SIMPLIFIED METHODOLOGY FOR THE PREPARATION AND EVALUATION OF EDUCATIONAL INFRASTRUCTURE PROJECTS

15th May 2016

Table of Contents

Introduction

This methodology is aimed at facilitating the preparation and evaluation of educational infrastructure projects that are presented before the public investment management system (PIMS) and are intended to become part of the public investment program (PIP). This version is based on the Chilean methodology applied after 2013, with some improvements[1].

This methodology has six chapters: the first chapter describes the theory underlying this methodology and the background of the education sector; the second indicates how to perform the diagnostic and how to determine the specific problem. The next two chapters deal with the identification and definition of alternative solutions to the problem; the sixth is how to evaluate the alternatives and how to select the best and lastly how to present the chosen alternative, which will ultimately be the investment project.

1 Theory on Which this Methodology is Based and Background of the Education Sector

The right to education shall be accessible to all inhabitants of the country, because the role of education is defined in the context of the provision of equal opportunities and freedom of education.

The educational system encourages private initiative in the administration and financing of education, while ensuring equal opportunities for all citizens, thus directing public resources primarily to a lower-income population.

The educational system is characterized by the decentralized management of educational institutions. This work is done by local governments (municipalities) and municipal or private corporations, leaving the Ministry of Education in a regulatory and supervisory role.

Overall, the implementation of investment projects in education is aimed at contributing to the improvement of the physical infrastructure of the educational system, adapting its facilities, to thereby improve the nursery, kindergarden, primary and secondary educational levels.

Investment in physical capital (building infrastructure and purchasing equipment) is complemented, among other things, with the implementation of curriculum innovation innitiatives, teacher training and supervision. The implementation of those initiatives, along with government subsidies that finance the operation of the educational

[1] METODOLOGÍA PARA LA PREPARACIÓN Y EVALUACIÓN DE PROYECTOS DE EDUCACIÓN. División de Evaluación Social de Inversiones, Ministerio de Desarrollo Social, Gobierno de Chile 2013.

[2] Remember that the "fundamental means" of the solution tree are the exact opposite of the “root causes” of the problem tree. So when looking for actions that could implement those fundamental means, we are solving the root causes of the detected problem.

[3] There is an exhaustive set of education indicators, categorized according to input, context, process and output framework and recognizing the hierarchical nature of education systems (distinguishing a national system, school, classroom and individual student level). Specific attention is given to outcome indicators. Outcome indicators are further differentiated as output,

institutions and other sector programs, aims to increase the efficiency of the educational system.

In general, investment initiatives done by the government in matters of infrastructure and educational equipment are targeted to increases in coverage, increased capacity, improved educational services, among others things; i.e. with project implementation, a new or better service is provided, services whose social profitability is guaranteed and supported by existing sector policies or through previous studies.

Empirical evidence suggests that the national income growth in a nation cannot be fully explained by the growth rate of traditional production factors, such as capital, land, the quality improvement of productive resources and the adoption of new technical processes. Implicit in this empirical evidence is the importance of improving and increasing the stock of available human capital in the economy.

In the human-capital economics theory, individuals are considered to be endowed with a given, initial educational capital stock whose monetary value can be considered equivalent to the present value of their life long income stream. Through the educational process, it is possible to generate additional knowledge and skills that adds to the available stock of human capital in the economy and which determines the ability to generate additional income in the future. Thus, education can be considered as an investment flow in human capital aimed at developing additional productive capacities in individuals. This investment obviously implies a sacrifice of present consumption (i.e. costs) but it also generates certain benefits into the future, therefore it is theoretically and practically possible to determine the profitability of the investments done in education by comparing its costs and benefits, both in present value terms.

Evaluating investment projects in education is a technical exercise that is conceptually no different from evaluating any other investment initiative; identical aspects in matters of projection of future flows of costs and benefits and discounted cash-flow analysis have to be made. However, in this particular case, the monetary valuation of the future benefits derived from an education project requires information about the profile of future jobs and salaries for the target population, those projections are normally difficult to elaborate. For this reason, it is normal and customary in many countries to use a simplified cost-effectiveness criterion for making investment decisions in this sector.

This cost-effectiveness decision rule is based on the assumption that the benefits of investments in education infrastructure are evident and need not be calculated. The criterion is therefore to choose the project alternative that achieves those same benefits at minimum cost. This assumption is backed by public policies that allocate resources to investments in educational infrastructure considering it socially convenient and profitable, because they increase the human capital stock in the economy.

2 Diagnostic of the Current Situation

In the diagnostic phase, what has to be done is to analyze all the variables that identify, describe, explain and measure the problem or deficit that has been detected. The importance of defining clearly and precisely the root problem is that it establishes the basis for identifying the project and suggests alternative solutions. In order to perform a comprehensive analysis that allows a good identification and understanding of the problem, it is essential that the team performing the diagnostic be multidisciplinary. Obviously, the entities that are directly affected by the problem have to be involved, also the managers of the educational system in the project study area, experts or specialists (if the situation warrants) and members of the educational community (teachers, principals, administrative staff, students, representatives of parents, local/municipal public officials, etc.). The diagnostic should be a participatory exercise involving all key stakeholders.

In general terms, the development of the diagnostic comprises the following steps:

- Identification of the root problem.
- Definition of the project study area and its area of influence.
- Determination of the current and projected (future) demand for educational services.
- Determination of the current and projected (future) supply of educational services.
- Determination of current and projected (future) educational indicators.
- Calculation and projection of the deficit or gap.

2.1 Identification of the Problem

One type of problem refers to an inconvenient or dissatisfactory situation or a negative fact that occurs to stakeholders. It can be produced by the lack of a good service or by the existence of something considered bad. Basically, it refers to an unsatisfactory situation that cannot be resolved autonomously by those who are affected by it.

The importance of clearly defining the root problem is that this definition will provide the basis of establishing a project that resolves it. This project should always be formulated in such terms that it effectively solves the root causes, not the symptoms, of the identified problem. Avoid defining the problem as the absence of a specific solution, since this approach involves a lack of project alternatives. A problem that has been defined as “the lack of a specific solution” can obviously only be solved with the one predetermined alternative.

Any investment project in the education sector should contribute to achieving the strategic goals and objectives set by the government for the sector. But at the same time, the project should have as its immediate objective solving specific, clearly identified problems.

For the purposes of this methodology, there are two situations that have to be distinguished because they determine how to address and analyze the problem. These are:

1) First situation: When there is an existing school or educational establishment in the area where the problem was detected.

2) Second situation: When there is no school or educational establishment in the area.

The first situation means that there is an existing school or educational establishment, but the service that it provides does not achieve the goals and objectives set by the national educational system. In other words, it delivers educational services but not in optimal conditions, either because there is a deficit in the quality of its services or a lack of capacity of the existing facility to meet current enrollment and/or future potential demand, or insufficient training of teachers, or existing infrastructure in poor condition, or a combination of many of these factors, etc.

The second situation is one where a school or educational establishment does not exist in the area; in that case, the requirements that the national educational system demands will not be satisfied. In other words, there is a geographic area or segment of the population that is not being serviced or attended; this area does not have access to education according to the goals set for the national education sector. Thus, there is a deficit of coverage or capacity to provide educational services, which may be associated with lack of infrastructure.

