9,248,300 students enrolled in elementary school, i.e. 80% of the entire Mexican student population. From 1974 to 1975, there were 11,435,800 students enrolled in elementary school, i.e. 76% of the entire student population.

At the secondary level, from 1970 to 1971, there were 1,219,800 students, i.e. 10% of the entire student population, enrolled. In 1974-75, there were 1,896,000 students enrolled in secondary school, i.e. 12% of the entire student population (Gill, 1976).

The demand for student enrollment at the secondary level has increased tremendously, primarily because of an increase in elementary school graduates. Obviously, this situation has put great pressure on the Federal government to open more and more secondary schools. Unfortunately, the Mexican government has not been able to deal with this problem simply by expanding the traditional secondary school (Educación Directa or Direct Education). Therefore, it has had to look at other educational alternatives which would help to solve the bottleneck at the secondary school level. The alternative chosen by the Federal authorities through the SEP was Telesecundaria.

The Beginnings of the Mexican Telesecundaria Program

Telesecundaria was born in 1966 as an experimental system of instructional television, as a means of extending the secondary school system to rural areas.

The idea of Telesecundaria was first conceived at the Dirección General de Educación Audiovisual y Divulgación (General Direction of Audiovisual Education), which is a division within SEP, as a solution for
the problem of the 180,000 elementary school graduates who were unable to enter secondary school in 1965 due to a scarcity of both schools and teachers in the countryside.

Telesecundaria began on a small scale in September 1966, with closed-circuit broadcasting to an experimental school in Mexico City. Eighty-three 7th graders, divided into four classes, received televised instruction in the standard subjects. Three of the classes had a regular teacher to supplement the television lesson; one class received the television lessons without the aid of any classroom personnel. An evaluation was performed at the end of the 1966-67 school year, and the experiment was deemed a success (Mayo, et al., 1973, p. 2).

The following year, open broadcasting began to 6,569 7th-grade students in 304 classrooms scattered throughout eight states. Although "by 1970, Telesecundaria was serving approximately 3% [30,955] of the entire Mexican secondary school population" (Mayo, et al., 1973, p. 3), by 1976 Telesecundaria was reaching up to 61,000 pupils in 16 out of the 29 Mexican states.

With the help of Telesecundaria, the Federal government has been able to reach thousands of students living in rural areas where the traditional school system (Educación Directa) has been unable to work, primarily due to high costs in building new schools, hiring new teachers, and paying for textbooks, materials, and other expenses. The traditional system would cost three times more than what Telesecundaria costs. Therefore,

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2 At the secondary level, the standard subjects are: Spanish, physics, English, mathematics, biology, chemistry, history, geography, civics, music, art, technological education, and physical education (SEP, 1974).
Telesecundaria is seen by the Federal government as an inexpensive system which has the capacity to reach hundreds of students simultaneously, a task that would be impossible to perform through the traditional system. Furthermore, Telesecundaria has proven that it has the capacity to graduate more students than the traditional teaching system, thereby relieving the bottleneck at the secondary school level.

Telesecundaria is one of the oldest instructional technology projects in Mexico, and one of the first to be developed in Latin America, during the late 1960's. The conception of this system followed the same pattern as many other projects around the world. It began during the time when the industrialized countries, like Japan, the U.S., France, and England, exported development models and instructional technology to developing countries, like Nigeria, El Salvador, American Samoa, Korea, Brazil, and the Ivory Coast. Under these circumstances, Mexico was no exception.

Therefore, we can see that the creation and implementation of the Mexican Telesecundaria program was due to two main reasons: first, an internal need of the country to provide elementary school graduates in the rural areas with secondary school; and second, an external influence from the industrialized countries to apply instructional technology, especially instructional television, and new development models in developing countries like Mexico.

Regardless of this latter fact, Telesecundaria is one of the very few projects implemented in the Third World which uses 100% Mexican capital. There is no financial support for this system from any of the industrialized countries.
Other Mexican Instructional Technology Projects

Telesecundaria is not the only instructional technology project that has been implemented in Mexico, however. There have been many other projects which use either radio or television for instructional purposes. These purposes have been of many different kinds, for example: literacy, health, nutrition, and birth control programs. The following projects are, besides Telesecundaria, representative of the use of instructional technology in Mexico.

Radioprimaria. The planning of the Radioprimaria system as a pilot project began in August 1969. Broadcasting began in the school year of 1970-71. This system was envisaged as an experiment to be evaluated in various rural areas and in some suburban schools in the Federal District (Mexico City). But because of organizational problems elsewhere, the only places where Radioprimaria now exists are in one area around the city of San Luis Potosi³ and in one classroom at the Experimental Education Center in Mexico City (Spain, 1973, p. 15).

In the year 1970, Radioprimaria began in the state of San Luis Potosi. This instructional radio project brings classes by radio to 4th, 5th, and 6th grades in the rural areas of San Luis Potosi, where there is a great lack of elementary school teachers.

This project began without a pilot study, and with many organizational deficiencies. One of these problems has been a straying of the project from its original goals and objectives (Spain, 1973). However, radio

³ San Luis Potosi is one of the states in Mexico. It is located 300 miles northeast of Mexico City. The capital city of this state is also called San Luis Potosi.
has proven to be a very effective teaching medium in rural areas.

Two years after its introduction, Spain (1973) made an evaluation of Radioprimaria for six months (June-December) of 1972. The following are some of the most important of his observations.

1. There is a lack of supervision at all levels of the project in San Luis Potosí, and in Mexico City as well.

2. "A great deal more organization is needed for the Radioprimaria system to be operating as had been planned". (Spain, 1973, p. 7).

3. The radio programs were the same, or nearly the same, in each of the three years that Radioprimaria has existed. So a child who was in the 4th grade in 1970-71 is hearing the same programs this year, 1972-73, for the third time.

4. The system differs widely from school to school because implementation of Radioprimaria has been left to individual teachers.

5. The transmission and reception subsystems suffer from malfunctionings. There is no technical assistance available when a radio set becomes broken.

However, the most important of Spain's findings was the fact that people in rural areas see education (in this case Radioprimaria) as a means of getting a better job in the cities, of emigrating and thus leaving the countryside; even though the cities are already overcrowded and a rural immigrant's opportunities are slim. Spain (1973, p. 5) noted that, "The rural people did not feel that their area was 'developable', only that some children could develop themselves enough to go elsewhere".
Radioprimaria has also failed to motivate its teachers sufficiently to use Radioprimaria. Sometimes teachers do not use Radioprimaria simply because they know nothing about it. Only 18 out of 44 schools were using Radioprimaria the day that the researcher went to observe and evaluate their use. All 44 schools were supposed to be making use of Radioprimaria that day.

According to Spain (1973), one of the best innovations that the Federal government can introduce to Radioprimaria in order to enable it to work effectively would be to change the present curriculum and to design a new one which would be more appropriate to rural reality and needs. This innovation could better motivate both teachers and students, and then the system could work more effectively. Furthermore, if the new curriculum were addressed to rural needs, then people living in these areas would not need to leave the countryside for the cities.

**Mass Media vs. Direct Education Program.** In 1976 there was a research project intended to test the effectiveness of mass media teaching techniques as compared to direct methods of education in teaching basic concepts of hygiene, health, and diet. The instructional medium selected was radio, and the project was carried out over a period of 12 weeks.

The target population was mothers with children five years old and younger, living in three rural communities. The radio broadcasts consisted of songs lasting three minutes, each at two-hour intervals.

It was found that the mass media treatment group learned the nutritional concepts very well, with an increase of 54% in knowledge. The dietary habits changed positively among these rural mothers (Clearinghouse
Plan Puebla. In 1967, the Ministry of Agriculture, the Graduate College of Agriculture at Chapinco, the state government of Puebla, and the Rockefeller Foundation, working through the International Maize and Wheat Improvement Center, began an instructional technology project using films and audiovisual aids, to help campesinos (peasants) improve their agricultural practices by informing them about chemicals, seeds, and technologies, in order to improve their corn production. Since 1973, the sole supporter of this project has been the Mexican Ministry of Agriculture.

This project has eight practical goals:

1. to introduce higher-yielding varieties of corn;
2. to develop and disseminate information on improved agricultural practices;
3. to open and maintain communication channels between campesinos and change agents;
4. to get adequate and timely supplies of agricultural inputs to easily accessible distribution points;
5. to make crop insurance available to campesinos;
6. to help bring the costs of agricultural inputs into line with the prices fetched by crops in local markets;
7. to stabilize the market price of corn; and
8. to ensure campesinos access to low-interest credit.

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4 Puebla is another state in Mexico, located 85 miles southeast of Mexico City.
According to the Graduate College of Agriculture at Chapingo, this project has been a success since the campesinos' income gains increased, as did their corn yields, and the quality of their living conditions improved (Clearinghouse on Development Communication, 1978).

Radio Huayacacotla. In 1965, the United Nations Food and Agriculture Organization, and the Ashraf Pahlavi Foundation International, began an Instructional Radio project directed to stimulating the campesinos' self-reliance, self-expression, cultural integration, and agricultural productivity. In 1973, the Sistema Educativo Radiofónica, and in 1975, the Fomento Cultural y Educativo, also joined their efforts to this program.

The Radio Huayacacotla programs are broadcast daily from 4 p.m. to 8 p.m. They include news, agricultural education segments, entertainment, and useful information on a variety of subjects. This project is an attempt to create and use "two-way" radio as a stimulus to self-development.

According to the results, provided by the Food and Agriculture Organization, this project has been a success, since the audience has responded with an extraordinary "vitality" and "political consciousness" to the programs (Clearinghouse on Development Communication, 1979). Doubtless this project contains many idealistic objectives that cannot be measured or evaluated in a more objective way. Nevertheless, an attempt should have been made to assess them.

Tarahumara Radio Schools. In 1955, the Jesuit Mission in Mexico began an Instructional radio project as an extension of the 50-year-old
Jesuit-run educational programs, addressed to children and other residents of the Tarahumara Sierra, with the objective of meeting the practical and academic needs of Tarahumaran Indian children and adults by increasing their social and employment opportunities while reinforcing their cultural identity.

This use of radio was discontinued in 1974, because of delays caused by equipment failures that interrupted the flow of instruction. Currently, this project uses interpersonal education as a means of carrying out its objectives.

Tarahumaran Indians, few of whom speak Spanish and thus can comprehend the Spanish broadcasts, fared less well than their non-Indian peers in overall mean achievement. The broadcasting of the radio programs in Spanish was also one of the reasons why the Jesuit mission decided to discontinue it, and instead to use direct teaching in the Tarahumara language (Clearinghouse on Development Communication, 1978).

Conclusions

Certainly, all of the above-mentioned instructional projects indicate efforts made by the Federal authorities to improve the life-style of thousands of Mexicans living in the poorest regions of the country. However, none of these projects, nor Telesecundaria itself, has been planned and designed in a scientific and reliable way, e.g. through the use of systems analysis.

Hence, it is the purpose of this work to apply such techniques in order to improve the functioning and structure of the Telesecundaria system, by making the best possible use of its already existing structure and resources.
"Since creative thought is the most important thing that makes people different from monkeys, it should be treated as a commodity more precious than gold and preserved with great care."

A.D. Hall

A Methodology for Systems Engineering
CHAPTER II

WHY SYSTEMS ANALYSIS?

Man has created large and very complicated organizations which cannot be studied and analyzed with traditional tools and methodologies. As a result, man has had to come up with a new body of knowledge and technology that will enable him to design, analyze, and improve such organizations.

During the early 1920's, the great biologist and philosopher Ludwig von Bertalanffy created a new organismic conception in biology which emphasized consideration of the organism as a whole, i.e. as a system, and saw the main objective of biological sciences in the discovery of the principles of organization at its various levels (Von Bertalanffy, 1968, p. 12).

Later, and independent of Von Bertalanffy, this "systems approach" to organizations became popular not only in biology but also in various fields, principally in management and engineering, which had long been systemic in practice, but not in a formal way. With time, Von Bertalanffy's General Systems Theory became much more specialized and established close ties to related areas such as systems analysis, systems engineering, cybernetics, operational research, and information and decision theory, among others.

In seeing an organization as a system, the systems analyst conceives the organization as a whole and not simply as a subdivided "body" which has to be studied or analyzed through its parts. Rather, in this systems approach, conclusions and generalizations concerning
the system are drawn from the system as a whole, as an entire
entity which cannot and should not be decomposed without referring
the parts to the whole system. The systems approach is very useful
in dealing with very complex systems; and certainly education is
one of those. Therefore, I consider that Telesecundaria, because of
its complexity, can be better analyzed and improved through the
systems approach than through conventional approaches that may have
been used in the past.

The Purpose of Systems Analysis

Systems analysis is particularly useful when an organization's
problems are very complex and characterized by many factors with
much uncertainty.

According to Mitchell (1980, p. 1), "Systems Analysis is the
adaptive mechanism by which the educational technologist can explore
a variety of alternative courses of action, and evaluate their
consequences, continually readjusting the state of the system as
conceived in pursuit of its intended end-state or purpose."

The underlying premise of systems analysis is that of analyzing
a system through the study and understanding of the nature and
functioning of the different subsystems within a given subsystem, and
analyzing the several interrelationships among the subsystems, as well
as the interaction between the environment and the system itself.

It is important to note that not every systems analyst has the
same definition or conception of systems analysis. Each may use the
term in a different manner, according to his/her own purposes and
conception of the system under study. But the main features are
essentially the same.

Social systems interact with their environment and therefore can be categorized as open systems. Hence, the nature of Telesecundaria should be defined as that of an open system in a continuous exchange of information, resources, etc., with its environment. Furthermore, a systems analysis study applied to Telesecundaria must pay great attention to the environment of the system, since this last one notably affects the system's functioning and achievement.

At this point, I would like to make clear what I understand by "system". In trying to define what a system is, I chose the definition given by Beishon and Peters (1976) in their book *Systems Behavior*, because it relates well to the purpose of this study. Both authors define a system as "a set of objects together with relationships between the objects and between their attributes connected or related to each other and to their environment in such a manner as to form an entirety or whole". Nevertheless, it must be pointed out that the so called "objects" of this definition include human beings, since social systems are made of people.

Although systems analysis is a mechanism through which the systems analyst can study and analyze a system, and also "evaluate alternative courses of action and evaluate their consequences" (Mitchell, 1980), systems analysis can also be used either to design or improve a system. As Van Gigch argued, improvement in systems analysis refers to the processes of ensuring that a system, or systems, performs according to expectations: "Improve the system refers to tracing the causes of departures from established operating norms, or investigating how the
system can be made to yield better results—results that come
closer to meeting the design objectives" (Van Gigch, 1974, p. 3).

On the other hand, systems design refers to the establishment
of a new system which must operate according to specifications.
Furthermore, systems design questions the very nature of the system
and its role in the context of the larger system (Van Gigch, 1974).
According to Mitchell (1980), systems design also involves normative
planning to implement the client's goals and raising questions about
who the client is and whether underlying premises are justifiable.

Whether we design or improve a system, we should always be
concerned that the system works effectively by revising the design and
functioning until the difference between observed and expected
performance is reduced to satisfactory (Mitchell, 1980).

In the present work we will be concerned with the improvement of
Telesecundaria, rather than with its design. However, improvement of
this system might be reached by redesigning certain parts of the
system's structure; some others might be based on the introduction of
new elements in order to offset certain malfunctions.

The Use of Cybernetics

"The central thesis of cybernetics might be
expressed thus: that there are natural laws
governing the behavior of large, interactive
systems—these laws have to do with self-
regulation and self-organization. They
constitute the 'management principle' by
which systems "grow", and are stable, learn
and adjust, adapt and evolve..."

Stafford Beer
When analyzing a system in order to improve it, it is best to use as many tools available to us in order to reach the desired outcomes with a higher percentage of probability. If we combine different techniques that are designed to bring about similar results through different means, then our design will be much more accurate and therefore more useful, and it will also be more valid in terms of its scientific strength. And as I pointed out before, the use of any of these approaches has to do with what the systems analyst has in mind—the purposes—since such approaches as optimization, improvement, control, and design, are useful under different circumstances and with different problems, as well as depending on the characteristics of the system being studied.

One of the approaches to be used in this work as a means for improving the Telesecundaria system is that of cybernetics. Its use in this work is due to the characteristics of the system as well as those of its environment (see Chapter III), and the nature of the problem(s) being considered (see Chapter IV). "Systems Theory is also frequently identified with cybernetics and control theory... cybernetics, as the theory of control mechanisms in technology and nature and founded on the concepts of information and feedback, is but a part of a general theory of systems" (Von Bertalanffy, 1968, p. 17).

In other words, cybernetics is concerned with control exercised through information and feedback. And control is the fundamental premise of any system that seeks self-regulation, such as education.

Control is very necessary to any system, and doubtless even more necessary to a large and complex one like Telesecundaria, in which it
is not only important for the system's internal control, but also
to exercise a certain amount of control over its environment.

A complex system is, according to Beer (in Schoderbek, et al.,
1975, p. 60), a richly interconnected and highly elaborated system.
A complex system, it is also a probabilistic system because it is
not predetermined in its behavior.

Unlike the situation in many other countries, Mexican complex
systems, (e.g. health, education, economy, and agriculture) administered
by the Federal government lack, most of the time, regulation and
control. In this case, Telesecundaria is no exception.

In order to deal with and improve a deficient control and
regulation mechanism within a complex system like Telesecundaria,
cybernetics provides the systems analyst with very efficient tools,
e.g. feedback control, information theory, requisite variety,
regulation, and control. All of these techniques will be applied
within the systems analysis that follows.

In addition to what I have said above, Telesecundaria can be
defined, in cybernetic terms, as a third-order feedback system.\(^5\)
However, the system does not always present the underlying characteristics
of a system of this kind. For instance, this system lacks a well
memory on which it should base its future decisions. Sometimes decisions
are taken quite haphazardly because important data within its memory

\(^5\) According to Schoderbek, et al. (1975, p. 341), a third-order
feedback system is a system with a memory, able to initiate alternative
courses of action in response to changed environmental conditions and
to choose the best alternative for the particular set of conditions,
coupled with the ability to reflect upon its past decision making. It
is a reflective goal-changing system.
are lost. Sometimes decision-makers within Telesecundaria are not willing to make use of information, for political reasons, or perhaps because of their lack of training and knowledge about the system they are running. Moreover, it is also true that the system lacks a well-structured and effective feedback system through which to obtain relevant information to be used in future decisions.

Doubtless, the system needs an efficient feedback system as well as more experienced and better trained decision-makers who would be able to make correct and opportune decisions based on their knowledge about systems in general and this one in particular, the environment, and information from past decisions. However, for this to become a reality, Telesecundaria needs educators, communicators, educational technologists, management consultants, and psychologists as decision-makers.

Currently, Telesecundaria lacks requisite variety through which it can deal effectively with its environment and therefore be able to reach a homeostatic level.

Since control in the Telesecundaria system is one of the areas through which requisite variety, negative and positive feedback, evaluation, regulation, and homeostasis can be reached, then a control subsystem should be designed according to the four basic elements of a control system, as proposed by Schoderbek, et al. (1975, p. 93):

1. a control object or the variable to be controlled;
2. a detector or scanning subsystem;
3. a comparator;
4. an activator or action-taking subsystem.
Additionally, a fifth missing element will be included in the control subsystem to optimize its functioning: an information subsystem. This last component is very important for effective control, since control is achieved as a result of transmission of information (Beer, in Schoderbek, et al., 1975, p. 98). Without information there can be no decision-making process, since the purpose of information is to reduce uncertainty about the outcome(s). In short, "Information is the lifeblood of any system" (Schoderbek, et al., 1975, p. 142).

In regard to Telesecundaria, the control object or the variable to be controlled is not a single item, but hundreds of objects and variables which include:

1. the student's level of achievement;
2. teaching behavior;
3. training of human resources;
4. secondary effects of the system's output upon its target audience and the various local communities;
5. effective transmission; reception, and production;
6. the economic, political, and social consequences of the system upon Mexican society in general;
7. budgetary aspects;
8. attainment of goals and objectives;
9. attitudes towards the system;
10. efficient work, communication, and decision-making process among the various subsystems of Telesecundaria; and
11. others.
A detector or scanning subsystem is very important for Telesecundaria since its environment can be classified as one of a high perceived uncertainty (Duncan, in Schoderbek et al., 1975, p. 175). This means that there is a large number of factors and components in the environment, that these factors and components are not similar to one another, and, finally, that such factors and components are in a continuously changing relationship.

This last aspect within the Mexican environment unfortunately is due to a great lack of continuity in decisions, projects, resources, and many other factors that the Federal government undertakes. This, at the same time, also might be at least partially due to a lack of information and training among Federal government members.

The third element in a control subsystem refers to a comparator. The basic and most important task of a comparator is that of comparing the outputs produced by the system against operational standards previously identified as the kind of outputs the system must produce. In comparing the real outputs against these standards, the differences can be measured and then further decisions minimizing such differences can be made on time and effectively.

Finally, an activator or action-taking subsystem must be included. This subsystem will carry out the decisions already taken with the goal of bringing the system to a homeostatic level or to a variety level (high-variety) depending on where the trouble was first located, whether inside or outside the system.

Regarding the fifth element, which is an information subsystem, a communication system, or, better, a communication network, will have
to be implemented for three reasons: first, to facilitate and conduct feedback of any sort, either inside or outside the system; second, to restrict communication flows among the parts of the system and between the system and its environment (Rogers, 1980, p. 97); and third, to accelerate cooperation among the various subsystems through information to enable more accurate and effective decisions to be taken.

Hence, if Telesecundaria is to be effective as it was designed or intended to be, rather than as a chaotic complexity, the use of certain cybernetic tools—for example, feedback control, requisite variety, information theory, control, and regulation—in correcting some, if not all, malfunctionings within the system, is of primordial importance.

Steps for Analyzing a System

Churchman (in Schoderbek, et al., 1975, p. 8) has outlined the following five basic system properties:

1. objectives of the total system and specifically the measure of performance of the system itself;
2. the system's environment;
3. the resources of the system;
4. the components of the system (subsystems); and
5. the management of the system.

All these properties are to be taken into consideration in the present work when analyzing and improving Telesecundaria, because such elements conform to the structure of the system and define its functioning (inputs and outputs) as well. Therefore, it is clear that any improvement in the system has to be necessarily carried out through these properties. Improvement must be carried out through innovations.
in the given structure of Telesecundaria because this system cannot be redesigned in its totality (due primarily to the high costs that the whole operation could represent to the Federal government). It has often proven very effective to implement change within the existing organizational structures rather than to try to replace them with totally new ones (Van Gisch, 1974, p. 305).

There is another reason why changing the existing structure of Telesecundaria is desirable. If the improvement of the system is only brought about through a radical change of the existing structures of Telesecundaria, probably all the support and cooperation that the various local communities have given to the project will be lost, and hardly ever recovered.

Hence, in conducting this systems analysis, we seek the improvement of Telesecundaria. This will be basically accomplished by the introduction of some changes and innovations within both its structure and operation, with the purpose of strengthening and improving the performance and the effectiveness of the system.

How systems analysis will be applied to Telesecundaria is of primary importance if such improvement is to be properly carried out. Therefore, I have chosen several approaches from various authors concerned with the application of systems analysis. Hare (1967), Checkland (1972), Mayo, et al. (1973), and Schoderbek, et al. (1975) have outlined, in their own ways, the steps for analyzing a system of this nature.

Mayo, McAnany, and Hornik (1973, pp. 9-46) have outlined the
following six steps for evaluating instructional television systems from a systems perspective.

1. Specify system's internal objectives, define external objectives, exploring underlying assumptions.
2. What has been the effort expended?
   What has been the effectiveness of the project?
   What has been its relative effectiveness?
   What has been its efficiency. 6
   What was the process of the project's achievement?
3. Choice of some area of evaluation.
4. Long term effects and unintended consequences of the projects.
5. Explaining achievement of objectives.
6. Deciding what to evaluate.

Although these steps cannot be thought of as being of a rigorous systems analysis nature, they contain several aspects which are essentially systemic, e.g. outcome and goals.

Schöderbek, Kefalas, and Schoderbek (1975, p. 134) have outlined, with some differences from the above authors, some steps for analyzing a system of any sort.

1. Formulation: clarifying, defining, and limiting the problem.
2. Search: determining the relevant data.
3. Explanation: building a model and exploring its consequences.

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6 According to Mitchell (1980) efficiency refers to how well the system operates to convert inputs to intended outputs.
4. Interpretation: deriving conclusions.
5. Verification: testing conclusions by experiment.

As can be seen, these five steps are not as exhaustive as others to be proposed next for analyzing a system. However, these steps include the basic premises that must be taken into account whenever we apply systems analysis.

Checkland (in Beishon & Peters, 1976, pp. 51-77) has defined the following steps for analyzing a system of any kind, as well as the points or aspects to be analyzed.

1. Why are you studying the system?
2. What kind of system is it?
3. What is its goal or purpose?
4. What constitutes the system? a) components, b) boundaries, c) subsystems.
5. What constitutes the system's environment?
What are the system's inputs and outputs and interactions with this environment and other systems?
6. Identification of systems variables.
7. How does the system operate?
8. Systems response to abnormal inputs, reaction to component breakdowns and/or failure.
9. Future changes in the system.

Finally, Hare (in Beishon & Peters, 1976, pp. 296-302) has outlined 12 steps for the application of systems analysis to a system of any kind.
1. Are the objectives and constraints perceived by the investigator the same as those perceived by the organization?

2. Are the effectiveness measures used in the analysis appropriate?

3. Are the attention and awareness functions of the system correctly oriented?

4. Have operating standards been developed for the system?

5. Are vital system processes protected against danger or failure?

6. Has adequate provision been made for undating the system?

7. Is the system protected against direct falsification or illicit interruption?

8. Are operators actually performing according to the system definition and plan?

9. Will the system accept and act upon signs of impending disaster?

10. Have potential difficulties at the boundaries of functions, departments, components, or modules been adequately "bridged"?

11. Has the analyst correctly evaluated his own resources in relation to the task of analysis and implementation?

12. Is the system chosen for analysis and implementation big enough?

It should be noted that for the purposes of this work only some of all of the steps described above proposed by these eight authors will be
applied to the analysis of Telesecundaria.

In some steps, all of the above mentioned authors coincide in what has to be analyzed, as, for example, in the analysis of objectives, environment, effectiveness, the need for a model, the kind of system being analyzed, its resources, and its efficiency. However, as mentioned above, the systems analyst is the only one who must decide what to analyze and how, always according to the purposes and characteristics of the system under study.

Based on the above and on my understanding of the characteristics of Telesecundaria, I have decided to apply systems analysis to Telesecundaria through the following steps taken from the different approaches presented above:

1. Defining the problem;
2. What kind of system is Telesecundaria?
3. The objectives of the system;
4. What constitutes Telesecundaria: subsystems;
5. Defining the environment of Telesecundaria and describing the kind of interaction between them;
6. Defining the inputs and outputs of the system;
7. How the system functions;
8. What are the operating standards of Telesecundaria?
9. What has been the effectiveness of the system?
10. What has been the efficiency of the system?
11. Identification of new important variables that should be taken into account by the system's administrators;
12. Building a model of the system's present structure and
functioning;

13. Building a new model of the improved functioning and structure of Telesecundaria; and


Using this procedure, each of these points will be carefully answered and analyzed so as to form a systems analysis and improvement of this Mexican Instructional Television system, Telesecundaria.
"We are immersed in a life in which the world obeys the second law of thermodynamics: confusion increases and order decreases."

Norbert Wiener
CHAPTER III
THE SYSTEM: CURRENT CONDITION

Unlike many other developing countries like El Salvador, Korea, Niger, and American Samoa, which inaugurated instructional technology projects for the purpose of bringing about some sort of change within their own educational systems, the Mexican Telesecundaria program was inaugurated in 1967 as a mere extension of the traditional secondary school system, without the purpose of bringing about changes or innovations in the given structure of the Mexican educational system. Furthermore, Telesecundaria maintains the same objectives and curricula for teaching students in the rural areas as the Direct Educational system (DE) does for teaching students living in urban or semi-urban areas of Mexico.

Since Telesecundaria belongs to the Mexican Secretariat of Public Education (SEP), this government division is the one, and the only one, that makes decisions about the very existence of this system and the one that makes the major decisions and defines the policies to be implemented within the system. However, Telesecundaria has its own administration and its own decision-makers.

As Telesecundaria belongs to the SEP, it is the Federal government which financially supports the system. An annual budget for operations is assigned to Telesecundaria through the SEP. However, Telesecundaria shares its expenses with the various local communities that make use of the system.

In the present chapter, I explain in detail the structure of
Telesecundaria as well as its present functioning and condition, through the study of its component parts, objectives, environment, operation, and obtained results. In order to make more explicit the present system's performance and condition and to understand better the various interrelationships among its subsystems as well as that of the whole system with its environment, a model of the system has been designed and is shown at the end of this chapter.

The System's Objective

"The human factor is the sine qua non in education."

P.D. Mitchell

The main objective of Telesecundaria is to bring secondary school education to all of those rural students who, for whatever reason, cannot obtain secondary school through the traditional direct teaching system in their own communities.

Most of the time students in rural areas are not able to continue their education after being graduated from elementary school because of a scarcity of schools. Regular schools are unable to take the high number of students that each year want to continue their studies.

Doubtless the Federal government has found it impossible to open more secondary schools because of the high costs that the whole operation would engender and also because of a lack of teachers at the secondary school level.

Hence, the main policy objective of the government has to be achieved
through a system capable of reaching thousands of students dispersed throughout the country at a very low cost, and effective enough for teaching the basic content of the secondary curricula.

Despite the existence of other possible alternatives, for the Federal authorities, television was the first and only choice of medium to be used in carrying out the plan. Thus, after one year of evaluation, Telesecundaria was inaugurated.

**The System's Structure**

Basically, the structure of the Telesecundaria program is comprised of the following six subsystems:

1. a management subsystem which is located inside and outside the system;
2. a teaching subsystem: telemáestros (teleteachers) and teleclasses (television lessons);
3. a production/transmission subsystem: broadcasting of television lessons;
4. a supervision subsystem: coordinators and supervisors;
5. an evaluation subsystem: tests and grading; and
6. a student subsystem: approximately 80,000 Mexican students living in 16 states.

**Management Subsystem.** As mentioned earlier, Telesecundaria relies for its management on both the SEP and a management division within itself. This means that major decisions are taken by an external management division located within the SEP; and, on the other hand, minor decisions are made within the Telesecundaria system itself.
Obviously, this represents a big problem of coordination and consensus among the parts since both management divisions must make important and relevant decisions concerning the structure, nature, and operation of the system.

Nevertheless, the SEP has the right to participate when decisions concerning the global goals or purposes of the system as well as its attainment are made, since Telesecundaria belongs to the official secondary school system and was first conceived of and designed by the Dirección General de Educación Audiovisual y Divulgación (General Direction of Audiovisual Education), a division within the SEP.

In 1973, a cost-effectiveness analysis of Telesecundaria was performed at the request of the Mexican government. Among various findings, conclusions, and observations about the system, the researchers found that:

the founders of the Telesecundaria were anxious to establish an independent identity for the system. Such separation bred resentment toward the Telesecundaria and eventually led to much tighter control of it by SEP authorities. Strict administrative controls have been placed on the system and all procedures concerning student promotion are reviewed closely by SEP officials (Mayo, et al., 1973, p. 101).

A more detailed analysis of the management subsystems of Telesecundaria will be given later in this chapter.

Teaching Subsystem. Since the teleteachers (telemaestros) are hired from the traditional secondary school system, they are subject matter specialists who only teach one specific course within the entire curriculum. Nevertheless, some teleteachers teach the same subject--e.g., Spanish, mathematics, civics, English--at three different grade levels
(see Table 1).

Normally, teleteachers hold a degree from the Teachers' Superior Normal School, and therefore they are officially recognized, and capable of teaching at the secondary school level. When a secondary school teacher is hired by Telesecundaria to become a teleteacher, special training in elocution, television techniques, scriptwriting, and the use of audiovisual aids, is given to the teacher for a period of one month. At the end of this training period, the new teleteacher begins to work on the daily preparations of his/her subject-content according to his/her own mode of presentation.

Usually teleteachers have only one hour to rehearse in the studio before broadcasting begins. This short time for preparation is the consequence of a tight schedule in the production and broadcasting of the television lessons.

Since no pre-recording is practiced by Telesecundaria, the teleteachers have to work hard to get their scripts ready as soon as possible; as a consequence, the preparation time devoted to the collection of supporting material is very short.