The existence of these two different situations clearly reinforces the importance of clearly defining the problem at hand in the first place – because this definition is the basis for designing the solution/project. If the target is wrongly chosen/selected then the project, assuming that it is correctly designed and implemented, may be very successful at hitting a wrong target. The definition of an action plan, the decision to carry out the project and its posterior implementation will all depend on how precisely and clearly the problem was specified.

Once the root problem affecting a facility or specific area has clearly been defined, it is necessary to describe the problem in as much detail possible (the level of detail will depend on the level of analysis performed, i.e. project profile, pre-feasibility or feasibility study). But in general, this description should address the following aspects at least:

A) State all possible minor sub-causes defining the main root cause of the problem that must be resolved.

B) Define, a priori, if this is a problem affecting one or several existing schools or educational institutions, or if the problem consists of lack of coverage or service in a given area.

C) Determine the geographical location of the problem that has been identified. Initially this location can only be an approximation; later the different levels of analysis should allow for the fine-tuning of the specific and exact geographic limits.

D) Take into consideration how the problem was detected or discovered. This will require verifying whether the information is reliable, investigating where it came from, when it was updated, and what the frequency of the measurements was, etc.

E) Determine how long this problem has been in existence without being settled. If it is not a recent situation or occurrence, you must estimate how long it has existed and also find out if it has been addressed previously (obviously without success). If there was any action done to address the situation, it is important to know when it was executed and if there is information on the impacts and results. Most likely, if some investment decisions took place within the last five years, it was a partial solution or it may have only solved the symptoms or immediate problems, but not the root problem or, at worst, it may have been a failed solution or a bad project. The important thing is to rescue the experience of those who detected the problem, designed and implemented the solution and did the diagnostic and analysis that was carried out at that time.

F) Lastly, to effectively describe and communicate the problem, it is very useful to describe the context and the immediate surroundings of the situation, i.e. briefly indicate the socio-economic and cultural characteristics of the population, geographical location, etc.

Setting the correct scale and dimensions of the identified problem is a fundamental part of demonstrating and arguing about the relative urgency of a given situation. The basic issues to be resolved at this point are:

G) Determining who detected the problem, what was the source of problem detection. Normally, when the stakeholders that are directly affected raise the problem, it is because it is a situation that has not been addressed by higher levels of government and its consequences are still being felt clearly. On the other hand, if it is a problem that was detected through other instances, it is important to find out how those whom it directly affects perceived it, for example, teachers, parents or tutors, neighbors, among other people, for the purpose of looking at the system from within in order to validate the proposed solutions.

H) Determine a priori which part of the population is being affected and their socio-economic and cultural characteristics.

I) Where appropriate, compare the problem parameters with either international, national, regional and/or community indicators in order to provide objective indications of the existence of a real problem.

J) Determine for how long this problem has been in existence, and estimate for how long it could continue. This provides an indication of the relative urgency of solving the problem.

Regarding the expected evolution of the problem, the emphasis at this point is to estimate what could happen if no action is taken to resolve it. For this purpose, it is important to consider the following:

K) Educational services that will not be delivered, or those that are being provided but not in optimal conditions and/or those that will have to be suspended in the short term if the project is not executed.

L) Compare the current population that is being affected by the problem with the projected population that could be affected, if no corrective action is taken. Normally, this estimate can be made with the help of interviews with experts in the field or existing technical reports.

2.2 Definition of the project study area and the area of influence

What comes next is the definition of the geographic areas that limit and draw up the boundaries of the analysis of the problem that has been identified. For this purpose, two levels of analysis are defined. The first is known as the project's study area and the second is the project's area of influence.

The project's study area is a geographical area that serves as a first reference that helps to provide context to the problem. The study area provides limits for the analysis and it facilitates its implementation. In contrast, the project's area of influence has to be much more specific; it should narrow down these reference limits, generally to a specific area where the problem directly affects the population and where the alternative solution should probably be located.

At this point, the fundamental elements that help defining the project's study area are provided. First, the factors to be considered in defining the study area are analyzed. Secondly, some guidelines for the construction of a location map that clearly visualizes the study area and its main characteristics are presented.

2.2.1 Delimitation and characterization of the project's study area

Clearly defining the study area will greatly facilitate the development of a good diagnostic. This is the area that defines, in the first instance, the geographical boundaries where the problem under study has to be quantified and measured.

* In the absence of a school or an educational institution in the location where the problem has been detected, the center of gravity or reference for the definition of the study area should be that area that is not being served by the educational system. In this case, the study area should comprise all schools or educational establishments where the project beneficiaries are currently going or could eventually go in the future.

* Conversely, if there is a school or an educational institution in the same location where the problem has been detected, that school shall be taken as a benchmark to determine the study area. In this case, the study area should be the entire area in which all possible alternative schools are located. However, the gravity center of this study area should be

the school that generates the problem. A given school can be considered an “alternative school”, meaning that most of the target population has easy access to it.

For the delimitation and characterization of the study area, it is advisable to consider the following elements:

- Network of existing schools or educational institutions.
- Relevant limits.
- Accessibility conditions.
- General characteristics of the study area.
- Administrative aspects and features of the educational system.

2.2.2 The network of existing schools or educational facilities

This network is composed of all those educational establishments that provide some form of educational service in the analyzed geographic area, regardless of the type of administration and financing they might have. If there is an establishment that is creating the problem, it will also be a part of this network, and it shall become the focus of the analysis; the study area shall include the area influenced by that establishment. On the contrary, if the problem is more general, affecting more than one school or a certain area, the study area should be large enough to include the area influenced by the entire network of establishments.

Some sources of information that might help to identify this group of schools/establishments are the following:

- Statistics of the school/establishment that is the focus of the problem.

If the problem can be isolated to one particular school or facility, then statistics on current and past enrollment, drop-out rates, the data of those schools from where the students were transferred, the student home addresses, etc. will be very useful elements in identifying both the problem and alternative establishments.

For example:

Let us assume that a given high school (A) currently has a high level of congestion, i.e. its facilities are saturated (packed full). The enrollment analysis showed that the students in high school A increased significantly only in the last two years. A more detailed study of the history of the students admitted during that period detected that the majority came from another high school (B) that is closely located. Consequently, it is necessary to study in detail the situation of high school B, because congestion in A could be explained by problems in the infrastructure of high school B or to a poor quality of education provided in that high school. Therefore, the root problem is not located in high school A, but in B.

- Local government or municipal educational statistics.

Statistics in the municipal area, such as those from the last census, or data on enrollment in schools in that municipality, will help to identify those educational establishments that may be considered part of the network.

In the example cited above, the study of student enrollment of all secondary educational establishments in that town or municipality has found out that two other schools, one private (C) and one municipal (D), showed a significant increase in their enrollment over the past two years. Therefore, these two schools, C and D, should also be considered part of the school network under analysis, since their increase may be due to a transfer from the establishment (B) that showed problems or from school (A) that was congested; therefore, they have to be considered as alternative schools for both A and B.

- Direct interviews with the community and stakeholders.

When there are no other statistical sources of information, or as a complement to and verification of existing data, interviews with community representatives (e.g. parents of students) or surveys may be used. These interviews will be aimed at determining how the community perceives the problem and how it is currently coping with it. This will not only facilitate the identification of the alternative educational establishments to be considered in the network but contribute ideas to generate alternative solutions.