Needless to say, all telelessons are produced according to the objectives of each lesson and at the same time according to the objectives of each course. The objectives of each course are defined by the SEP when they design the curriculum to be followed in each course at each of the three different grades. So, the teleteacher has to keep these objectives in mind whenever she/he writes a script or chooses the method of presentation (teaching strategy).
| TABLE 1 |
| TELESECUNDARIA SUBJECTS BY GRADE |

<table>
<thead>
<tr>
<th>7th Grade Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish</td>
</tr>
<tr>
<td>Mathematics</td>
</tr>
<tr>
<td>Biology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8th Grade Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish</td>
</tr>
<tr>
<td>Mathematics</td>
</tr>
<tr>
<td>Biology</td>
</tr>
<tr>
<td>English</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>9th Grade Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish</td>
</tr>
<tr>
<td>Mathematics</td>
</tr>
<tr>
<td>Physics</td>
</tr>
<tr>
<td>Chemistry</td>
</tr>
</tbody>
</table>

Source: Mayo, et al. (1973, p. 6)
Production/Transmission Subsystem. The production crew consists of one producer/director, one cameraman, one floor manager/floor hand, one switcher, and the teleteacher.

Production crews are not specialized in one particular subject, but rather one particular crew is used in the production of several different kinds of programs.

Since the producer/director is usually hired from commercial television stations, in order to be able to work for an educational television system like Telesecundaria, she/he must first take a 4-week training program in the operation and objectives of the system, as well as become familiar with the available resources and operation of the system.

Cameramen, floor managers, switchers and technicians are not necessarily hired from commercial television, but from other places as well where television is produced. These crew members do not receive any special training prior to entering the system.

Both teleteachers and producer/directors work together in the elaboration and production of each program. However, the teleteacher is the one who decides about the content and mode of presentation of the subject matter, and is also charged with the entire responsibility for the production and quality of the outcome.

Telesecundaria broadcasts its television lessons through Channel 5, which belongs to Televisa, S.A. The use of Televisa's Channel 5 by

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7 In Mexico, the largest single commercial television broadcasting company is Televisa, S.A. This is a private enterprise which began on January 8, 1973, when a consortium was formed of the four channels 2, 4, 5, and 8. This network represents two-thirds of Mexico City television, as the other two channels, 11 and 13, are government-operated. Televisa's coverage throughout the country reaches approximately 28 million viewers (Televisa, S.A., 1979).
Telesecundaria is in accord with an agreement reached between the government and this private commercial television enterprise. The agreement was reached when the Federal government asked Telesecundaria to choose between either paying in cash a 25% tax on all revenue or donating 12.5% of their total programming time to the government. Not surprisingly, the broadcasters chose the latter (Eoff, 1978, p. 50). Therefore, Telesecundaria is broadcast as a Federal service within the 12.5% of the time allotted to the government for its broadcasts.

From Televisa, the signal goes to the Communications Tower, also located in Mexico City, and from there the signal travels to the rediffusion stations located in Las Laja, in the state of Veracruz. From there, the signal is sent to the different communities in which Telesecundaria operates.

In a week, students receive about 30 televised lessons. Teleclasses average 20 minutes in length with a remaining 40 minutes of each class divided between preparation and follow-up activities supervised by the classroom coordinators. This remaining 40 minutes after the teleclass is due to the very tight broadcast schedule for the 3 grades following each other (Jamison, et al., 1976, p. 259).

Coordination and Supervision Subsystem. Telesecundaria has hired from the ranks of 5th and 6th grade elementary school teachers personnel to work as television classroom coordinators to oversee all instruction at the 7th, 8th, and 9th grade levels (Jamison, et al., 1976, p. 258).

During the time prior to the broadcast, the coordinator should introduce the students to the content of the television lesson and explain to them what they are expected to learn or to be able to do when the
program is over. Also, the coordinator has the responsibility of supervising the students' work, answering questions, clarifying doubts, and helping the student during the 40 minutes remaining after the broadcast.

Teleclassroom coordinators are supposed to receive from the SEP and the General Direction of Audiovisual Education, through the special Telesecundaria Post Service (Correo de Telesecundaria), a monthly package of materials designed to help them perform their jobs, and also to help them achieve the teaching and learning goals of the program. These materials include guides, schedules, topics, and other materials concerning both subject matter and the television lessons.

When a primary school teacher is hired by Telesecundaria to work as a coordinator, she/he takes a 3-week training course which includes talks and demonstrations on the basic secondary curriculum, class-room learning activities, adolescent psychology, and basic concepts of TV classroom administration (Noguez, 1976, p. 44).

Doubtless, when Telesecundaria was first designed and implemented, one of the most important parts within its structure was the supervision subsystem (division). This last division, of course, should be composed of well trained people. The supervisor's job is to supervise the coordinator's performance and achievement in the various local communities.

The supervisors mainly assist the coordinators in teaching the content of television lessons to the students. They also advise and guide the coordinators whenever they are having difficulties, e.g. lack...

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8 Mr. Antonion Noguez was, at that time (1976), head of the Technical Department at the General Direction of Audiovisual Education (DGEAD).
of knowledge in the different subject matters, misunderstanding of objectives, inefficiency in the teaching strategy, and lack of supporting materials.

The supervisors are supposed to report their findings and observations directly to the management subsystems of Telesecundaria and the SEP for purposes of decision-making.

Thus, the most important task of the supervision subsystem is to be the vehicle through which information about the system's performance is re-incorporated into the system. Similarly, the supervision subsystem also plays the role of a control subsystem since it is the means through which certain malfunctionings (e.g. of coordinators and learning) can be corrected, and then the output brought back to its operation's standard pattern.

**Evaluation Subsystem.** The main function of this subsystem is not, as might be thought, to evaluate the system's performance and results but rather to evaluate the student's achievement through the application of two tests: one given to the student at the end of the first term (4th month), and the second one, a final test, given to the student at the end of the second term (8th or 9th month). These two achievement tests are applied at the three grade levels, and the obtained results are the main factors which contribute to the students' grading.

Through this evaluation subsystem, Telesecundaria gets relevant information concerning its effectiveness which is reflected in the students' achievement. For instance, let us say that if a high
percentage of students successfully finish their school year, then the system is considered to be effective.

Results from the tests are sent to the SEP, and then this institution gives the official results directly to the students. Official records of each Telesecundaria student are kept there.

**Student Subsystem.** (See section below on "Target Audience Characteristics.)

**Environment**

The environment of any system certainly is not only that "thing" that lies outside its boundaries and with which the system establishes an operation of importing and exporting of people, materials, energy, and information. It is also a conglomerate of factors that affect and determine to a great extent the system's performance (Schoderbek, et al., 1975; p. 172). Furthermore, despite the influence that these factors exert on the system, this last one does not have the power to control them totally but only to a certain degree, through an effective "environmental scanning subsystem" which will inform the system's management about the structure and behavior of its environment. Moreover, for the environmental scanning subsystem to be effective it is not only necessary to inform the system about the environment's behavior, but about the changing conditions and the uncertainty of these changes as well.

It can be safely assumed that the environment of Telesecundaria contains the three basic dimensions of any environment that Schoderbek, et al.' (1975, p. 172-182) pointed out: 1) complexity; 2) uncertainty; and 3) change.
Complexity. The environment of Telesecundaria is complex, first because Telesecundaria is a complex system. Undoubtedly, there is a positive correlation between the complexity of a system and that of its environment. Second, the environment of Telesecundaria is complex also because of the large number of factors that exist within itself. When speaking about the factors within the environment of Telesecundaria, I am specifically referring to political, economic, socio-cultural, administrative, and nutritional factors, among others. Furthermore, this specific environment is also complex because of the large number of interrelationships among all of the above-mentioned factors.

For explanatory purposes I should divide the environment of Telesecundaria into two areas: one, a very close environment, which includes the SEP, budget, resources, educational policies, and decisions of any sort, the various communities, the socio-economic, nutritional, and cultural characteristics of its target audience; and, second, a non-close environment, which includes, among other factors, the Mexican political, economic, social, and cultural systems. This latter environment is what constitutes the meta- or macrosystem of Telesecundaria.

Uncertainty. The environment of Telesecundaria is uncertain because of the intrinsic characteristics of the whole Mexican political, economic, social, and educational systems.

The reader should bear in mind that Mexico is a developing country and that therefore this country exhibits certain characteristics, such as a high unemployment rate, high population rate, scarcity of
opportunities for the people who immigrate to the cities, low rural development, low educational level, insufficient number of schools, nutritional problems, social services, and others. The environment of Telesecundaria is also uncertain due to the rapid changes that take place in every facet of Mexico's life: development is taking place!

Change. Finally, the environment of Telesecundaria constantly changes because innovations are being made in every sphere of modern Mexico.

Since new institutions, policies, decisions, economic factors, social aspects, educational improvements, and cultural values are emerging day by day, then it is obvious that this environment surrounding Telesecundaria, a tiny and fragile system within the context of large and powerful systems, should also change.

Aside from all of the above-mentioned variables that immerse Telesecundaria in a complex, uncertain, and changing environment, there are many other factors that should be taken into consideration but, unfortunately, it is not within the scope of this work to analyze them here. However, in Chapter IV, the environment of Telesecundaria will be more deeply analyzed and some conclusions drawn.

Functioning: Activities and Management

Telesecundaria began its operations on a small scale in the year 1967. At the beginning, this system offered televised instruction only to 7th grade students, but later it expanded to cover 8th and 9th grade students, respectively. Obviously, with this expansion Telesecundaria
student enrollment increased year by year, and in 1976 the system was teaching up to nearly 61,000 students in 16 different states within Mexico (Hooper, 1976, p. 126).

In 1967-68 the number of students in Telesecundaria was 6,569; in 1968-69 the number increased to 16,240. In 1969-70, when Telesecundaria was teaching at all three levels, the number of students increased even more to 25,888 (see Table 2).³⁹

At the beginning, coverage was confined to those areas able to receive Channel 5's signal: the Federal District (Mexico City), and the states of Mexico, Hidalgo, Morelos, San Luis Potosi, Tlaxcala, Oaxaca, Puebla, and Veracruz (Jamison, et al., 1976, p. 260). Later on, in 1976, coverage expanded to seven other states: Campeche, Nayarit, Sinaloa, Sonora, Tabasco, Yucatán, and Guanajuato.

Production activities are carried out in four television studios maintained by the SEP. However, due to the expansion of the system and therefore to the increase of its production needs, Telesecundaria's television lessons also began to be produced at the Mexican Cultural Television facilities (TV cultural de México). Despite this fact, programs are still transmitted live. "A project was initiated in 1969 to send taped lessons by plane to the northern state of Sonoroa, but this effort is gradually being discontinued because of administrative and scheduling difficulties" (Mayo, et al., 1973, p. 7).

In 1973, the research team of Mayo, McAnany, and Klees found that

³⁹ According to Chapa (1976), in the year 1970 there were 49,662 students enrolled in Telesecundaria. This number is contradicted by both Mayo, et al. (1973) and Jamison, et al. (1976).
most observers (i.e. educators, psychologists) of Telesecundaria televised lessons were skeptical of their quality. Indeed, these lessons are not as good as they might be. This poor quality in the production of the television lessons might be due to the following three factors: first, to a shortage in funds coming from the SEP; second, to a lack or insufficiency of training in both teleteachers and director/producers concerning the use of television for educational purposes; and third, to a lack of up-to-date knowledge from the SEP and DGED (General Direction of Audiovisual Education) authorities concerning the use of instructional television in other developing countries, e.g. El Salvador, Nigeria, Korea, and Brazil.

All of these “maladies” could be avoided if projects like Telesecundaria were not implemented until careful planning, design, testing, evaluation and research have been completed.

According to Tiffin (1978, p. 195), “in at least seven [of eight ITV systems studied in Latin America] systems the decision to use television was made by forceful personalities with a visionary concept of ITV who were intent on developing an ITV system at all costs”. Later, he adds (p. 205), “There was no formal evaluation of the extent to which ITV systems are attending to the educational needs of the communities they serve. This is not surprising in view of the general failure to conduct a needs analysis”.

In looking at other instructional technology projects around the world, I found that Telesecundaria spent less time in preparation than other projects like those in Nigeria, which spent two years in preparation, American Samoa, which spent three years, El Salvador, which
TABLE 2

STUDENT-ENROLLMENT IN TELESECUNDARIA

<table>
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<tr>
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<tbody>
<tr>
<td>7th grade</td>
<td>6,569</td>
<td>10,916</td>
<td>12,175</td>
<td>14,499</td>
<td>12,432</td>
</tr>
<tr>
<td>8th grade</td>
<td>--</td>
<td>5,324</td>
<td>8,240</td>
<td>9,459</td>
<td>9,194</td>
</tr>
<tr>
<td>9th grade</td>
<td>--</td>
<td>--</td>
<td>5,473</td>
<td>6,997</td>
<td>7,350</td>
</tr>
<tr>
<td>TOTALS*</td>
<td>6,569</td>
<td>16,240</td>
<td>25,888</td>
<td>30,955</td>
<td>28,976</td>
</tr>
</tbody>
</table>

Source: Jamison, et al. (1976, p. 261)

*Although this table covers the total number of students only until the year 1972, in previous references I have mentioned that in the year 1976 there were 61,000 students in the system (Mayo, et al., 1973). Furthermore, according to data obtained through Revista Proceso (Toussaint, 1981, p. 55), the number of students in Telesecundaria in the year 1980 was 79,415.
spent nine years, and the Ivory Coast, which spent four years. In comparison with all of these projects, Telesecundaria spent only one year of preparation (Schramm, 1977, p. 150).

Undoubtedly, within this period of preparation, time and money must be devoted to the training of human resources. This operation must be an ongoing process that should last until the moment that the system stops its functioning.

In El Salvador, for example, when the ITV project was inaugurated in 1968, a great deal of attention was paid to the training and updating of teachers.

Before the 1972 school year, the entire ITV staff participated in daily training seminars and laboratory exercises derived from existing theories of teaching with television, and experimentation with new instructional design techniques was encouraged throughout the following year. Retraining of teachers within the ITV system... obliged [them] to study teaching methodology, ITV utilization, principles of secondary education, and the new... curricula in their subject matters. The subsequent full-year retraining programs were strengthened by the addition of courses in evaluation, guidance, techniques of investigation, and library science (Mayo, et al., 1976, p. 33-40).

If Telesecundaria, and the SEP as well, want to improve the quality of its programs, then, first, both teleteachers and producer/directors must be well trained in matters such as: educational television, communication theory, psychology of education, teaching techniques, and educational technology. If these pre-requisites cannot be fulfilled, then the quality of television lessons will remain the same.

On the other hand, the actual performance of coordinators teaching at the different local communities has also proved to be not as good as...
it might be. Here, the problem is also related to a lack of training and the low educational levels of coordinators. According to J. Mayo (1973, p. 28):

The level of general education of a teacher should be an important criterion in the selection of new coordinators. For coordinators already employed in the system, one might attempt to motivate them to obtain additional education. Another alternative is that DGEAD (General Direction of Audiovisual Education) itself could offer in-service general education courses for coordinators. Or one could even require that all coordinators with less than a specified level of general education attend such courses.

In the same study, it was found not only that Telesecundaria coordinators have a low level of knowledge about teaching techniques and pedagogy in general, but that traditional teachers at the Direct Secondary School System (Direct Education, or DE) do also. Despite the fact that in this study our concern should be with Telesecundaria coordinators, we must bear in mind such facts, because they might be the cause of the almost similar results in student achievement in both Telesecundaria and Direct Education obtained by Mayo, et al., (1973) in their cost-effectiveness study of the Mexican Telesecundaria program.

Nevertheless, the training of human resources cannot become a reality if the Federal government does not provide Telesecundaria with better financial support. A real commitment on the part of the Federal authorities to develop the Mexican rural areas through the education of its youth can only be shown, I believe, through the financial support that the Mexican authorities give to Telesecundaria. No system can effectively work with insufficient financial support, even less an instructional technology system of this nature.
I understand well, of course, that the Mexican government cannot afford a costly system, especially when that project was implemented mainly because it was expected to be less costly than other traditional ways. But, if a system like Telesecundaria is kept working only because it has proven to be less expensive than Direct Education regardless of its malfunctionings (stemming from a lack of adequate economic support), then I do not see the reason for keeping this system, since there are many other ways, such as using radio, that can do almost the same job with much lower operating costs.

In fact, Telesecundaria is one of the least costly ITV systems in operation today. The low operating costs of this system are to a great extent based on the effective work of the local patronatos (patrons) who pay the bills for the monthly rental of a teleclassroom. Aside from this, the students' families pay for the television set, uniforms, books, television antenna, and many other materials used during the school year.

Since people living in the rural areas of Mexico are very poor (average annual income $350.00 U.S.), the local patrons make an outstanding effort to support the children's studies. "The local communities pay a significantly higher percentage of schooling costs with the Telesecundaria system than with the Direct Teaching system—24% versus 16%" (Jamison, et al., 1976, p. 282). This means that families of Direct Education students pay approximately $32.00 US per student per year, while families and patrons supporting Telesecundaria students must spend approximately $36.00 per student per year (Mayo, et al., 1973).
Thus, taking into consideration that the families of the students enrolled in the Direct Education system are wealthier than their counterparts in Telesecundaria, it seems unfair for the SEP authorities to ask these people to pay more for their children's education.

The underlying premise of this action is that before Telesecundaria is brought to the rural community, the community must show a real interest and responsibility towards the system, which is proved by having them pay for the services they get from the system. At least the Federal government could help the various local communities with their expenses by paying some of the expenses, e.g. books, or monthly rental of the teleclassroom.

However, this last aspect is not the only one that makes Telesecundaria one of the less costly systems in the world. There is also the fact that coordinators receive very low salaries due to their poor level of training and educational background.\(^{10}\)

Thus the low operating costs of Telesecundaria are due, to a great extent, to the economic contribution of the various local communities, to low salaries paid to coordinators, and to a shortage of financial support provided by the Federal government, so that operations can be proved to be less costly.

Within the production of television lessons, Mayo, et al. (1973), and Klees (1976), found that the teleteachers' performance on the screen suffer what has been commonly called "talking-head". This, in

\(^{10}\) In 1974 there was a strike by coordinators who were asking the government for an increase in their salaries.
fact, is a problem that could be due to two factors: first, to low financial or economic resources for the purchasing of all the necessary elements to be used in the production of better programs; and, second, to a poor training level of both teleteachers and producers concerning the use of television for educational purposes.

Certainly, a "talking-head" style does not make use of the unique possibilities of the medium, principally the visual mode. And, in order to make use of such unique possibilities, creativity, knowledge, and charisma must be combined. This brings us to the understanding of the fact that an effective teacher is not always an effective instructional television teacher (Schramm, 1972, p. 57).

However, as stated above, without the necessary financial support for training and purchasing of adequate television resources, the teleteachers cannot produce better television lessons. On the other hand, poor quality of television lessons might also be due, to a great extent, to the tightness of scheduling for producing such programs. If this tight schedule is to be loosened, then the DGEAD should make use of its large stock of videotapes (Jamison, et al., 1976). Furthermore, Telesecundaria itself must solve its administrative and scheduling problems for the sending of videotapes to the 16 states which Telesecundaria serves.

According to the results obtained by Mayo, et al. (1973), students enrolled in this ITV system performed in general as well as students in the Direct Education (DE) system. Nevertheless, Telesecundaria students scored lower than their ED counterparts in the General Ability Test (Mayo, et al., 1973, p. 62).
Mayo, et al. (1973), from Stanford University, carried out an evaluation of both Telesecundaria and EO systems through 9th grade students in the following areas:

1. **Achievement.** Spanish, mathematics, and chemistry tests were given twice to both groups.

2. **Ability Testing.** General skills in reasoning, numerical, and logical thinking were tested.

3. **Student Aspiration.** Tests were given to find out what the students in Telesecundaria were planning to do in the near future.

4. **Attitudes and Opinion Tests.** Questionnaires were given to find out what the students thought about Telesecundaria.

Results from achievement tests indicated that Telesecundaria students performed as well as students in the traditional secondary school system, with Telesecundaria students having perhaps a slight edge (Mayo, et al., 1973, p. 57).

Despite this fact, Telesecundaria students living in more urbanized areas like Sonora, Mexico, Mexico City, Guanajuato, Puebla, and Tlaxcala, performed even better than Telesecundaria students living in more rural areas (Mayo, et al., 1973, p. 64).

Achievement results of this study indicate that many disadvantaged students can learn, but it will be unrealistic to expect students with disadvantages [these disadvantages may be due to nutritional, socio-economic, cultural, and general life opportunities] to achieve at the same level as students from more urbanized areas. This does not mean that poorer students should get inferior instruction but rather that, in order for them to have a more equal opportunity to learn, they need better or equal instruction (Mayo, et al., 1973, p. 64).
But the question here is how it happened that Telesecundaria students performed as well or even better than ED students if the former come from more disadvantaged environments. According to Mayo, et al. (1973), the high achievement level of these students can be attributed to their high level of motivation (as well as those of their families) towards education. This, in fact, is true since people living in the rural areas of Mexico see education as a means to leave the countryside by immigrating to the cities where they expect to find a better life. Unfortunately these hopes turn into frustrations when rural people find out that Mexican cities are already overcrowded, and therefore job opportunities are very limited.

According to the results obtained from the aspiration tests, it is evident that Telesecundaria students, because of their age and family situation, are more likely to find a job after they graduate from secondary school than their counterparts in the traditional system as well as more likely than their counterparts in Telesecundaria who live in more urban areas. Meanwhile, ED students show a higher aspiration level, which includes continuing their studies towards a university degree, or the study of a more skilled vocational or technical career.

Now, the students' needs for finding a job after graduating, in order to help support their families, present the Federal government with a huge problem to solve: the opening of more jobs.

Doubtless, the Mexican countryside shows one of the most chronic problems of our times—the lack of jobs. In 1979, the National Bank of Rural Credit (Banco Nacional de Crédito Rural) carried out a study
in order to measure the magnitude of the unemployment and under-
employment problem in the rural areas of Mexico. Through this study,
it was found that the unemployment rates in these areas averaged
about 70% (Cornelius, 1979, p. 157). However, Cornelius then went on
to quote further government figures indicating that out of seven million
people who should have been working, only a little over one million
people were able to find jobs, an unemployment rate of about 86%.

Finally,

even if disadvantaged rural students can learn from
a system of TV instruction [like Telesecundaria]
schooling may foster aspirations that cannot be
fulfilled. If school engenders desires for more school
and better jobs that are simply not available, the high
level of motivation may wither and be replaced by a
frustration that will hinder rather than help

Despite these facts, the Telesecundaria system appears to be
accomplishing its basic pedagogical objectives. And, what is more
important, "the qualities of individual sacrifice and community
self-reliance that are so necessary to the operation of the Telesecundaria
system may be, in themselves, the most lasting rewards of the system"

The decision-making process that takes place inside the management
subsystem of Telesecundaria is an obscure process which is hard to
understand and even harder to describe. In fact, there is no
information describing how the decision-making process takes place.
However, knowing how the macrosystem in which Telesecundaria is
immersed operates (behaves), knowing how Telesecundaria itself
functions, then we can infer how this last one is carried out.

We know that Telesecundaria was first administered by the DGEAD,
within the SEP. Later on, and after some problematic relations
between the DGEAD and the SEP, the administration of Telesecundaria was finally put into the hands of the SEP. However, after some years, the administration of Telesecundaria went back into the hands of the DGEAD; even so, the SEP has still kept a great amount of control over the system.

Because this thesis is based on information gathered during the years 1966 to 1976, we cannot know the present state of the system, including its management subsystem. Efforts were made by the present author to get more current information about the system. Unfortunately, these efforts proved fruitless, due to a lack of interest on the part of the Telesecundaria authorities in this project.

Nevertheless, we know that the administration or management subsystem of Telesecundaria relies on both the SEP and the DGEAD. Within these two institutions, major decisions concerning the very nature of the system, as well as its objectives and purposes, resources, and political aspects, take place. As mentioned before, the most important decisions concerning the nature, structure, and operation of Telesecundaria are not taken within the system itself, but rather on the outside.

Now, it is very likely that inside Telesecundaria a management subsystem exists. If this is true, then only minor decisions concerning the structure and operation of the system are taken there, since it is the SEP which owns and controls the goals of Telesecundaria.

Thus, we can conclude that Telesecundaria has three different management subsystems. The first one is located in the SEP itself.
the second one is located within the DGEAD Division, which at the same time is subordinated to the first one in the SEP. A third one is located inside Telesecundaria itself and is subordinated to the first two management subsystems located within the SEP and DGEAD, respectively.

Therefore, the use of these three management subsystems should be very complicated, since a great deal of coordination and consensus is needed for these to work effectively.

Needless to say, the amount of time needed for every important decision that must be made is very high, since every management subsystem has to decide whether the decision must take place in that particular subsystem or in one of the other two subsystems.

Furthermore, decisions appear even harder to make when we learn that the Mexican government's projects or programs lack continuity most of the time. This lack of continuity might also be due to the common practice of changing people's jobs very frequently during each presidential period of six years.11

Inasmuch as education requires continuity of support, fashions are dangerous because the problems being confronted by education are only likely to be solved, if at all, in the long term (Hooper, 1976, p. 129). Thus, continuity of programs and objectives in education must be given a great deal of attention by the Federal government if long term objectives are to be achieved in a proper and effective manner.

11 For instance, in the present administration (1976-82) of President López Portillo, Channel 13 has changed its director seven times. In one case, the director only lasted in office for a period of seven days (Mr. Abel Quezada, who worked in this capacity from December 10-17, 1976).
Target Audience Characteristics

In addition to the fact that Telesecundaria students live in rural communities, these students also display the following five characteristics, according to Mayo, et al. (1973):

1. Telesecundaria students are generally older than Direct Education students;
2. students in Telesecundaria come from large families (average of eight persons living in the same house);
3. parents of Telesecundaria students have less formal education than parents of ED students;
4. fathers of ED students have better jobs than those of Telesecundaria students, a fact obviously related to their superior level of schooling; and
5. there is a higher rate of dead or absent fathers for the Telesecundaria students.

After looking at each of these five characteristics of Telesecundaria students, we can conclude the following: their high levels of motivation arising from their age, the large size of their families, the low level of schooling of their parents, the low income jobs of their fathers, and the death or absence of their fathers, make Telesecundaria students more likely to find a job after graduating from secondary school than their counterparts in the ED system. Similarly, Telesecundaria students are also more likely to be highly motivated by the fact that Telesecundaria is their only chance to continue their education and thus to find a better-paid job.

It is also important to note that the interest of the students
families in the system is also related to the fact that the student is seen by his/her family as a future economic support, and also as a means of leaving the countryside to go to the cities, where they believe there are more job opportunities.

Doubtless, the Mexican Telesecundaria must perform an even better job than the ED system in order to help rural students to overcome their disadvantages. Moreover, Telesecundaria and the Mexican authorities must realize that it is of paramount importance for the country's development to keep these young people in the countryside where, in fact, they are more needed. But for this to become a reality, first, the Federal government must have a real commitment to help and develop the Mexican rural areas; second, the Federal government must open more and better jobs in these regions; third, the Federal government must motivate these young people to stay in the countryside; and, fourth, the Federal authorities should structure the Telesecundaria school curriculum in such a way as to make it more realistic for the needs and interests of the people living in the rural areas.
Models of the System's Current Structure and Performance

The structure of Telesecundaria, as noted earlier, comprises six subsystems: management, teaching, production-transmission (broadcasting), supervision, student evaluation, and student subsystems. This structure has been maintained since the beginning of the system in 1966. (Recently, however, the administrators and decision-makers of Telesecundaria have decided to make this system into an "Intensive Telesecundaria"; this will undoubtedly produce changes in the system's structure).

The management subsystem of Telesecundaria is currently controlled by three different systems located within what can be termed the system's 'environment'. The General Direction of Audiovisual Education (DGEAD) maintains very close ties with the Direction of Telesecundaria. Decisions coming from either the SEP or the Mexican political system necessarily pass through the DGEAD, and from there to the Telesecundaria system itself. At a higher level of decision-making, the SEP also exercises a great deal of control—perhaps the highest—over Telesecundaria through both the DGEAD and its internal management system. This control is obvious, since the system's purposes and goals are established by the SEP; moreover, such control is also exercised over the curriculum used by the system. At an even higher level of control, one from which the SEP, DGEAD, and Telesecundaria are administered in one way or another, is the Mexican political system, with its economic and social components. Major decisions concerning the purposes, goals, budget, structure and political aspects of Telesecundaria are directly and unquestionably made and administered by the Mexican political system within which the SEP, the DGEAD, and
and Telesecundaria are located.

At an internal level in Telesecundaria, the management subsystem maintains a local control over each subsystem. Decisions taken within each of the various subsystems must be passed to the management division for a closer examination and approval. That is, little innovation and decision-making flexibility is allowed at a local level within each subsystem, making Telesecundaria an autocracy in itself, controlled by another autocracy externally.

There is a close interaction among the various subsystems of Telesecundaria, since the production of the system's output depends on the work of every subsystem linked together. At the end of the process, at the student level, success is evaluated through the evaluation subsystem; from there, results are fed to the management subsystem, from which these results are sent to the DGEAD and the SEP, respectively, for evaluation. Finally, from the SEP, results are communicated to the political system.

Thus, we must visualize Telesecundaria as a hierarchy in which decisions are made at the top level, then travelling down through the system via the SEP and the DGEAD. Conversely, information about the results obtained by Telesecundaria are sent back through various systems until they reach the top level of this hierarchy. The entire process and current structure of the system can be seen in Model 1 (Figure 1).

At an operational level, the major decisions in the Telesecundaria system are made by outside systems, e.g., SEP, DGEAD, and the Mexican political system. Such "major decisions" have to do with matters such as the nature, purpose, goals, curriculum, budget, and other important aspects of the system. Meanwhile, at an internal level of the system, through the
Model 1.

Fig. 1 Model of the current structure of Telesecundaria.
management division, "minor decisions" concerning procedures, objectives, teaching, production, evaluation, supervision, and training are made.

The management subsystem of Telesecundaria controls all aspects of the system with the exception of Televisa, S.A., which has a direct agreement with the federal government concerning its operation within Telesecundaria as the means through which the television signal is broadcasted to the rural communities receiving Telesecundaria service. The rest of the system is controlled by the management division. Feedback in the form of information, resources, results, etc. travels from the local subsystems until it reaches the management subsystem, from which, after evaluation, information is sent back to each subsystem in the form of orders.

As shown in Model 2 (Figure 2), the success of the system depends to a great extent on the performance of both teleteachers and coordinators. The former are responsible for the planning, design, production, and success of each television lesson. The teleteacher also decides which method of presentation, according to his/her own criteria, relates best to the idea being taught. Behavioral objectives, if any, are also decided by teleteachers. At the end of the line are coordinators responsible for assessing and supervising the work of the students in the teleclassroom. The coordinator explains the content of the television lesson and is responsible for its being understood.

The major threat to the system's functioning and success is the fact that Telesecundaria does not really help in developing the rural areas. Thus, students who have graduated from the system leave their local communities and go to the cities in search of better jobs. As
Fig. 2. CURRENT FUNCTIONING OF TELESECUNDARIA.
discussed above, however, job opportunities in the already overcrowded Mexican cities are slim, and thus frustration often arises.

The reader should bear in mind that the two models depicted in this chapter portray the current structure of Telesecundaria as well as its operation; no suggested improvements have been introduced at this point.
"In reality, the purpose should be to better understand the whole Telesecundaria system, with the hope of improving it for the benefit of its students."

Judith A. Mayo
CHAPTER IV

ANALYZING AND IMPROVING TELESECUNDARIA AS A VIABLE SYSTEM

The attempt to improve any kind of system is a very serious matter since changes and innovations that are intended to take place inside the system can jeopardize the very nature of the system, as well as that of its outcome; if these changes and innovations are not carefully planned and consistent with the purposes of the system under study.

This is especially true for educational systems like Telesecundaria because of the fact that these systems have the tremendous responsibility of organizing the learning and attitudes of thousands of young people. Thus, a wrong or inadequate change can have very serious consequences for those whose education is of vital importance for their future role in society as well as their own personal development.

In improving the functioning of tele-educational systems, we are primarily concerned with the quality of instruction that the students receive. Hence, all our efforts should be addressed to correct malfunctioning within the system for the benefit of the students. Similarly, in improving Telesecundaria, it is also the case that malfunctioning must be corrected in order to improve the quality and effectiveness of instruction for the benefit of the society in which its students live.