- Information at the regional/provincial level.

When the administration of the education sector is performed at the regional or provincial level, or if coordinating bodies at those levels exist, it will be appropriate to review regional/provincial data. This can be especially useful when dealing with problems that exceed local, municipal or community boundaries, as in the case of specialized education projects (for example, differential education [for handicapped children] or technical education).

- Statistics of the Ministry of Education.

Often the Ministry of Education collects detailed statistical information on enrollment in educational institutions in the country; in many cases, this may also include private schools or establishments. This information can be very useful in identifying private establishments that could be considered as alternatives to public facilities in the study area or to better identify the problem.

Continuing with the previous example:
Suppose that the statistics on teacher training programs in the Ministry of Education show that teachers from establishment (B), with the high attrition of students, have not been participating in such programs in recent years. This could be one cause of the inferior quality of the education provided by establishment (B) and the exodus of students into schools A, C and D.

2.2.3 Relevant Limits

Once the set of establishments that make up the network within the study area has been identified, the next thing is to set the relevant limits that frame the problem. The determination of these limits can be provided by:

- Geographic boundaries.

The existence of geographical features (for example, lakes, rivers, streams, hills, forests, etc.) within the study area may make it too difficult or too risky to access the schools from certain areas. In such cases, these geographic accidents define one or more boundaries within the study area.

- Administrative boundaries.

If the administration of the educational system is decentralized, the community or town boundaries or the regional/provincial limits shall define other relevant boundaries for the study area. Sector authorities only have an opportunity to seek a solution to the identified problem inside their jurisdiction.

- Other obstacles may also determine the study area limits.

Existing urban infrastructure in the area can determine other limits. A highway or a busy road, a railway line, an irrigation canal, an airport or a large fenced property, etc. could all become study area boundaries or obstacles, because they make access to the alternative schools very difficult or even dangerous.

For example:
An irrigation canal crosses the area, cutting the access of many residents to the school. In this case, an alternative to building a new school or expanding an existing school could be a project to build a new bridge or pedestrian gateway to facilitate access to the alternative schools or educational establishments. In this case, the study area will extend beyond this geographical accident or obstacle.

2.2.4 Accessibility/approachability conditions

Conditions of access that are existent in the entire study area must be determined, as it is important to identify where difficulties may arise. This accessibility is conditioned by the existing means of transportation or by the operation of the transport system. Usually, the accessibility conditions are given by:

- Existence and quality of access roads.

This factor can be very important, especially in projects located in rural areas where, even though physical distances may not be very great, access roads may not exist or, if they do, they may be in such poor condition that they prevent the passage of vehicles. This type of factor could explain the high absenteeism rates in schools; therefore, the alternative solution to this problem could be to solve the access problem instead of

investing in new schools or expanding existing ones.

- Public transportation.

In both urban and rural educational projects, it may be the case that the public transportation system does not have enough capacity, or that its frequency may be too low to satisfy the transportation demands of the school population. This factor may also set limits to the study area, or can justify an alternative project that improves the public transportation service. In the latter case, the boundaries of the study area must be extended as far as it is reasonable to extend the possibilities of access.

- Fees and fares of the public transportation system.

In some other cases, existing public transportation may have adequate capacity and frequency but the ticket price charged may leave low-income sectors without access to buses. In such a case, and assuming that lowering the transportation costs is not feasible, the study area shall be limited to one perimeter where access is possible only by the means used by the target population (e.g. on foot, horseback or bicycle). Keep in mind that one alternative project may be to provide low-income students with transportation vouchers; this may be cheaper than building a new school.

- Weather conditions.

When studying accessibility, it is important to consider the effect of weather. Extreme weather conditions like cold, snow, flooding of rivers, etc. can significantly vary the characteristics of accessibility from one season to another. If problems such as those mentioned are frequent and there is no possibility of avoiding or reducing them, it is necessary to limit the study area to one that provides adequate accessibility throughout the year, or during the period of project implementation in the case of some initiatives (for example, a literacy campaign). However, it may also be appropriate to consider the alternative of changing the school's academic calendar in order to better use those periods of benign weather.

- Public safety conditions

It may be the case that access to a certain school or educational establishment or to a given neighborhood puts students and teachers at high risk of criminal attacks or gives rise to widespread insecurity. In such a case, and if it is not viable to improve in the near term the conditions of public safety, these problem areas shall influence the boundaries of our project study area. Of course, this can also be a factor in high dropout rates.

2.2.5 General Characteristics of the Study Area

To clearly define the study area, it is important to know the characteristics of the area and population. Some features that should be specified are:

- Type of zone

Specify whether the area is urban, rural or a mixed zone. Whatever the case, it is important to note, by sectors if necessary, what the population density is in the area.

Example:

Suppose that enrollment of new students in an agricultural school has suffered a marked decrease. Studies reveal that there has recently been considerable industrialization of the entire area, transforming vast tracts of agricultural land into industrial parks and housing. As the characteristics of the area have changed from rural to urban, there will obviously be a consequent reduction in demand for training in agricultural matters. Therefore, to invest in expanding the premises of that agricultural school will be add to the problem, not to the solution.

- Socio-economic conditions of the population

The specification of the socio-economic conditions of the population within the study area should include aspects such as income levels, housing conditions, education levels by age group, family composition, etc. In general, all those aspects that may influence or determine the definition of the study area are relevant. Here it is useful to refer to data provided by socio-economic surveys or census.

- Location of the population according to socio-economic stratification

Although there may be no geographical obstacles or physical barriers that help us to define our study area, it may be limited by the location of the population whose problem we intend to resolve. It is important to know the distribution of the population in the study area in terms of socio-economic stratification, and to define homogeneous areas according to this feature of the population, indicating in each stratum the number of inhabitants and location on the map. In any case, this factor should be considered in conjunction with accessibility, since part of the potential population or troubled population could be excluded by inaccessibility.

For example:

Public school (F) was created three decades ago with the purpose of addressing some extreme poverty sectors located on the banks of a river. Currently, school F shows serious deficiencies in its infrastructure. The Ministry of Education has requested funding for refurbishment. However, a study of the socio-economic characteristics of the population living in the study area has revealed that the extreme-poverty population disappeared from that locality years ago.

Nowadays, new medium- and high-income families occupy that area. And these new families do not send their children to public school (F). Therefore, students in school F no longer come from the riverbank but from new low-income populations located many kilometers away. Consequently, the project to refurbish school F has been scrapped. The school land was sold and with these resources, a new school was built near the area where current students came from.

- Infrastructure in the area

It is desirable to identify the existing conditions in terms of infrastructure in the study area. Aspects such as the availability of potable water or sewage systems shall affect sanitary conditions. And the existence of streetlights, police and fire stations affect public safety. All this will influence access to the educational establishment and the quality of service that can be delivered.

- Cultural aspects

It is important to analyze the existence of traditions, habits and customs or other cultural aspects that can determine the boundaries of the study area. The use of traditional dress, the use of dialects or local languages, eating habits, the possibility of mixed classes (i.e. boys and girls together), the relationship of parents and students with their teachers, etc. are all important aspects for study, especially when the problem is located in, or includes, areas other than those of the predominant ethnic groups in the country.