This system must work at its best possible level because of the disadvantaged environment in which Mexican rural students live. Therefore, not only malfunctioning within the system are to be corrected, but also some elements within its structure, in order to ensure an even better
level of instruction and learning.

The Problem

Malfunctionings within Telesecundaria have been identified at two different levels: structural problems and functional problems.
The problem which this thesis addresses is how to correct such malfunctionings within Telesecundaria, without threatening the very nature and goals of the system, and by making the best possible use of already existing structure and resources.

It is my belief that one available way to alleviate Telesecundaria's problems, both structural and functional, is through systems analysis and cybernetics. In order to apply such techniques, we first have to understand the nature of the system as well as its purposes. Second, we must study the different elements of the system and the relationships among them within the system. Third, we must understand and analyze the system's functioning. Finally, we must observe, evaluate, and understand the system in a holistic way.

We have already examined some of these aspects in the previous chapters. In the present one, we will further analyze such problems and try to propose solutions with the help of systems analysis and cybernetics.

Analyzing and Improving the Structure of Telesecundaria

"There is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things."

N. Machiavelli
"If the systems analyst proposes change, which is the essence of the instrumental process, he meets the proponents of status quo, for the essence of the institutional process is to stand pat."

Van Court Hare, Jr.

The Management of Telesecundaria. One of the most important problems within the structure of Telesecundaria is that of its management subsystem. There is an urgent need for a management subsystem which is located inside the system, not outside it. Both major and minor decisions concerning Telesecundaria must be taken within the system itself. Even if the federal government, through the SEP, is responsible for the economic, political, social and educational aspects of this system, decisions concerning the structure and functioning of the system must be made inside Telesecundaria.

Tiffin (1978) carried out a research program in which case studies were made of eight of the fourteen ITV systems; including Telesecundaria, in Latin America. In one of his most important findings, Tiffin (1978, p. 196) points out the following: "An assumption of Living Systems Theory is that deciders should be an integral part of the system. In five cases [out of eight] decisions have been made by someone outside the system and control of the internal variance has been left to a manager internal to the system."
Thus, if administrators or the people involved in the management of Telesecundaria are expected to make opportune and accurate decisions concerning the system, then these people must be the only ones to make these decisions, without any external interference. This is not to say that the SEP and DGEAD authorities must never be involved in major decisions concerning Telesecundaria, but rather that they will only participate in and monitor extremely important matters such as the policy of financial support for the system, the achievements of Telesecundaria, and curriculum changes that concern them as federal authorities. But, these federal authorities must not be concerned with "domestic affairs" which should be the unique responsibility of those who work for and inside the system. At the same time, if Telesecundaria is expected to exercise adequate control over every single aspect of its operation and results, then it must be controlled by its own internal management subsystem.

However, not only must these decisions and control of the system lie within the system's management in order to be more accurate and adequate, but it is also important that the people involved in these two processes be capable of doing the job. And for this to become a reality, educators, psychologists, communicators, and educational technologists must be the people who manage the system, not politicians. If there are well trained and experienced people who are able to manage Telesecundaria in an effective way, then control will be properly exercised throughout the system.
Introducing a Control Subsystem. As mentioned above, in order that Telesecundaria be properly administered, management action must lie within the system and well trained people must be the ones who exercise this management action. But it is also necessary to include within this new management system a subsystem which will help administrators enhance the important decision-making process and the whole functioning of the system as well. This subsystem will also help compare the outputs of the system against operation standards and then, if necessary, correct any deviations that may occur.

Hence, I propose to design and implement a control subsystem within Telesecundaria to provide control presently lacking in this system. A review of the management science field suggests that it is of paramount importance for Telesecundaria to have an effective control subsystem if organization and effective functioning are to be achieved.

According to Schoderbek, et al. (1975, p. 93), a control subsystem must contain the following four elements:

1. a control object or variable to be controlled;
2. a scanning subsystem;
3. a comparator; and
4. an activator or action-taking subsystem.

In a subsystem of this nature, the control variable will be identified as that output produced by any of the six subsystems (e.g., television lessons, broadcasts, tests, objectives) or the environment which deviates from the system's operational standards or which might even be thought of as threatening the effective functioning of the entire Telesecundaria system. Thus, such deviation will be reduced to an acceptable
level according to the policies and decisions already taken by the administrators of the system.

The scanning division within the control subsystem will work as a "scrutinizer" of the source from which the control variable proceeds, with the purpose of better understanding the reasons that promoted such inappropriate action and to act more effectively upon the deviation in order to minimize the probability that an output or action of this kind will occur in the future.

After the source(s) which promoted a deviated action has been identified and examined, information about it is sent to the comparator division within the control subsystem. In this division, the task to be performed is to find out how large the discrepancy is between the obtained "false output or action" and the operational standards for that output that have been previously established by the administrators of the system. In the case of a deviated action coming from the system's environment, the procedure will be to compare such action against the expectation standards of the environmental behavior of Telesecundaria, and trying to reduce as much as possible its uncertainty by scanning it.

Finally, when such deviated action has been properly evaluated and compared against its operational standards and the difference between expected and obtained outputs or actions has been measured, information is sent to the activation division, where a final decision must be made, with the purpose of reducing such a discrepancy and trying to avoid further outputs and actions of this nature in the future (see Figure 3).

In regard to Telesecundaria, a control subsystem will be designed for each of its various subsystems: management, teaching, production/
Figure 3.

DESIGN OF A CONTROL SUBSYSTEM FOR TELESECONDARY.
transmission, supervision, and evaluation. Each control subsystem will be designed according to the four characteristics established by Schoderbek, et al. (1975).

The purpose behind the design of one control subsystem for each of the six subsystems within Telesecundaria is to ensure the proper work and functioning (outcomes) of every subsystem. However, a major regulator will be designed for the purpose of regulating the control action of each of the control subsystems, as well as that within the management subsystem, which in fact controls the entire Telesecundaria system.

Control within the Management Subsystem

The variables to be controlled by the control management subsystem are:

1. the environment of Telesecundaria;
2. the teaching subsystem;
3. the production/transmission subsystem;
4. the supervision subsystem;
5. the evaluation subsystem;
6. the students' achievement (student subsystem); and
7. the students' attitudes towards the system.

A scanning subsystem within the management control subsystem will act as a collector of information regarding the performance of each of the five subsystems mentioned above, plus information about the target audience and the environment of the system. Such collection of information will help reduce the uncertainty in the decision-making process performed.
within the management subsystem of Telesecundaria.

A comparator function within the management control subsystem will attempt to reduce the discrepancy between obtained and expected outcomes from each of these four subsystems through the improvement of the mechanisms that produced or elaborated such a deviated output, as well as between the expected and obtained results concerning the effects of the system's output upon its environment and the target audience.

Finally, an activator function would involve decision-making if discrepancies exist in the functioning and outcomes of each of the four subsystems, with the objective of improving as much as possible the global outcome of Telesecundaria.

A model has been designed to clarify the way in which the management control subsystem would operate (see Figure 4).

Control within the Teaching Subsystem

The control variables involved in the teaching control subsystem are the following:

1. scripts for television lessons;
2. research on the subject matter;
3. teachers' ability and capacity to work in television;
4. teachers' behavior;
5. teaching strategies;
6. teaching effectiveness; and
7. objectives and instructional design.

A scanning subsystem within the teaching control subsystem will collect information about the performance of the teaching subsystem, as
Management Subsystem of Telesecundaria

Figure 4. Control within the management
a means of making more accurate decisions within the activator division, concerning the global outcome of this system. A comparator function will help to reduce the discrepancies between obtained and expected results (outcomes) of the teaching subsystem.

Finally, an activator function will operate if such discrepancies in fact do exist, with the objective of reducing these discrepancies to an acceptable level.

A model of the teaching control subsystem has been designed to show how the subsystem would function if implemented (see Figure 5).

**Control within the Production/Transmission Subsystem**

The control variables to be controlled by the production/transmission control subsystem are:

1. maintenance of equipment (television studio);
2. personnel training;
3. broadcasting and production schedules;
4. scripts and teleteachers' performance on the air;
5. Channel 5's broadcasting signal;
6. Televisa, S.A. administration;
7. maintenance of antennas and television sets in the various local communities;
8. television lesson guides sent by mail to coordinators;
9. special mail service between the subsystem and coordinators; and
10. Channel 13's broadcasting signal and its rediffusion station throughout the country, especially the 16 states
Figure 5. Control within the Teaching Subsystem of Teleeducation.
THAT THE TEACHING SUBSYSTEM OF TELESECONDA.
receiving Telesecundaria's signal.

A scanning function within the production/transmission control subsystem will collect any relevant information concerning the performance of the production/transmission (broadcasting) subsystem in order to enable more accurate decisions about the system's global outcome.

A comparator function will try to reduce the discrepancies between expected and obtained results (outcomes) of this particular subsystem, if necessary.

An activator function will operate if discrepancies or malfunctionings exist in the performance and obtaining of results by this subsystem (production/transmission).

A model of the production/transmission (broadcasting) control subsystem is shown here to clarify how the control subsystem would operate if implemented (see Figure 6).

**Control within the Supervision Subsystem**

The control variables in the supervision control subsystem are:

1. coordinators' training;
2. coordinators' competency to teach at the secondary school level;
3. coordinators' teaching behavior;
4. coordinators' use of subject-matter guides;
5. supervisors' training;
6. supervisors' ability and competency to work with coordinators;
7. supervisors' knowledge of subject matter;
8. supervisors' and coordinators' knowledge of secondary school curriculum;
9. coordinators' and supervisors' use of feedback systems; and
10. supervisors' evaluation of coordinators' performance.

The scanning function within the supervision control subsystem will collect relevant information concerning the total performance of this supervision subsystem in order for the activator division to make more accurate decisions about its global outcome and functioning.

A comparator function will reduce the discrepancy between obtained and expected outcomes by improving malfunctionings detected by the scanning subsystem.

The activator function will respond if discrepancies or malfunctionings exist in the performance and obtaining of results by the supervision subsystem.

A model of the supervision control subsystem shows how it would function if implemented by the Telesecundaria authorities (see Figure 7).

Control within the Evaluation Subsystem

The variables to be controlled by the evaluation subsystem are, among others:
1. students' migration to the cities;
2. students' attitudes towards school;
3. students' attitudes towards the development of the rural areas;
4. students' attitudes towards the system;
5. use of feedback between students and each of the five
SUPERVISION SUBSYSTEM OF TELESERUNDIA.

Figure 8: Control within the Supervision Subsystem of Teleserundia.
subsystems;
6. students' learning level;
7. evaluation of the global functioning and output of the entire system;
8. secondary effects of Telesecundaria output and functioning upon students and the environment; and
9. effectiveness and secondary effects of the curriculum upon target audience and communities.

The scanning function within the evaluation control subsystem will collect relevant information concerning the total performance of the evaluation subsystem in order to make more accurate and opportune decisions in the activator division about the global performance and functioning of the evaluation subsystem.

The comparator function will reduce the discrepancy between expected and obtained results by improving malfunctionings detected by the scanning subsystem.

Finally, the activator response will occur if discrepancies do exist in the performance of the evaluation subsystem.

A model of the evaluation control subsystem is shown here (Figure 8).

It is hoped that by using one control subsystem for each subsystem within Telesecundaria that high variety in the environment could be reduced to a great extent and thus operational problems be avoided by an effective organization and proper functioning of the system. Thus, it is clear that the rationale behind the use of a control subsystem for each subsystem within Telesecundaria is that, in order to control the system, there must be as many actions accessible.
to the controller as states in the system (Ashby, in Schoderbek, et al., 1975, p. 76)--that is, "only variety can destroy variety". This, in fact, is what the introduction of such mechanisms is intended to do.

The Importance of Feedback. "Most practitioners and theoreticians are concerned with implementing communications and control procedures to contribute to the organization of personal and social development. This hinges on cybernetic feedback processes" (Mitchell, 1975, p. 1). Feedback, according to Wiener (1967, p. 276), consists of modifying the behavior of a system by reinserting the results of actual past performance. This means that any information concerning the functioning of the system as well as of its output will be sent back to the different control subsystems located in each of the five subsystems (e.g. teaching, management, evaluation, production/transmission, and supervision subsystems) within Telesecundaria, in order to improve the controlling (regulatory) action and also to help more accurate decision-making at the local and global levels within the system, in this case Telesecundaria.

In regard to the system of Telesecundaria, it is of primary importance for its effective regulation and operation to have an appropriate feedback channel in continuous operation along the entire system. Feedback operation in Telesecundaria has been solely confined to informing the management subsystem about the operation and local decisions made within each of the four structural subsystems, and also bringing back information about test results from the students. A system of the magnitude and purposes of Telesecundaria cannot continue
to operate under these circumstances.

What is proposed at this stage of the study is to design a new communication network that will allow all subsystems of Telesecundaria to share the information obtained about the success of its television lessons as well as its secondary effects upon the students. Moreover, local decisions made within each of the structural subsystems (e.g. teaching, supervision, evaluation, management, production/transmission) should be shared by means of feedback with the other subsystems, so that the whole system will be aware of the entire process that is taking place.

In designing such a communication network, attention must be paid to the quality and effectiveness of the global outcome of the system by each of the structural subsystems. Such an operation will be handled through the evaluation subsystem; from this subsystem, feedback in the form of information will be sent to the management division and the other three structural subsystems, in order to inform every division of effectiveness and quality of their task in the production of the global output. Thus, if necessary, arrangements may be made for reducing the discrepancy between the expected and obtained output so that improvements will be made on a regular basis at both system and subsystem levels.

On the other hand, it is also important to note that such a feedback mechanism will not operate exclusively at the student level. It also will gather information about the effects of the output on the communities in which the students live, with the purpose of helping develop the rural communities. Through the information obtained on this
particular aspect of the system, decisions can be made at a higher level of responsibility (e.g., political, economic systems) to join efforts with Telesecundaria in the development of the Mexican countryside.

A model of the expected structure and performance of this feedback mechanism or communication network has been designed (see Figure 9). It is primarily intended to evaluate not only the performance of the students through the application of tests (which is currently being done), but also the quality, motivation, and structure of each television lesson as well as its effectiveness in promoting learning. It is also intended to evaluate the secondary effects that these television lessons have upon the target audience (students) and the local communities in which they live.

All the information gathered concerning such matters through the use of a feedback mechanism will be sent back to the system through the evaluation subsystem and the control subsystem. It is hoped that when results of the system's output (i.e., Telesecundaria's) and its effects are known, studied, understood, and analyzed by people working within the control subsystem of the management subsystem of Telesecundaria, improvements will be made to offset any deviation that may occur between expected and obtained results.

Analyzing and Improving the Functions of Telesecundaria

Taking New Variables into Consideration. In this study of Telesecundaria, I have found that the system still maintains the same structure, objectives, and operation that it had fifteen years ago when it was first inaugurated. However, the environment, the
target audience, the socio-economic situation of the various local communities, the country's development and needs, the aspirations of those whom the system serves, and the effects of the system upon Mexican life, as well as many other factors, have dramatically changed since this period. If Telesecundaria does not want to become overwhelmed by the dangerously high variety level of its environment, then the system must make changes in itself and become more in accord with the reality of Mexico and its needs. This change in itself might give Telesecundaria the strength to cope with such high variety and thus to work more effectively.

Within this process of change, a great deal of attention must be paid to the inclusion of new variables within the scope of this system. These new variables must be taken into consideration when defining the system's purposes or goals, and also when new decisions concerning the structure and functioning of Telesecundaria are made, after accepting and implementing the various changes and innovations suggested in this work.

Probably one of the most important factors to be taken into consideration for the effective performance of the Telesecundaria system in the future is the analysis of long-term and secondary effects of the system's output, not only upon its target audience but also upon the local communities as well. I am specifically referring here to the effects of an urban-designed curriculum that is used by Telesecundaria and which leads to a high level of immigration of the brightest and most able rural youths to the overcrowded Mexican urban areas in search of better jobs and a more comfortable life.
According to Jamison et al. (1976, p. 285), "A commitment to rural development cannot be met by a wholesale transfer of an urban-oriented curriculum to a rural educational system, but must involve resources invested to create rewarding employment opportunities within rural areas." This represents a huge challenge to the federal government since the creation of more jobs for the thousands of students who graduate from Telesecundaria every year is a very costly, long-term operation that needs urgent implementation and careful planning. On the other hand, I believe that if the Mexican countryside is to be developed for the best interests of the country as a whole, then a more rural-oriented curriculum should be put into practice through Telesecundaria. Otherwise, rural students' interests and needs will be modified and adjusted to a fictitious urban world to which they do not belong because it simply does not exist.