2.2.6 Administrative Features

Finally, as additional background information for the analysis, one must know the type of administration that operates the network of educational establishments in that area (if it is a national or a decentralized public administration, or private corporations, or parent centers, etc.). It is also important to know the type of financing and budget that each of the educational establishments has. These issues can significantly affect the viability of alternative solutions to the problem.

2.2.7 Map of the Study Area

Once all points mentioned above have been analyzed, all this information has to be transferred into a map of the study area. This does not require a very precise cartography. Initially, just a good sketch or roadmap where the following data are reflected may be sufficient:

2.2.7.1 The Boundaries of the study area:

Indicate each of the relevant limits that have been identified, specifying what type of limit (geographic accidents, administrative limit, city limits, etc.).

2.2.7.2 The location of the educational-establishment network:

Show in the map each of the identified educational establishments of the network. If

possible, indicate for each type of institution (whether it is public, private, mixed, etc.) the type of teaching it delivers (pre-school, primary, secondary-high school, humanistic and scientific, technical and vocational, etc.). Where possible, also indicate the distances between settlements, measured in units of travel time.

2.2.7.3 The location of the population:

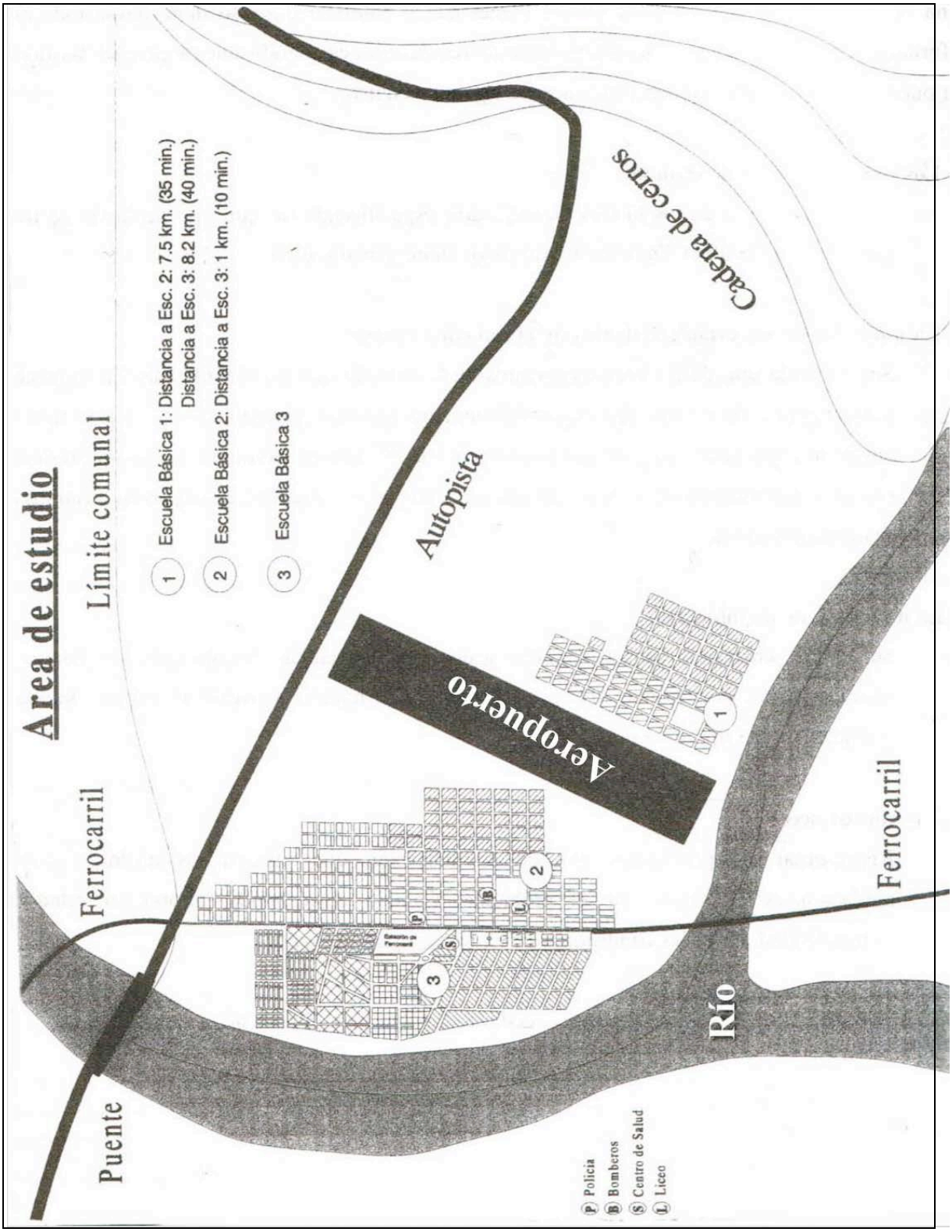
Show in the map the location of the different population groups identified and their socio-economic classification or strata if possible. This can be done by blocks, by neighborhood units or other areas.

2.2.7.4 Roadways:

Show in the map the main roads used by different population groups affected by the problem. Where appropriate, note their status and accessibility depending on the weather or time of year.

The following illustration represents an example of a map of a study area.

Diagram 1: Map of the Study Area



2.2.8 The Area of influence of an education project

The “area of influence” of an education project corresponds to the geographical area that includes the network of schools or educational establishments to which those who are affected by the problem could have access.

The study area of a project should be considered as a preliminary sketch, a rough drawing of the area where the problem occurs. Whereas the area of influence is a detailed zoom-in of the study area, where potential alternative solutions will be analyzed. The area of influence may be equal to the study area or a subset of it, depending on the limits established for both.

To determine the limits of this “area of influence” it is necessary to define a priori, according to the problem, some of the most important characteristics of the educational services to be delivered. In this sense, to state that “the beneficiaries effectively have access” means that the given area exhibits the minimum conditions for the population to obtain – without difficulty – the benefits that the educational system aims to provide (i.e. according to the recommendations of the sector authorities and the type of problem detected).

It is important to clearly define the area of influence because it marks the geographic limits within which a project could become a real solution to the potential population. For a proper identification of this area, it is advisable to consider the following factors at least:

- Location of the potential population.
- Conditions of accessibility.
- Socio-economic conditions.
- Level and type of education.
- Administrative features.

2.2.8.1 Location of the affected population

It is necessary to have a thorough knowledge of the geographical location of the potential population and/or the population that is currently affected by the problem, both those who are directly affected by it and those who are indirectly affected. This aspect, taken together with accessibility, will ultimately determine the alternative locations of the project.

2.2.8.2 Accessibility conditions

The area of influence of an education project should cover, as far as possible, a homogeneous geographical area that presents favorable access throughout. If these accessibility conditions are not available, the analyst should consider whether there are the means to facilitate proper access in order to prevent this condition from interfering with the provision of the educational service. In addition, the area of influence should include limits within which accessibility is relatively uniform for the entire population of the defined area.

For example:

If the map of Figure 4 is closely observed, it should become evident that the railway line divides the city in two and thus hinders communication between the two sectors. However, this accessibility problem can be solved rather easily by enabling new railway crossings. On the other hand, the location of the airport completely isolates one sector of the city; in this case, there is no easy way to connect the isolated city sectors. Thus, the area of influence of basic schools (2) and (3) may be extended beyond the railway line, but only up to the airport.

2.2.8.3 Socio-economic conditions of the affected population

The influence area should cover an area in which the socio-economic conditions of the affected population are somewhat homogeneous. In other words, where the income levels of most of the affected population are similar (within a certain range). This is in order that the proposed education service suit conditions at that income level.

2.2.8.4 Level of education to be imparted

One factor to be considered in the definition of the area of influence, where it is appropriate, is related to the different levels and courses that shall be imparted by the school or educational establishment, assuming that the problem was been detected there. This has a directly relationship to the age of the student population to be served.

For example:

If a given school shall only deliver the primary or basic level, then the age of the student population served by this educational level should fluctuate approximately between 5 and 15 years of age. In this case, the influence area is set usually by reference to a travel time, between 15 and 20 minutes, provided that the full extent of the area has favorable access conditions (i.e. considering all transport means that enable and facilitate access). This is so because it is assumed that children of those ages cannot move easily from one place to another on their own and if they do so, it is to travel only very short distances by foot or bicycle.

However, if the beneficiaries are high school students, then the ages should range between approximately 13 and 18 years of age, in that case the area of influence could be much wider, it could be the entire town, the district and even the regional level, depending on the types of teaching and the geographical conditions of the area.

2.2.8.5 Type of education to be imparted

The type of education to be delivered plays an important role in defining the area of influence, mainly when it comes to the delivery of special or non-traditional education.

That is, when the service that is being offered is related to adult education, vocational education or special education (aimed at people with learning disabilities, mental defects, or poor children at risk, etc.)

Since these are special cases in education, the percentage of the population seeking such care is much lower. Therefore, attention is concentrated on a smaller number of schools or educational establishments; this affects the area of influence, which is generally much broader in size than that of a regular or normal school. In these cases, the area of influence usually includes one or more municipalities or towns and, in some cases, the entire province or region. Everything will depend on the number of alternative schools that exist in the region and the estimated a-priori demand for those educational services.

2.2.8.6 Administrative features

In those cases, where the study area is not equal to the area of influence, and especially when the latter includes different administrative characteristics, it is important to consider what the jurisdictional limits are when defining the area of influence of the project.

For example:

In those territories where, as a result of a government decentralization effort, the administration of the educational system has been granted to municipalities or towns, it is important when determining the area of influence to consider the limits within which the responsible administrative authority may have direct influence.

2.2.9 Map of the Area of Influence

To demarcate the area of influence within the study area map, the following is required:

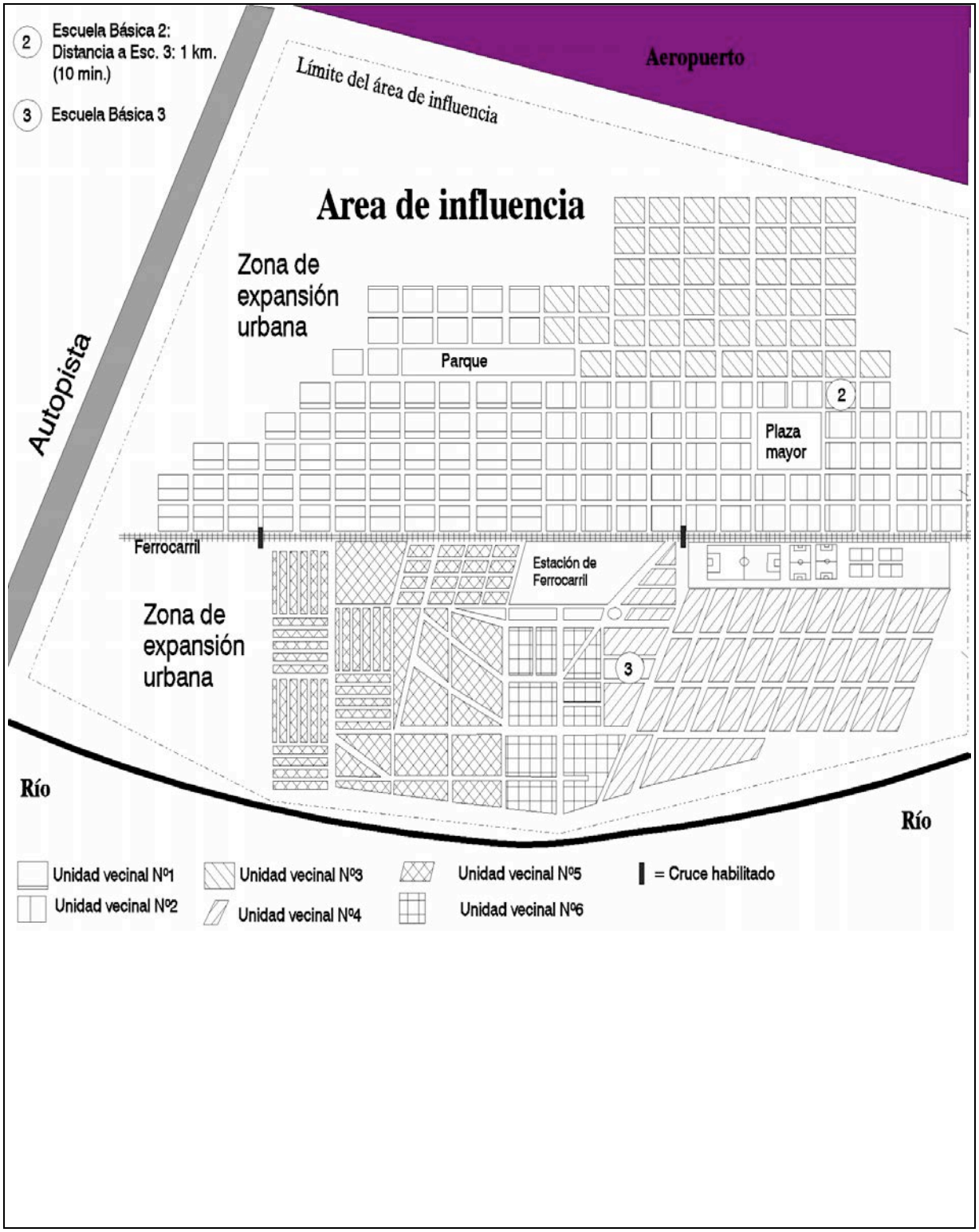
2.2.9.1 As mentioned above, it is necessary to define a priori, according to the problem detected, some characteristics of the educational service to be delivered by the project. Typically, these include the definition of the target population, the ages of that population, the type of education to be imparted, methods to be used, etc.

2.2.9.2 Mark on the study area map the corresponding area of influence that we intend to cover, according to the previous point.

2.2.9.3 Verify that the area defined in point b presents, if possible, favorable access to the fullest extent, i.e. all the target population should be able to access the educational premises without difficulty. If not, identify the conditions that must be improved so that access becomes favorable and possible for the target population.

All the information gathered in the three points mentioned above should be reflected on the area of influence map, with their geographical boundaries clearly identified, along with main roads, alternative schools or educational establishments (of any kind), and the distances measured in travel time between schools or between schools and the area that is lacking educational services (see Figure 2).