According to Mayo, et al. (1973, pp. 116-117), Mexico's Telesecundaria has proven to be a very highly cost-effective system for extending educational opportunity; however, it does not seem to be closing the economic or social gaps between urban and rural students. Rural students continue to perform less well in learning, reflecting their poorer backgrounds and lack of adequate preparation. This pattern is likely to continue unless a new approach to rural education can be developed.

This "new approach to rural education" must rely first upon a real, deep and sincere commitment on the part of the Mexican authorities to the poorer and less-advantaged Mexicans who live, in the words of Spain (1973), in one of the "two Mexicos"—the rural one. Second, this commitment must be carried out through even higher quality teaching,
directed to fulfilling rural needs.

Telesecundaria's new administration should take advantage of the system's already high levels of support from the various local communities, if changes and innovations are to take place. However, research must be done before, not merely after, implementing changes in order to be aware of the people's responses and interests beforehand.

The second most important aspect to be taken into account by the Telesecundaria authorities concerning the functioning of the system in this highly changing and complex environment is the allocation of more financial resources by the federal government for the system, and the use of these resources more effectively.

There is an urgent need for more and better trained personnel, especially at the teaching, production, and supervision levels of Telesecundaria. The target audience of Telesecundaria is one of the most disadvantaged groups in Mexico. Thus, in order to help these students to be better educated and capable of performing in a job in the future, this system must improve the quality of its outcome at an even greater rate than that of the direct teaching system (Educación Directa).

But good training is not enough for the improvement of the outcome, since it is also important to purchase more and better equipment and hardware resources. This will help the system to meet its already numerous demands.

In a word, Telesecundaria needs more financial support, because of the increasing numbers of students enrolling in the system every year.
If there is not such an increase, we may conclude that the system will continue to pursue the simplistic expansionist strategy of making itself larger in its own image and therefore jeopardizing its own survival (Combs, 1970).

Objectives. The general objective of Telesecrendaria is to bring educational opportunities, specifically at the secondary school level, to all those students living in the Mexican rural areas who, for whatever reason, cannot attend classes in the traditional secondary school system. As shown in Chapter III, the main reason that rural students cannot be enrolled in the traditional school system is the lack of schools and teachers in the rural areas.

Despite the fact that this general goal has existed in the system since it was first established, it does not include more specific objectives through which the system's performance and output can be directly evaluated. For instance, the purpose stated above does not include the development of the rural communities, directly or indirectly, through the education given to their young people. Neither does it deal with individual learning objectives. Rather, the system's purpose simply deals with a mere educational opportunity that is to be made available because education is thought to be an important matter, regardless of the specific curriculum and instruction given to the young people.

To bring any kind of education to the rural areas because it is important to the federal authorities and to the majority of people living in urban areas, without referring to more specific outcomes for the intended audience is unlikely to produce the intended results. Education
in itself does not have any meaning without reference to specific objectives and content.

New objectives in Telesecundaria must be as clear and detailed as possible. They should be stated in as specific a form as possible; otherwise, the system’s performance and the federal government’s interest and commitment to developing the rural areas cannot be evaluated because of vagueness of criteria.

Among the most important objectives that Telesecundaria should have, and to which its efforts must be addressed, is the cultivation of real motivation and the promotion of attitude change in both students and their families, concerning the students’ intention of moving to the cities, and their view of education as a “master key” that will automatically open the doors of plenty.

Indeed, education will help improve the lifestyle of those who live in very poor environments, but only to a limited extent. Significant changes will depend on the federal government’s efforts to make more economic and social opportunities in the rural areas. Hence, Telesecundaria should not be seen as a “horn of plenty”, since it can only offer one kind of improvement. However, if education is combined with all the necessary social, economic, nutritional, and other improvements of life in the rural parts of Mexico, it will undoubtedly prove to be much more effective.

Another important aspect of this problem, to be taken into consideration by the authorities of Telesecundaria as an objective of the system, is increasing the quality of the system’s outcome. Telesecundaria can be improved. Analysis of the existing operation suggests that training and economic resources must be available to
Telesecundaria. Therefore, the federal government should provide
the system with such economic aid to enable the system to
accomplish its tasks effectively.

If this economic support is obtained (if not, the government's
commitment to the rural areas will be proven insufficient) the
management of Telesecundaria must provide teleteachers, coordinators,
supervisors, and director/producers, with more and better training
for their roles. Such training must be an ongoing process.

It is conceivable that an improvement in the quality of
television lessons might even induce the Telesecundaria students to
perform at an even higher level than their counterparts in the DE
system. However, this possibility cannot be taken for granted, since
there is no research to support this conjecture. Nevertheless, Chu
and Schramm (1979) found that television is more likely to be an
efficient tool of learning if it is planned and organized efficiently.
And within this organization and planning, quality plays an important
role.

Finally, Telesecundaria must include within its repertoire of
objectives the evaluation and measurement of its global outcomes as
well as those of the various subsystems. The lack of evaluation and
measurement at every level of the system is partially responsible for
some of the system's malfunctionings, as well as negative secondary
effects upon the students and their communities.

It Telesecundaria is expected, as designed, to help in the
development of the rural areas specifically, as well as the country
as a whole, then this system must continuously evaluate the success
or failure of its outcome; then, if necessary, it must make the
necessary corrections or adjustments in order to reach a desired and effective operation level.

We cannot expect the system to work at an optimum level, since it is impossible for a social system to reach this high level of performance. However, the system must work at a high level of efficiency, which means that it should produce better television lessons in terms of their quality and content and also in terms of their effectiveness in developing the rural areas through the education of rural youth.

Telesecundaria must establish certain performance parameters for each of the various subsystems, for the total or global system's functioning and outputs, and for the effects of the system's output upon its target audience and local communities in general. Without these performance parameters for measuring deviation between expected and obtained results, the whole system of Telesecundaria will never work effectively; if there is no quality and effectiveness control, the system will have less efficiency and effectiveness.

**Human and Material Resources.** In contrast to many other ITV projects around the world, the Mexican Telesecundaria dedicates very little effort and budget to the training of its human resources. According to Schramm (1977, pp. 150-151), Niger, for example, offers its teachers a 12-week training course, American Samoa and the Ivory Coast offer inservice training to their teachers, and El Salvador offers a full year of retraining for each teacher. Mexico, in comparison, offers only a 3-week training course to its coordinators and a one-month training course to its teleteachers and director/producers.
Indeed, there is an urgent need for more training and a higher educational level for both teleteachers and coordinators. According to J. Mayo (1973, p. 28), "it was also noted that the higher the level of general education of a teacher, the higher was the level of his students' achievement." This, she continues, tends to confirm Beeby's hypothesis (J. Mayo, 1973, p. 3), which holds that teachers' levels of general education and the quantity and quality of their professional preparation are directly related to their educational system's stage of development (see Appendix A). From this, we can conclude that it is important to understand that the quality of the training given to teleteachers and coordinators within Telesecundaria, and their own educational and professional background, are of paramount importance for an improvement in the students' achievement.

Results obtained from the Stanford Research Team (Mayo, et al, 1973) show that Telesecundaria and DE (Direct Education) students performed at almost the same levels on three different tests. On the other hand, J. Mayo (1973), in her research, showed that there was a great similarity in teaching behavior among Telesecundaria and DE teachers. What is even more important about these teaching similarities is that in both systems, teaching performance was at a very low level since teachers never explained, never asked students to give examples, never used any teaching aids, never supervised individual work, and 90 percent of the teachers never offered their students any individual help.

Thus, it is very likely that the almost identical student performance level in both Telesecundaria and DE might be due to the very similar teaching performance in each system. Furthermore, it is
very likely also, according to these research results, that if there is poor teaching then there is also a low level of student achievement in both Telesecundaria and DE, even when they performed at almost the same level. In other words, the fact that there is a very similar achievement level in both systems does not demonstrate that such a level of performance and achievement is optimal. And if Beeby's hypothesis of the positive correlation existing between the teachers' general education level, their professional training level, and the students' achievement level is correct, then the students' achievement level in both Telesecundaria and DE is very poor or, at least, not as good as it might be in a country where development, skilled training, and education are of paramount importance.

What I suggest in order to improve the teaching subsystem is that both teachers and coordinators be hired on the basis of their professional capacities and a higher education level be required, above all in the case of coordinators. This higher education level will be indicated by a degree from the Superior Normal School, or, if possible, a university or college degree in the case of teleteachers. However, a degree from the Superior Normal School should be a necessary standard for both teleteachers and coordinators.

In addition, I also propose that both teleteachers and coordinators complete a six-month training course before starting their teaching activities within the system. This six-month special training will emphasize the study of psychology of education, educational technology, curriculum design, communication theory, educational television, drama, script-writing, evaluation in education, oral skills, and related subjects. It is obvious that this program cannot be thoroughly studied
in a six-month period. Therefore, I propose that during the first year of activity within the system, teachers and coordinators will have to complete an 8-hour weekly training course which would be basically the same as the one taken before entering the system, although this post-training will place more emphasis on practical exercises, adolescent psychology, and the secondary school curriculum. After these two basic training programs are completed, teleteachers, coordinators, director/ producers and supervisors can be expected to participate in an annual seminar on advances in ITV, and the study of other ITV programs developed in other countries.

The underlying rationale for this kind of training is to redress a weak or sometimes complete lack of knowledge concerning the use of ITV in other countries such as El Salvador, Korea, the Ivory Coast and American Samoa. Undoubtedly, these seminars will provide the teaching, production and supervision personnel of Telesecundaria with the valuable experience of being in touch with similar projects in other countries, as well as exchanges of information and techniques with colleagues from other countries.

Certainly, this whole operation would entail high costs, but if there is a real and sincere commitment to the rural areas and in general to the development and needs of the entire country, this kind of improvement must be implemented in order to counteract deficiencies. When considering the urgent need for training, I always try to keep in mind what the former (1959-64) president of Mexico, Adolfo López Mateos, once said when he was still in office: "Mexico faces many problems, but perhaps the most important of all is the development of our country through education... in one way or other, the quality
of what we offer is of very great importance" [author's translation].

With respect to the way in which this training service should operate, for many of the coordinators it will be difficult to spend eight hours a week in the cities where the training centers will be located. Thus, one possible solution to this problem might be the use of a special mail service through which reading materials, exercises, and short tests will be given to the coordinators working in distant communities. Another solution would be the use of television for training coordinators. These television training programs could be broadcasted on Saturdays or weekday evenings. However, a training service for coordinators which uses a combination of television and reading materials sent by mail would be even better, as coordinators would be learning both directly, from television, where demonstrations are visual, and from the printed materials, which would supplement this experience.

In regard to the training of teleteachers and director/producers, the use of a training center located in Mexico City does not represent a major problem since television lessons are already produced in television studios located in this city.

Material Resources

With respect to the problems deriving from the lack of sufficient material resources, the most feasible solution is the allocation of more financial resources from the federal government to the system. Although the availability of hardware resources is of great importance to the system, it is also the availability of its own broadcasting facilities. Telesecundaria cannot be dependent on the broadcasting
facilities given it by Televisa, S.A. Rather, in order to cope with the increasing demands of students in very distant communities throughout the country, it is necessary to broadcast on another channel.

It is widely known that Telesecundaria broadcasts its programs under very tight scheduling constraints, primarily due to the practice of broadcasting programs live instead of using videocassettes. This problem will increase due to the high population increase in the states where Telesecundaria offers its services (see Chapter V). On the other hand, the establishment of its own broadcasting center, in Mexico City for example, would help Telesecundaria to reach more rural communities than it does now. This would be a great step forward for Telesecundaria and also for the rural communities, since the system has had to refuse several requests for its services from various communities because of a lack of capacity, principally at its broadcasting and production levels. But, once again, the availability of its own broadcasting center depends primarily on the level of funding given to Telesecundaria by the federal government.

Because rural parents, through patronatos and family groups, pay more for their children's education than parents whose children study in the DE system, and also due to the fact that people living in the rural communities are very poor and must make an outstanding effort to support their children at school, I consider it more equitable that the federal government allocate a special part of the budget given to Telesecundaria to subsidize textbooks, uniforms, and other classroom materials. Necessarily, this subsidy to the rural communities will increase even more the need for financial support from the government.
However, I believe that this is the only means by which Telesecundaria can help avoid any growth of resentment within the rural communities towards the system.

**Production and Transmission.** One of the major problems in the production area of Telesecundaria is the lack of personnel. First of all, the director and producer should not be the same person, since bias can affect the product (television lessons) and a hazardous work relationship with teleteachers may occur. Therefore, I recommend that another person be hired so that the director and producer fill two positions.

On the other hand, since the teleteacher is the only person in the television studio who really knows the subject matter of each television lesson, there is always the possibility that the teleteacher may make mistakes which are not corrected by any other person, unless the teleteacher him/herself notices them. In the worst cases, a television lesson is broadcast with such mistakes intact. I suggest that at least one other subject matter expert be placed in the television studio in order to assist the teleteacher when mistakes are made. With this practice, an even better quality in the outcome should be obtained, and the teleteacher may also feel more secure in the job.

Ideally, supporting the teleteacher should be a group of experts who can assist in an even more complete way. This group might be made up of specialists in educational psychology, communication, educational television, and educational technology, among other fields.

Another change that I consider necessary to implement within the
production area is that of making specialized-grade production crews instead of using crew members for the production of all three grades of television lessons. Although there is no research to support this view, the current practice appears to be less advantageous than making specialized crews who could save time and improve the quality of the outcome because of a better knowledge of the production needs for each subject taught at each grade level.

In regard to the structure and style of the television lessons, Mayo et al. (1973), Jamison et al. (1976), and Klees (1976) agree that these aspects of the programs are not as good as they might be. According to Lundgren (in Schramm, 1972, pp. 12-22),

A good program must always meet the demands of its specific target audience. It should also avoid teaching in the traditional meaning of the word, by stimulating the students through presentations where they meet people and milieus that are completely unknown to them. In one single word, a good ITV program makes use of the unique possibilities of the medium.

On the other hand, Egly (in Schramm, 1972, pp. 25-27) explains how Tele-Niger produced its television programs:

In this project television was conceived, not as something for optional use by a teacher as an 'illustration' within his course, but as direct communication with his students. The broadcasts were thought of as 'shows' for students, not 'model lessons' taught by a 'super teacher'. The program was so designed that the students, too, could be relaxed and enjoy the television.

Unfortunately, Telesecundaria television lessons lack almost all of the above-mentioned characteristics with the exception of one:

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12 Rolf Lundgren is Director of the Instructional Programming Unit of the Swedish Broadcasting Corporation.
13 Max Egly is Director of Tele-Niger.
Telesecundaria television lessons at least meet the basic demands of its specific target audience, since the system provides the rural student with an opportunity to study what is not available through other means. However, Mexican television lessons cannot be labelled either as stimulating nor as relaxing.

Whether or not television lessons can or should be thought of as shows, Mexican television lessons at least could be more stimulating. This, I think, can be done by introducing more variety of rhythm through the use of movement and action. A television lesson using the so-called "talking-head" technique cannot expect to stimulate and relax its students but, rather, the contrary. Nevertheless, in the case of Mexican rural students, their level of learning and achievement has increased even with the use of monotonous television lessons. However, their need for education and what it represents for them goes much further than their attraction to the television programs themselves. Their need for education as a means of leaving the countryside is the major factor responsible, I believe, for the high standard of achievement of these rural students, not the quality of the television lessons.

In order to make more stimulating, relevant, and attractive television lessons, it is necessary first to train teleteachers, directors, and producers in the use of ITV, and second, to obtain from the government more financial support for the purchasing of production resources, including telecinque, video-cassettes, scenography, lights, and other necessary materials.

However, if both training and financial aid are neglected, it is predictable that poor quality television lessons will most likely account
for a gradual decline in the students' positive attitudes towards the system, as happened in El Salvador (Mayo et al., 1976). It may also happen that this will reduce, sooner or later, the students' performance and achievement, even though Chu and Schramm (1979) argue that variations in the production techniques do not significantly contribute to learning from television.