Diagram 2: Map of the Area of Influence



2.3 Determination of current and projected demands

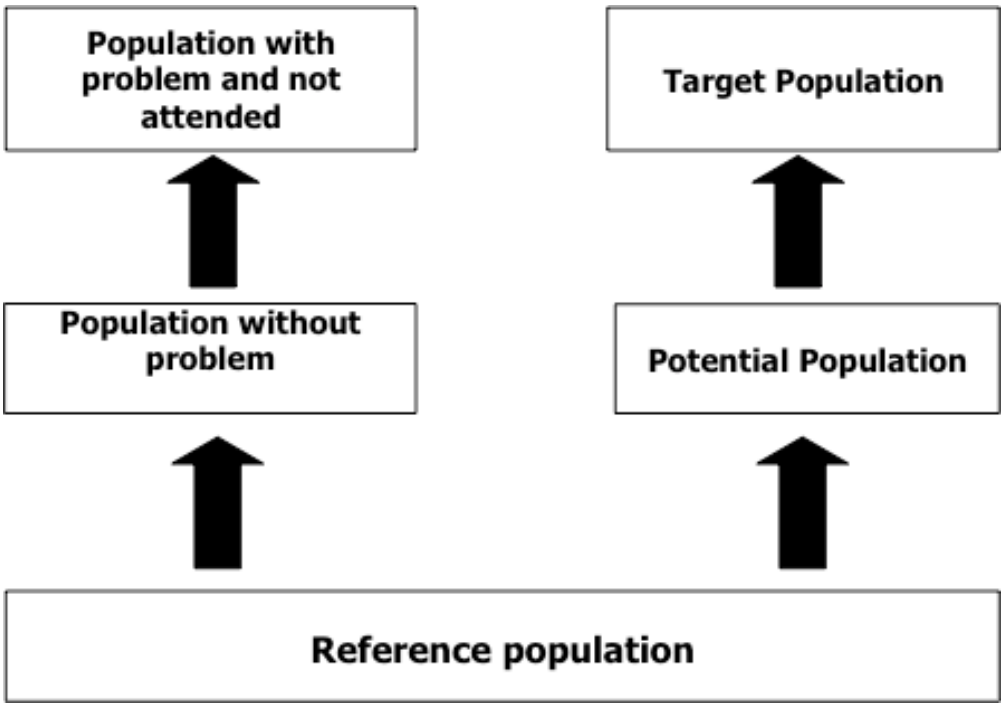
In the case of the education sector, demand shall mean the whole population requesting the educational service. In this respect, we must distinguish the following concepts:

a) The reference population: This corresponds to the total population that is located inside the area of influence. Its determination and projection is the basis for determining the population subsets defined below.

b) The potential population: This is a subset of the reference population; it is the population that is being affected by the identified problem. The potential population is synonymous with a troubled population, a deprived or affected population. The potential population is the potential demand for the project to be implemented.

c) The target population: The target population is determined from within the potential or affected population. The target population will be that subgroup that will see its problem being solved through the project, (i.e. once some criteria and restrictions have been analyzed).

Diagram 1: Different Classifications of the Population



d) Once the alternative solution has been selected: this solution should obviously become the chosen project – it is possible to clearly define the target population.

One important factor to be considered in the determination of the target population is national and sector strategic goals and policies, because these indicate government and sector priorities. Also, it is important to detect the funds being allocated to the various population sectors and what target groups should be given special treatment (for example, children living in extreme poverty, the disabled, etc.).

The fact that a problem has been identified means that there is a gap that the educational system is not covering according to official standards. The minimum number of aspects to be considered in the analysis of demand are:

- Population in the area of influence and its physical location
- Population characteristics
- Characteristics of the area

2.3.1 Population within the area of influence

At this point, the total population within the area of influence must be quantified. The analysis of this information should allow for the extrapolation of the "potential population" and its location. In other words, what is the school-age population that is being affected by the problem that has been identified? This age group shall constitute the potential demand for the project. To identify the potential population, it is necessary:

- To break down the total population by age group.
- To select out of the total population that proportion of it that has the characteristics required for it to access educational services (e.g. a student population aged from 6 to 13 years attends basic schooling, and from 14 to 17 years of age high school).
- To determine the percentage of the population that is experiencing the problem, i.e. the potential population.

2.3.2 Characteristics of the population

The purpose of considering other characteristics of the population within the area of influence is that this allows the group of potential beneficiaries of the project to be narrowed down further, according to the conditions or requirement given by the type of educational service and educational topic you wish to address. Among these, the most widely-used characteristic for the analysis of demand is the socio-economic level. In particular, the income level is often used to stratify the population.

Among other things, the socio-economic level of the population is important in:

- Defining the real possibility of the population accessing alternative education services.
- Analyzing different financing alternatives (public, private, mixed, cooperation, etc.).
- Defining the means of transport currently used by beneficiaries to access the educational service, or those means they will use in the future.
- Defining type of support in terms of special programs and the emphasis of the educational services to be provided.

As already mentioned, it is important to know the cultural and religious characteristics of the population, especially when these correspond to significant minorities in the country. Also, it is important to do a separate analysis by gender (male and female students), as it may be the case that the problem affects men and women differently, and one must specify why this happens. Considering this will help in defining viable alternatives and designing a sustainable project.

For example:

Suppose that it has been found out that in a rural area somewhere there are a significant percentage of young people who would benefit from technical and vocational education if it were available. To address this need, the local authorities propose to expand the existing educational center in the provincial capital. However, the demand study also reveals that most of the potential population lives under extreme poverty and could not afford the daily bus fare back and forth to the vocational school, and that even fewer students could afford to stay in a dorm in the city. Moreover, it is customary in that region for young people to help their parents do the agricultural work. And last but not least, parents assign little value to formal education. As a result of all these factors, it is likely that real demand for this vocational school could be virtually zero, if the project did not consider these factors in its design.

2.3.3 Characteristics of the area of influence

Another important aspect to be analyzed is the characteristics of the area of influence of the project. A first variable to be considered is accessibility, which, as mentioned above, can be measured by the existence and conditions of access roads and transportation means. Also, future economic growth and the percentage of unemployment and migration patterns of the area should be considered because they could increase or decrease the expected demand for educational services.

When a school is the focus of a problem, it is important to analyze within the demand study current enrollment and historical records (going back a minimum of 5 years) to find out tendencies, patterns and trends, as this will help to determine the future behavior of demand.

It is important to consider as a background to the analysis the rest of the school population within the area of influence, while focusing on the age group of interest. It is necessary to know the size of this age group, its location and where it is currently being served.

Projecting demand means estimating what will happen to the potential target population of the project. The background information used for the demand projection should be tailored to a time horizon that is consistent with the operational life of the project.

For purposes of projecting demand, “current demand” shall mean the existing or actual student population at the time the study is being commissioned (i.e. year 0); and “demand for year 01” shall be demand that would occur, in theory, during the first year of project operation.

To determine which will be “year 01”, it is necessary to consider all the pre-investment and investment stages of the project, from its inception (project idea/profile, pre-feasibility, feasibility study and investment decision) to its final implementation, and to estimate the time necessary for each stage. In particular, consider carefully the timing of land acquisition, the necessary permits and the budget cycle. Adding all those times to the current date, you can get an estimate of the project’s year of implementation (or year 01). Normally project operation can start only after 2 or 3 years, counted from the inception of a mid-size education project.

Estimates must be made for the operational phase of the project, from year 01 to “n”, which requires the following:

a) Indicate the corresponding calendar years: the year the study begins development, the year the project begins operations (year 01) and the “n” year of the operation of the project.

b) For the projection of demand, we must use the annual growth rate of the target population within the area of influence. This statistic may be available to the entities that manage population statistics in the country. In the absence of a statistic for the target-population growth rate in the area of influence, we could consider using the growth rate of a larger area, but one that includes the area of influence and that could be considered representative. If there is no annual growth-rate statistic for the population, consider using census data from previous years.

The growth rate can be estimated through the following equation:

$$GR = 100 * \left(\sqrt[n]{\frac{final\_Population}{initial\_Population}} - 1 \right)$$

Where: n = number of years between the two years of population data used
GR = growth rate

Example of a growth rate calculation
Population in 1992: 3500 inhabitants
Population in 2002: 4900 inhabitants
Number of years between the two population-data years used: 10

$$GR = 100 * \left(\sqrt[10]{\frac{4900}{3500}} - 1 \right) = 3.42\%$$

c) The demand projection shall take into account the population to be served (i.e. the population calculated for the year in which the study is developed) and the annual growth rate of the population or the growth rate of the number of registered students. Note that the evolution of the number of enrolled students is used only to analyze trends (when this factor indicates something special).

The demand projection shall be calculated in the following way:

$$P_X = P_0 * \left(1 + \frac{GR}{100}\right)^X$$

Where: P_x = Projected population for year x
P_o = Most recent population
GR= Annual growth rate (in %)
x = Number of years between P_o and the year the projection is being done

Let us consider the following data:

Population: 4,900 inhabitants in 1998
Annual growth rate: 3.42%
Current year: 2002
Year 1 : 2006
Year 10 : 2016

In this case we shall have:

$$P_1 = 4900 * (1 + 3.42/100)^8 = 6414$$

$$P_{10} = 4900 * (1 + 3.42/100)^{18} = 8979$$

Therefore, the estimated population for 2006 will be 6,414 inhabitants and for the year 2016 it will have grown to 8,979 inhabitants.

For the purposes of population projection, it is very important to consider any characteristics of the influence area that could somehow affect increase or decrease in future demand. These include:

- If the population in this influence area is already consolidated or if it is a population densification area.
- If it is an urban expansion area for the city.
- If migrations are occurring (e.g. as a result of closing or opening sources of employment).
- If there are urban master plans for the area to establish rural, urban, or industrial limits or other types of restriction that may affect population growth limits.

If within the area of influence there is a zone that is defined as an area of urban expansion, it is highly likely that the future growth of the city will be concentrated in this zone. Consequently, the rate of population growth in the area of influence will be higher than the rate of population growth throughout the entire city (assuming that the area of influence covers only part of it).

In these cases, it is advisable to check with the responsible authorities for urban development and / or public housing, in order to know the construction plans in the area (number and type of housing). With these data, it is possible to adjust estimates of the growth rate or the estimated population for year 1 and year X (e.g. year 10). It is important to note that in these cases, only one growth rate is used, i.e. the vegetative growth as shown by the CENSUS or estimated by other variables for that sector. You must use the one that best represents the situation under analysis.

All data collected and the estimates should be reflected in a table of demand as the one suggested below:

Table I**:** Current and Projected Demand

Age Group	Current Population Male - Female	Projected population	
		Year 1 Male - Female	Year X Male - Female
Total			

2.4 Determination of current and projected supply

The supply of the educational system in the influence area corresponds to the total installed capacity at the moment the study is being developed. This shall depend on the existing infrastructure, the equipment and human and financial resources available. The supply of educational infrastructure is given by the installed capacity of educational institutions, and it is determined by the regulated capacity inside the classrooms, number of toilets and size of courtyards.

Analysis of the current supply shall depend on whether the problem has been detected in an area where there are currently no educational institutions, or if the problem has been detected within a specific school.

2.4.1 Case 01: When there are no educational institutions or schools

If there are no schools, the supply shall consist of infrastructure and educational services that are currently being offered in the area of influence. In this case, you must gather information about all schools in the area, regardless of type of administration and finance. Information that is relevant to the analysis of supply is as follows:

2.4.1.1 Characteristics of schools in the area.
2.4.1.2 Characteristics of the area.
2.4.1.3 Features of the educational services provided.

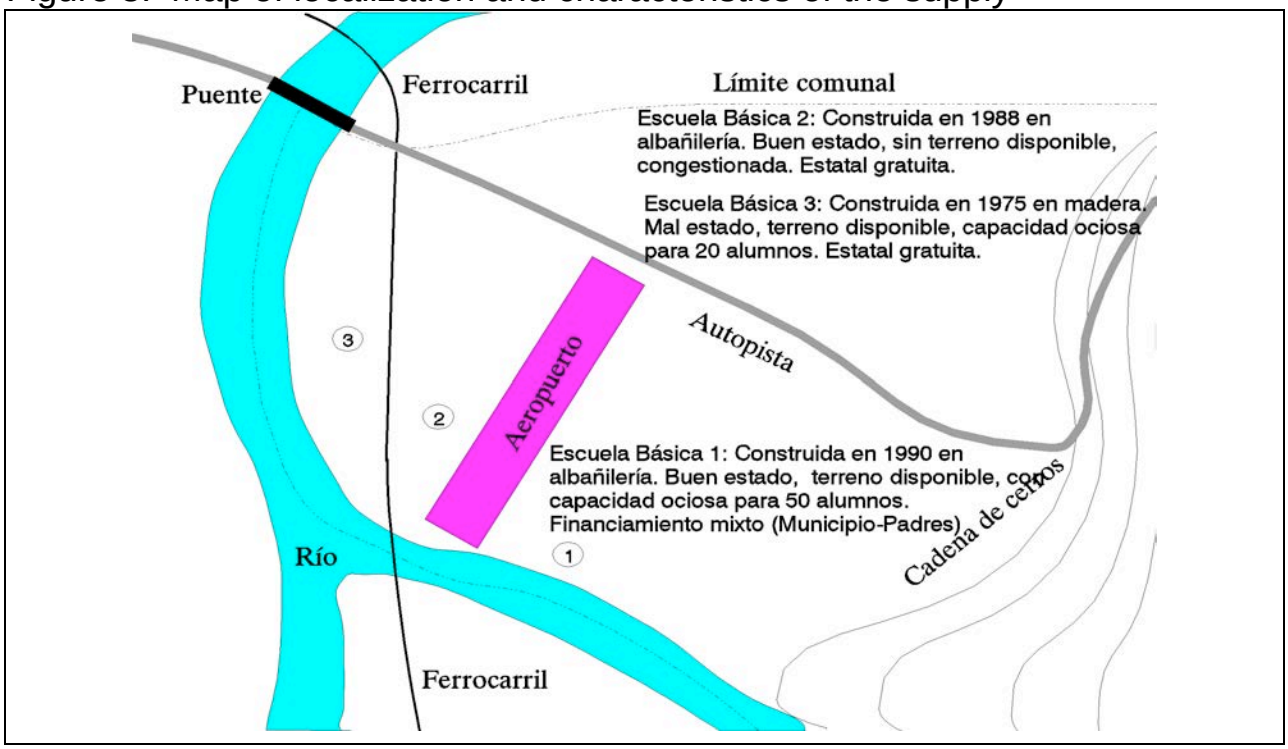
2.4.1.1 Characteristics of existing schools in the area

Generally speaking, you must gather information on physical infrastructure, type of education provided and administration of all establishments in the area of influence. This is to define installed capacity and their status in the influence area and also to know the types of service that are being provided. In that way it will be possible to identify those schools that offer real possibilities and alternative solutions to the identified problem.