In regard to the transmission subsystem of Telesecundaria, one of the biggest problems is the tightness of its transmission schedule, in part due to the availability of only a single channel for broadcasting up to 99 television lessons per week. As mentioned above, one of the most feasible solutions for alleviating these transmission problems would be the construction of Telesecundaria's own broadcasting facility. Unfortunately, the costs of purchasing this equipment would be very high.

However, there are other alternatives for expansion such as the use of Channel 13's facilities. Even when Channel 13's transmitter has a low capacity, this can be easily overcome, because this channel has several rediffusion stations throughout the country, in almost every state. Hence, Telesecundaria's signal can be easily distributed to all the rural communities currently using Telesecundaria service, as well as to future users of the system. Channel 13 is one of the best equipped television stations in Mexico and has four studios with all the necessary elements for producing better television lessons.

The second most important problem within the transmission area is the lack of supervision and maintenance of antennas and television sets located in the various rural communities. Regardless of the fact
that the rural communities are the ones who pay for television sets and antennas, the transmission subsystem of Telesecundaria should provide them with maintenance and supervision services in order to guarantee good reception of signals. Often, television sets and antennas stop working and there is no one capable of repairing this equipment in such small poor communities. Obviously, this could account for some negative effects on students if they are not able to watch the programs as they were intended to be viewed. Thus, a maintenance area within each of the rediffusion stations of Channel 13 throughout the 16 states receiving the Telesecundaria signal must be established.

Supervision. As ironic as it might appear, the major problem within the supervision subsystem of Telesecundaria is that there is an almost complete lack of supervision at all the levels of the system, and especially in the various local communities where coordinators work. Indeed, the most critical part of the system, where there is an almost complete lack of supervision, is the teleclassroom.

If supervision was effective, coordinators would improve their teaching behavior and the students’ achievement could be even greater. Unfortunately, coordinators now give their students no introduction to lesson material prior to the telelessons, lecture and dictate too frequently, do not permit student participation, do not prepare their lessons as well as they should, and do not assist in individual work, among other problems (J. Mayo, 1973, pp. 26-27).

Although supervision is a very serious and important matter at
the teleclassroom level, it is also of primary importance at all stages within the system's operation, for example, at the teaching, production, evaluation, and management levels. However, besides the fact that there is an urgent need for control within every subsystem and at the macrolevel of Telesecundaria (see above), it is equally important to have supervisors to assist and evaluate the coordinators' and teleteachers' work.

In order to resolve this serious problem, I would suggest the introduction of a supervision division in each of the 16 states receiving Telesecundaria service. These divisions obviously would not be large departments in which hundreds of people work, but rather small ones belonging to and controlled by the supervision subsystem in Mexico City.

Finally, it is very important to note that the supervisors must have some kind of training before entering the system, principally in subjects such as: teaching behavior, television production, curriculum, evaluation and measurement of education, educational technology, and others, depending on the area in which they will work.

Evaluation. The evaluation process within Telesecundaria is currently restricted solely to the administration of tests to the students twice a year. This practice is intended to evaluate the students' achievement in each grade; if satisfactory the student naturally will be allowed to continue to the next grade until s/he graduates.

Regardless of this fact, the evaluation subsystem does not evaluate the system as a whole, nor does it function as a feedback mechanism
through which the system's output will be reintroduced to the
system itself for the purposes of analysis and evaluation, and thus to
control more effectively future outputs and effects of Telesecundaria
as a whole.

In my view, it is a mistake not to use this evaluation subsystem
more widely, since it is not sufficient for Telesecundaria to rely
exclusively on the students' achievement level as a means of evaluating
the whole system's overall performance and output, although the
evaluation of the students' achievement through tests is very important
to Telesecundaria, as well as any other kind of educational system.

As discussed above, through the use of a more effective evaluation
subsystem and a new feedback network, the results from the global
operation of the system will be given to the management subsystem
directly from the evaluation subsystem and from there to the other
subsystems as well, so that the most important results and effects of
the system upon both its target audience and on the rural communities
in which they live will be given prompt consideration, either for
decision-making purposes or to improve the system's output (global and
local) through the use of the various control subsystems.

Expected Outcomes vs. Obtained Outcomes

The main purpose behind all the changes and innovations proposed
in this analysis is to improve Telesecundaria for the benefit of its
students, the Mexican rural areas, and the entire country itself.
The changes and innovations that are proposed for Telesecundaria are not
intended to enhance its reputation for being one of the least costly
ITV systems operating today, but rather to enhance its usefulness for
the people whom the system was designed to serve.

As mentioned above, in 1973 the Mexican authorities requested that the Institute for Communication Research at Stanford University carry out a cost-effectiveness analysis of Telesecundaria. Through this research it was found that indeed Telesecundaria is a highly cost-effective system for extending educational opportunity; however, it does not seem to be closing the economic or social gaps between urban and rural students. [and] this pattern is likely to continue unless a new approach to rural education can be developed (Mayo et al., 1973, p. 117).

This thesis is intended to contribute to the closing of the gap between rural and urban students through the improvement of the instruction they receive through this system by focusing on the management of the system. However, Telesecundaria cannot do the entire job by itself. The federal government must provide this system, as well as the rural reas, with all the necessary elements for its development, particularly from an economic point of view.

Through replacement of an urban-based curriculum by a rural-based one, the introduction of several control subsystems, the introduction of an ongoing training service for Telesecundaria human resources, the use of Channel 13 to help broadcast television lessons, the use of supervisors at every major step within the system, the use of an efficient feedback mechanism, the recognition and use of an internal management subsystem, a continuous evaluation process of the system's output and its secondary and long-term effects upon the target audience and the rural communities, and the improvement of television lessons, I expect the development of a more accurate and useful performance of Telesecundaria will better relate to the needs and the reality of
present Mexican society.

Telesecundaria has shown certain malfunctionings within both its structure and operation; these malfunctionings need urgent action and consideration on the part of federal authorities. The suggestions made in this thesis could be used for this purposes.

Finally, if this study help Telesecundaria to receive more attention from the Mexican authorities, and if it also helps the authorities to implement certain changes and innovations within the system to improve the system's performance, then I would say that the most important objective of this work will have been accomplished.

An Improved Model of Telesecundaria: Beer's "Viable System"

Since there are many changes and innovations that are intended to be made within Telesecundaria, I have decided to divide the single "improved model" into four complementary models. It is hoped that these models will facilitate the understanding of such changes since it may be confusing to show, in one single model, all of the proposed changes. Each model is progressively more complex and self-contained than the preceding one, so that finally the entire process can be seen from a "microscopic perspective".

Model 3. In this first "improved model" (see Figure 10) of Telesecundaria, the entire system is shown through the use of three different systems. System one comprises the six operational subsystems which make up Telesecundaria (e.g. teaching, management, evaluation). Each of these subsystems has a different operational function which is shown on the left. On the left side of each operation, the particular environment of each of these subsystems is shown. Inasmuch as each
Operational subsystems of Telesecundaria have different tasks and operational levels. Each of them will be mostly concerned with that particular part of the overall environment that directly affects its functioning and with which it maintains a continuous exchange of information and materials. For explanatory purposes, each of the different environments has been numbered from 1 to 6; however, these numbers do not indicate themselves different systems. On the far right side of this model is system two, which is designed to control the system of Telesecundaria. This control system contains each of the five control subsystems designed for each of the operational subsystems of Telesecundaria with the exception of the student subsystem. As discussed above, such control mechanisms will try to minimize any deviation or malfunction within each of the five subsystems' outputs by comparing them against expected results. Finally, at the upper right side of the model is system three, which is the metasystem. This metasystem will monitor only the overall operation and output of Telesecundaria. It is made up of both SEP and OGEAD. Such a metasystem will not interfere directly with the decisions, operations, and results obtained by the system, but rather it will simply monitor the managerial action and thus act as a consultant to the system.

As shown in this particular model, there is an exchange of energy (e.g., resources and information) between the particular environments (1 to 6) and each of the operational subsystems (system one). Thus, the functioning of each of the subsystems in system one is necessarily closely related to the amount of exchange it obtains from its environment. After the operation of each system one is completed, then the output is sent to system three, through system two, for decision-making purposes.
Figure 10. The Proposed Viable System of Teleeducation.

Note: Adapted from "The Heart of Enterprise" by Stafford Beer, 1979, pp. 116-201.
and monitoring. As will be shown in the following models, the metasystem (system three) can be any of the different subsystems of Telesecundaria (system one). Thus, this particular model does not mean that either the SEP or the DGEAD would necessarily control the entire functioning of Telesecundaria, but might be taken as examples.

Model 4. In this model (Figure 11) the reader can see that new elements (improvements and changes) have been added. First of all, from left to right, each of the particular environments (1 to 6) belonging to each system one is included within a "major environment" (meta-environment). Such a meta-environment is that which surrounds the entire system of Telesecundaria. Another change that has been introduced in this particular model is the use of separate control subsystems (system regulators) for each of the subsystems (system one). With this practice each division of system one is controlled independently; however, a "general control subsystem" located at the managerial level within Telesecundaria still exercises control over the others. The incorporation of both alternators and amplifiers within this model is also one of the major changes. Both mechanisms should control the information flow passing through each of the various subsystems of system one, so that information overflow (noise) will be eliminated. If there is an open sharing of information at every step within the system (Telesecundaria), then communication will be successful and hence effectiveness and the decision-making process will be enhanced. In this model, the internal variety of the whole system is as high as that produced by both its environment and its operation.

On the right-hand side of the model, this particular diagram
Figure 11. Two different perspectives within the viable system of telesecondary.

Note: Adapted from "The Heart of Enterprise" by Stafford Beer, 1979, p. 130.
exhibits a great deal of flexibility, so that interpretation and applicability of the model at two different levels is allowed: level I shows how the entire model can be interpreted by taking the SEP, for example, as the metasystem of Telesecundaria, and taking subsystems 1 through 6 (system one) as each of the subsystems actually operating within the system (e.g. teaching, evaluation, students). On the other hand, at level II, this model can also be interpreted or applied to the study of Telesecundaria in a more "microscopic" way. This means that instead of taking the SEP, for example, as the metasystem, we can think of the management subsystem as the metasystem. Then, each of the subsystems 1 through 6 can also be seen as the different departments or divisions within the management subsystem, which in this case is the metasystem. Furthermore, in this particular model we can think of any subsystem of Telesecundaria (e.g. teaching, production) as being system three, or, in other words, the metasystem, and therefore taking subsystems 1 through 6 as their particular departments, functions, or divisions. If this model 4 is applied in this way, then each of the subsystems of Telesecundaria can be analyzed and planned in detail.

Model 5. Within this particular model (see Figure 12), two new systems have been introduced into the overall improved model of Telesecundaria: systems four and five. System four might be seen as an integral part of the metasystem of Telesecundaria. However, it is not put at a higher level than system three (in this model, system three is the management division of Telesecundaria) which would mean that system three was being controlled by system four. Rather, as Figure 12
MODEL 5.

SPECIFICATIONS

Variety in both directions

Variety in one direction

Variety

Variety, e.g., information

Variety Filters

Information Attenuator

Innovation Amplifier

Connections between operations


Figure 12. Proposed functioning of the viable system of Telesecondaria.
shows, there is a sequence in numbering the systems from the top of the model (system five) to the bottom (system one), for explanatory purposes. We can also think of system four, for instance, as being the managerial division of Telesecundaria and of system three as being the planning and evaluation department, which belongs to the management unit. That is, the names used in this model to classify each system, as in the past two models, are merely examples.

In this model we can see how both systems four and three continuously interact in an exchange of information, resources, decisions, etc. Moreover, the variety of information contained in such exchange is reduced through the use of both attenuators and amplifiers. At an even higher level, the "macroscopic" level, we find that this model also contains system five, which in fact only monitors the action or operation within the entire Telesecundaria system through the SEP (system four).

In this particular case, the Mexican political system is termed system five, since this system will have a monitoring function within this improved model of Telesecundaria. For other purposes we could think of the management subsystem as system five, and thus see systems four and three as the most important functions or divisions of this particular subsystem. However, at a more microscopic level, we can go even further in understanding this management subsystem because we can see systems two and one as the control subsystem of the management division, and the different departments contained within its structure, including their very particular operations, variety, and environments.

Another major innovation to be introduced and implemented within Telesecundaria through the use of this particular model is that the
operation of each of the system one elements is closely related through the use of specialized connections (e.g. meetings, group work). Furthermore, this model also shows how the different environments are also in a constant interrelationship.

Model 6. In this model (see Figure 13), the "recursion effect" is introduced and applied to bringing about a better understanding, analysis, and evaluation of the functioning of each of the components within Telesecundaria. In this particular model, three recursions are shown, from a general to a more specific or microscopic level of conceptualization of the system.

For example, let us think of the teaching subsystem of Telesecundaria as system one. Within this particular subsystem there are also different departments, divisions, or groups of people (e.g. teleteachers, producers, decision-makers) working on specific tasks which, when efforts are joined, will produce the global output of this subsystem. If we want to portray such specific operations and structure, then we have to use a model like the one presented here. Through this model it is possible to analyze the functioning and effectiveness of each of the departments which make up the teaching subsystem (system one). This system has to have a managerial unit which will coordinate and monitor the operations of each department. Thus, such a managerial unit operating within the teaching subsystem can be conceived as being system five for this subsystem. Systems four and three could be the evaluation and planning divisions (departments) of this particular subsystem. If so, then system two will fill the function of a control division (regulator) within the teaching subsystem. Finally, system one could be defined as,
Figure 13. "THREE RECURSIONS OF THE VIABLE SYSTEM"

NOTE: ADAPTED FROM "THE HEART OF ENTERPRISE" BY STAFFORD BEER, 1979, P. 328
being the different operational departments of the teaching subsystem, e.g., research, production, and resources.

However, it should be noted that a third recursion level within any of the system one divisions (in this case, the teaching subsystem) can be reached, if desired, by considering each of the different departments (e.g., production, research) as system one. If this is the case, then we can think of either the production or the research departments as being a managerial unit in itself which can be decomposed consequently into systems five, four, three, two, and one, as shown in this model. Using this practice and method of analysis, the researcher, manager, or educational technologist can study any of the various subsystems which make up an educational system or any other kind of organization thought of as a system. Furthermore, s/he can also portray the relationship between each department, division, subsystem, environment, etc. and the rest of the system.

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14 See Beer (1979) for a fuller understanding of the "viable system".
"To understand himself, man needs to be understood by another. To be understood by another, he needs to understand the other."

Thomas Hora
CHAPTER V
IMPLEMENTATION

Undoubtedly, if changes and innovations within a given system are to be effective, then certain considerations concerning their implementation must be taken into account by the systems analyst. In the present chapter we will examine the different and most important aspects to be considered when changes and improvements within Telesecundaria take place, as well as the implementation process itself. Before beginning this section, it should be remembered that the implementation process proposed in this last section is not intended to be a "rule of thumb" nor an exhaustive recipe, but rather a set of considerations that I think are necessary to understand for these changes and innovations to be effective.

The Economic and Political Aspect

One of the most important aspects of the implementation process of Telesecundaria is the economic factor. Without sufficient economic support from the federal government all the proposed changes and innovations are very likely to be impossible. In a previous chapter, I stated that a real commitment to the rural areas of Mexico must be given by the allocation of more economic resources to the rural communities as well as to the system itself.

It must be clearly understood that Telesecundaria cannot improve and develop either the students' learning or the rural areas if there is no economic support first. Furthermore, if the allocation of such economic resources is not given to the rural areas, education, including Telesecundaria, will continue to be seen by students, their families, and
the entire rural communities as simply a means of facilitating immigration to the already overcrowded cities in the vain hope of obtaining a better job and thus a better lifestyle.

Because of a lack of jobs and opportunities in the Mexican rural areas, it has been estimated that approximately 700,000 people migrate to Mexico City annually, principally from the states of Guanajuato, Guerrero, Hidalgo, Michoacán, Oaxaca, Puebla, San Luis Potosí, Tlaxcala, and Zacatecas (Cabrera, 1981, p. 31). Telesecundaria operates in five of these nine states. Furthermore, these five states—Oaxaca, Tlaxcala, Hidalgo, Guanajuato, and Puebla—have shown a high rate of population increase (i.e. 5.8 percent) (Consejo Nacional de Población, 1979).

Needless to say, in any developing country such as Mexico, economic considerations play the most important role in the achievement of development. Thus, in this case, education cannot be the exception. Therefore, in order for these changes to be implemented the federal government not only must provide the system with a bigger budget but also, and most importantly, must develop in the rural areas necessary economic infrastructure (e.g. resources, schools, jobs, hospitals).

In regard to the political aspect of this implementation, there must be a continuity in the decisions, objectives, and policies formulated outside and inside the system. Unfortunately, if there is a distinctive characteristic of the Mexican political system, it is the lack of continuity in the vast majority of its undertaken projects. It must be clearly understood that Telesecundaria depends totally upon the federal government, which not only provides economic aid to the system,

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15 Mr. Cabrera is the Federal Secretary of the Mexican National Population Council (Consejo Nacional de Población).
but which also decides its purpose and therefore determines its very existence and nature.

Hence, the improvement of Telesecundaria at any level fundamentally depends on both the sufficient allocation of economic resources and the continuity of policies, purposes, and decisions established by the federal authorities.

The Socio-Cultural Aspect

Like any other kind of social system, Telesecundaria is immersed in an environment in which hundreds of variables directly or indirectly affect its performance. In this section, we examine two kinds of variables that interact with and affect Telesecundaria: the social and cultural variables.

Probably one of the most important considerations within the social environment of Telesecundaria is the effect of population growth. Indeed, Mexico has been classified among the nations with the highest population growth rates in the world. According to the Mexican population council (Consejo Nacional de Población, 1979, pp. 12-27), Mexico's population growth rate is estimated at 2.8 to 3.2 percent annually; this undoubtedly affects not only education but the economic, nutritional, and social aspects of the entire Mexican population as well.

Referring solely to the educational consequences of this factor, in general, the higher the population growth rate, the greater the problems of providing educational opportunities to children and young people. This is even truer for a country like Mexico, in which the population under 19 years of age represents 56 percent of the entire country (Consejo Nacional de Población, 1979, p. 38).
Despite the fact that more schools are being opened every year and also that already operating educational systems like Telesecundaria are being enlarged in order to ensure educational opportunities to a greater number of students every year, a consistent and coherent policy and action regarding the control of population growth must be implemented if systems like Telesecundaria are to be effective and contribute to the development of the country.

Furthermore, according to Cabrera (1981, p. 30), Mexico's population growth is not to be controlled exclusively through traditional contraceptive methods, but rather through the improvement of life in the rural regions in order to stop migration to the cities.

There is a limit to the practice of enlarging educational systems like Telesecundaria to bring educational opportunities to more students enrolling every year. If this limit is reached, the system gradually will become inefficient in its structure and operation and as a consequence there will be a waste of money, of resources, and failure to attain goals. Moreover, even if improvements within the system are implemented in order to deal more efficiently with an increasing student population, the system will eventually exceed its capacity and collapse.

Hence, if Telesecundaria is to become more effective and efficient through the implementation of the changes and innovations proposed in this work, then the federal government must create a new and more feasible solution to the population growth problem; otherwise Telesecundaria and other educational systems will not be able to cope with the increasing demands of students. Specifically, such a solution to this population problem must involve an improvement of life in the Mexican countryside.
In regard to the cultural aspect of Telesecundaria and its implementation, if attitudes and beliefs towards education in the rural areas are not changed, then the most important feature of education—to provide the individual with the necessary intellectual tools for his own development through the practice of a job—will be undoubtedly lost. Education should not be seen as simply a means of leaving the countryside and thus competing in the already overcrowded job market of the cities, but rather as a means of helping to develop and create necessary job opportunities within the rural areas themselves.

However, this widespread misconception of the role and use of education among the rural population is not simply due to a lack of knowledge, but rather to a lack of help or support and real commitment on the part of the federal authorities to these peoples and to the rural areas in which they live.

Once again, Telesecundaria cannot change attitudes and misconceptions by simply offering a more rural-oriented education. It is also necessary that the federal government create the necessary economic and social infrastructure to help develop the countryside, and thus diminish or stop rural immigration to the cities. Without this government participation, no educational system, even the best ITV project in the world, can expect to change and help develop a more accurate conception of what education is all about. The attitudes towards the role of education prevalent in the rural population are hardly their "fault", as little has been done to improve their life and opportunities in the rural areas.
The Resources Aspect

The third aspect that must be taken into consideration when speaking about the implementation of changes and innovations within Telesecundaria is resources—human, financial, and hardware. It is obvious that without adequate economic support, proposed changes cannot be carried out. Furthermore, without sufficient economic support neither new personnel and more training nor more hardware resources can be obtained to help increase the capacity of the system as well as the effectiveness and the quality of instruction.

New personnel are needed within the teaching subsystem to assist the teleteacher in academic matters as well as to design more effective teaching strategies. On the other hand, more supervisors are also needed at every level of the system, including the teleclassroom, where coordinators work. Finally, more producers and directors are needed within the production/transmission subsystem, as division of labor is essential to the system.

It should not be difficult to find skilled people who would like to work for Telesecundaria, since there are hundreds of young people in Mexico, who have already finished their university studies in areas such as television, communication, education, social research, psychology, and many other fields, and who do not have a (permanent) job. After hiring all the necessary personnel, it is most important to train these people for their future jobs. It is also important to note that training will also be given to the already existing Telesecundaria personnel.

The acquisition of more hardware resources will be of great importance to the system. However, if Channel 13's facilities are to be used by
Telesecundaria, little or no additional purchasing of hardware materials would be needed since, as mentioned above, this channel is well equipped, including its extensive network of rediffusion stations throughout the country.

The Structural and Functional Aspect

One of the first steps that must be taken in the process of implementation of changes within Telesecundaria is the decision to translate the management subsystem from the outside to the inside of the system. It is also important that when this translation of functions is done, both SEP and Telesecundaria agree upon the definition of their roles and responsibilities.

After all these responsibilities have been established and defined, the next step should be a request to the federal government for more financial support to Telesecundaria. In order for this to be effective, a carefully structured plan of all the reasons for changes and innovations as well as of some possible effects on and to the system, on the students and local communities, and on the whole country itself, must be submitted to the authorities responsible for its approval. Reasons, effects, estimated costs, proposed changes and innovations, etc., should be carefully planned before a request is submitted.

If more financial aid is obtained, then the next step should be the opening of a training center, probably located in Mexico City. This center would offer specialized courses to teleteachers, coordinators, directors, producers, and supervisors. Such courses will be offered for a longer period of time than has been available in the past. At least six months of training should be given to both teleteachers and coordinators.
before they take up their jobs in the system. Furthermore, this training program must be operated on a continuous basis through the organization of seminars and other specialized courses. However, this extension of the training program depends on the amount of financial aid given by the Mexican government, not simply a reformulation of the management system.

During this time, the establishment of five control subsystems should be implemented. People who have already worked for the system should integrate the groups that should work within each of the control subsystems. Nevertheless, a specialized training in management science and cybernetics should be available to these people.

After the control subsystem and the training center are already in operation, a research group within the evaluation subsystem must start working on the preparation of a research project intended to measure and evaluate the effects of a new curriculum, the changes in the structure and teaching method of television lessons, changes in teaching behavior, and attitude changes towards education, in the target audience and sample populations within the various local communities. According to the research results, changes and innovations within all these areas should take place.

The management subsystem of Telesecundaria must always keep in mind that research must always be carried out before decisions, changes or innovations are taken. It is neither helpful nor effective to make decisions first, and then carry out the research project. For instance, the cost-effectiveness analysis that the Stanford Research Team made in 1973 should have been done when the pilot study was being made, in 1967, not seven years later. Similarly, the teaching observation study carried out
by Judith Mayo in the same year should have been done previously.

On the other hand, it is important that the production subsystem start using video-cassettes in order to alleviate pressures of scheduling under which production has been working. With the use of video-recordings, many television lessons can be re-used in the future, and thus money could be saved, in addition to the fact that teleteachers and production crews would be working under less time pressure.

Equipment maintenance, above all in rural areas, must be a permanent service from the system to its clients. This is something that should not be delayed any longer since problems with both television sets and antennas can jeopardize the students' progress.

Finally, a subsidy program must be established that is intended to help the rural patronatos and other family groups within the various communities afford the various expenses of their children's education (e.g. uniforms, textbooks, chairs). If this program cannot be implemented fully, at least the federal authorities should provide the communities with some less costly materials.

Continuous Evaluation and Planning

Needless to say, all these changes and innovations cannot take place simultaneously. Therefore, it is very difficult to determine guidelines by which the entire implementation process is detailed step by step. However, I have tried to provide some guidance in the order in which some parts of the implementation plan could be carried out. Some aspects need further research and evaluation, or feasibility studies, before such decisions can be properly made.
Nevertheless, if the implementation of such changes and innovations within Telesecundaria take place, it will be of primary importance to the system to elaborate a continuous evaluation and planning operation strategy for the best results of the whole implementation process.

It would be useless to implement changes and innovations without the application of research and evaluation. In fact, a continuous evaluation strategy must be the "master key" in the improvement of Telesecundaria. The evaluation of the system's efficiency and effectiveness must be an ongoing process for Telesecundaria; otherwise, malfunctionings and weaknesses within the system will not be detected in time and will be even more expensive and harder to correct.

The continuous readjusting of the system against its operation pattern is of primary importance if a homeostatic level is to be achieved and entropy defeated. If homeostasis is achieved, then the system will be able to cope more effectively with the environmental variety that surrounds it, and then both efficiency and effectiveness will be enhanced.

Through evaluation, the system would not only be able to reach a homeostatic level and to adapt itself more effectively to changes in the environment, but will also be able to use the information gathered to plan its future performance and the changes within its structure more carefully. Without evaluation, there is no planning and hence neither efficiency nor effectiveness.
CHAPTER VI
CONCLUSIONS

This study has found that although Telesecundaria is a relatively inexpensive system and is capable of reaching thousands of young students dispersed throughout rural communities in Mexico in a way which appears impossible through the traditional secondary school system, it also exhibits several malfunctions and anomalies which considerably reduce both its efficiency and effectiveness as an educational system and therefore jeopardize the students' achievement and performance.

Indeed, although Telesecundaria appears to suit the perceived educational needs of Mexican rural students, its efficiency cannot be said to be optimal, nor adequate to the development needs of Mexico, since rural students continue to perform at a lower level than their urban counterparts. Furthermore, this system does not help narrow the economic and social gaps between urban and rural students (Mayo et al., 1973).

For Telesecundaria to become more efficient and effective, and better meet both the present needs of the Mexican rural areas as well as those of the entire country, this system should implement several changes and innovations within its structure and operation.

Among the most important changes and innovations to be implemented by Telesecundaria are the following.

1. The establishment of an internal management division (subsystem) which will be responsible for the entire system's operation.
2. More and better trained personnel at the various levels of the system, principally at the local community level, where coordinators work. Training must be an ongoing process.

3. More financial support is needed for the system to become more efficient in expanding educational opportunities to other states where there is a lack of schools. In addition, Telesecundaria requires more economic aid from the federal government in order to improve its operational needs. Without adequate financial support, none of the proposed changes and innovations can take place.

4. Telesecundaria lacks the variety necessary to deal effectively with its highly unpredictable and changeable environment. If this system is to cope effectively with such external variety and thus achieve a homeostatic level, then the system should introduce control within its structure and operation inasmuch as "only variety can destroy variety".

5. If Telesecundaria is to be effective in promoting the development of the Mexican countryside, to fill present educational needs, and to decrease urban migration, then this system should consider the introduction of a more rural-oriented secondary school curriculum.

6. If accurate decisions are to be made in time, a feedback mechanism should be implemented, linked to the evaluation
subsystem. This feedback mechanism would not only evaluate student achievement and performance, but also the secondary effects of the system's output upon its target audience and the various local communities.

7. Telesecundaria cannot continue to operate under a tight production and broadcasting schedule since this practice has been shown in the past to be affecting negatively the quality of television lessons, among other outcomes. Therefore, the use of a new channel (possibly Channel 13) and the use of video-recording should be of primary importance to the system.

8. Finally, a continuous planning of the performance and structure of the system, based on feedback results and the scanning process of each of the various control subsystems located within each of the five major subsystems of Telesecundaria should be an ongoing process which should lead the system to a homeostatic level, to adapt itself to change in the environment, and to perform in a teleological way.

The high costs that the implementation of such changes and innovations would represent to the federal government certainly present a problem. However, a real commitment to develop the countryside on the part of the federal government can only be understood in the manner in which it supports such development. The aim of Telesecundaria should not be to become the least expensive system using television as an
instructional medium in the world, but rather to become more efficient in the fulfillment of its task. Development, it must be understood, is not a low-cost process.

But economic support alone to Telesecundaria will not solve the entire problem of developing the rural areas, since it is also necessary for the federal government to create the necessary economic and social infrastructure that will provide education with fertile ground for progress to develop. There is an urgent need to bring to the Mexican rural areas all necessary incentives for keeping people from migrating to the already overcrowded Mexican cities. Students graduated from Telesecundaria are needed more in their own local communities than in any of the big urban centers. If all of the above-mentioned innovations and changes cannot become reality, then Telesecundaria will not be effective in the carrying out of its task, since for education to become effective, it must be accompanied by other social and economic changes.

Thus, the economic aspect is only one that could either help or nullify the performance of Telesecundaria as an agent of change and development. Another is the population growth rate, which constitutes a threat not only to education but to the entire development process as well. If the federal authorities do not make even greater efforts to control this problem, Telesecundaria or any other kind of instructional technology project will not be able to cope with the high annual increase in the number of students.

If Telesecundaria is expected to become more effective than it has been during the past 14 years of its existence, not only should the changes and innovations that have been proposed in this work be implemented,
but other economic and social changes as well. Education is not
and should not be thought of as the magic key that will bring us to
the horn of plenty, but rather as a complement to the development
process. Education should not be used to magnify nor conceal an
insincere commitment to develop rural areas, but as a means of
developing new opportunities and better lifestyles.

No change or innovation should be carried out without its
being first carefully tested and evaluated, not only on a short-term
basis, but long-term as well. We, as educators, must bear in mind
that often the most important and valuable educational outcomes of
all take years before they become a reality. Therefore, we should
pay more attention to the future by planning it carefully.

According to the most recent information which could be obtained
concerning Telesecundaria, both the Secretariat of Public Education
and the Radio, Television, and Motion Picture Direction (Dirección
de Radio, TV, y Cinematografía) are working on a plan to convert
Telesecundaria into an "Intensive Telesecundaria". This would mean
that a student enrolled in the system, instead of completing secondary
studies in six semesters (three years), could complete the entire
secondary school curriculum in only ten months (Toussaint, 1981, p. 55).

Once again, many decisions are being made without careful
planning and evaluation. Furthermore, many of these haphazard decisions
are being made by people outside the system. Once again, we can see
that short-term planning, if any, is more important for the Mexican
authorities than long-term planning. Now, more than ever, all the proposed
changes and innovations discussed in this thesis need urgent consideration
and careful implementation if both education and development are to progress
Finally, it is my hope that this work will stimulate and provide a certain amount of insight to those who wish to pursue further research in this area. It is also my hope that this work will be used for the benefit of all those students in rural México who study through Telesecundaria.
APPENDIX A

Beeby's Theory of Educational Development
Beeby's hypothesis states that all educational systems develop through four stages:

1. **First Stage.** In this stage the majority of teachers have little general education and almost no professional training. Because the school curriculum at this stage is frequently vague (or non-existent), the teacher is the sole authority for knowledge. The students' school day consists largely of rote exercises, memorization, and choral drills.

2. **Second Stage.** In this stage teachers continue to possess relatively little general education, but they now have more professional training. Authority is concentrated in an official curriculum, and teachers generally lack the confidence to adjust the curriculum to the interests and needs of their students. Students continue to be passive receptacles for the knowledge supplied by teachers.

3. **Third Stage.** In this stage teachers have more general education than in the previous stages, and they are better trained. They follow the official curriculum with less rigidity. Teachers' increased professional preparation raises their self-confidence and stimulates them to enrich the school day with special projects and audio-visual aids. Students actively participate in the learning process.

4. **Fourth Stage.** This stage includes teachers with a great deal of general education and professional preparation, who
stimulate their students to think for themselves. The learning process is individualized to relate to the needs, interests, and abilities of each student. Much time is devoted to projects, problem solving and exercises chosen by the students themselves.

(Beeby, in J. Mayo, 1973, pp. 3-4)

NOTE: A more detailed discussion of Beeby's Theory can also be found in Michael Young's book, "Distance Teaching for the Third World" (Routledge and Kegan Paul, ed.).
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