For example:

Within the expansion zone of a municipality, the plan is to build a large amount of social housing for low-income families. In this context, in the analysis of current supply, within those schools that have been identified as having a real possibility of satisfying totally or partially the identified needs, you must find those that are free of charge (gratis), or that have idle capacity or land available for expansion, and that are located near the target population, in order to minimize transportation costs.

Figure 3: Map of localization and characteristics of the supply



The information required for each school is as follows:

i) **Location:** Show on the educational institutions map the location of each school within the area of influence.

ii) **Year of Construction and Building Material Used**: Indicate on the map the year each school was built. Also specify the building material that was used (i.e. clay, wood, masonry, cement, etc.). In the case that, within the influence area, different sectors can be classified i.e. sectors with schools that were constructed in different years, indicate separately the school's surface, its characteristics and what type of education is imparted. Do this for all the schools in each sector. It is important to indicate the building materials used for the school, since the type of construction material largely determines the life-usefulness of the premises.

iii**) Type of Administration and Finance:** Identify the institution that is responsible for administering each establishment. Indicate whether this institution also administers other schools, and what their level of autonomy and management capacity is. Also indicate the type of funding available (public school, private school with a government subsidy or totally private school).

iv) **The Existence and Availability of Land:** Find out who owns the land currently used by schools, and its availability for future expansions in those same institutions. It is also appropriate to research the availability of other territory or buildings that could be used to increase the supply of educational services.

v) **Existing Surface and General Condition of the Building**: Indicate the capacity of each school and the general condition of its infrastructure. In addition, it is recommended to establish a link between the installed capacity of each facility and its student registration, in order to estimate the idle capacity (or saturation level) within the area of influence.

It is desirable that all aspects detailed above be reflected in a blueprint or drawing of the establishment.

2.4.1.2 Characteristics of the area

The purpose of characterizing the area in which the current educational supply is provided is to be aware of potential future restrictions on the project. Among these characteristics, it is appropriate to consider at the very least the following:

i) **Availability of Services**: Study the availability of basic services, such as electricity, water, sewerage and telephone services. Also, analyze the existence of public services such as health and communications.

ii) **Conditions of Public Safety**: Analyze the public security conditions that may affect the supply of the schools' network.

For example:

Nocturnal insecurity conditions may preclude the use of some facilities for evening classes or double shifts.

iii) **Access Conditions**: To study the existence and conditions of the access roads inside the study area. Also assess the availability and characteristics of public transportation. Analyze how these conditions of access can be affected by weather conditions.

iv) **Environmental and Health Conditions:** It is also important to analyze the existence of environmental hazards that could directly or indirectly affect the future operation of the project.

For example:

Systems of collection and disposal of liquid and/or solid waste (garbage), and the existence of vectors that could transmit diseases (such as rats, mosquitoes, etc.), as well as odors, air pollution and noise, either near to the available land that could become an alternative location of the project or located inside the area of influence.

2.4.1.3 Characteristics of educational services

Indicate the type of education provided by each school in the area of influence (i.e. if it is pre-school, primary, secondary/high-school [humanistic-scientific], technical, vocational and professional high-school, special education for handicapped children, adult education, etc.). Also indicate if any of the establishments are running non-traditional, special or experimental programs.

2.4.2 Case 02: When there is an educational establishment or school

If the problem at hand can be located in a specific institution, the current relevant supply shall be that of this school, and its supply can be determined at the most basic level by the infrastructure and services provided by this school. In this case, it would be necessary to analyze at the very least the following:

2.4.2.1 School enrollment/student registration at the school.
2.4.2.2 Where the enrolled students come from.
2.4.2.3 Geographical location of the school.
2.4.2.4 Physical characteristics of the infrastructure of the school.
2.4.2.5 Administrative features of the school.
2.4.2.6 Type of education provided by the school.
2.4.2.7 Characteristics of the environment of the school (area of influence).

2.4.2.1 School Enrollment / Student Registration

It is necessary to find out the details of the current enrollment of the school, differentiated by gender (male–female), by level and for each of the courses, besides indicating its work schedule. In addition, the study should summarize the socio-economic background of the population currently enrolled in the school, the educational level of parents and/or guardians, and prevailing cultural characteristics. This in order to further define the conditions that should enable the project to solve the problem or meet the identified need, and ensure its viability and sustainability.

For example:

Suppose that you have detected that students of a given school, located in a marginal low-income area, have achieved a very poor performance in the national standard tests that measure the quality of education. The diagnosis reveals that most of the parents of these children are illiterate and live in conditions of extreme poverty, and that they do not return home until late at night. Consequently, students often roam the streets during the evenings. Even those students who try to meet their school obligations normally perform their homework incorrectly because they do not have any kind of educational support at home. Therefore, any alternative solution improving the quality of education should include contemplation on ways to support children at home in completing their homework.

2.4.2.2 Where do the enrolled students come from?

In the area-of-influence map, the exact location of the problem school must be indicated. Also indicate the location from which the enrolled population comes from, and provide an indication of the time they spent in getting to the school. The identification of the characteristics of the population and the analysis of accessibility can also help to determine alternative solutions.

2.4.2.3 Geographical Localization of the School

Pointing on the area of influence map to the precise location of the school with the problem is important because it allows a display of the location of the school, which somehow affects the detected problem. At the very least the following should be indicated:

- Location of the population.
- Access roads and means of transportation.

2.4.2.4 Physical Characteristics of the Infrastructure

Regarding the infrastructure of the school with the problem, at the very least the following aspects should be noted:

i) Year of construction and building materials:
Indicate the year of construction of the main school building and later years when significant investments in the property were made. For each infrastructure part, specify the building material used.

ii) Original destination of the building:
In the event that the building occupied by the school was not originally built for this purpose, it is necessary to describe the current functional characteristics of the building.

iii) Installed capacity of the building:
Provide the total surface built and give a detail of each building, specifying its current use and its area in square meters. For comparison purposes, indicate the statutory capacity of all the designated areas, especially classrooms, toilets and courtyards according to the current regulations.

iv) The general condition of the building:
The status of each of the precincts of the school must be reported. It is recommended that simple qualitative indicators like “good”, “fair” or “poor condition” be used to describe the status of each precinct.

- Good condition: When the building being described only requires some maintenance. Example: The paint is in poor condition, clogged drainage, broken glass, etc.

- Regular condition: If there is damage or wear and tear of the building that could be recovered with minor works. Example: The power grid is in a poor state, wear and tear of floors, or the roof has leakages, etc.

- Poor condition: If the deterioration of the building is unrecoverable, if there is damage to the building structure or major construction works are required. Example: Fallen or broken walls, ceiling about to fall or is incomplete, etc.

To properly describe the condition of each building, it is recommended that the professional advice of a construction specialist be sought. Usually, the Municipal Works Directorate or the Regional Technical Secretariats of Education could help with this task.

v) Equipment:
You must indicate the detail of the existing equipment, specifying the type and quantity of educational equipment (furniture, blackboards, heating, etc.) for each of the existing premises, and also indicate whether they are in good, fair or poor condition.

vi) Availability of basic services:
You should indicate if the school has a proper connection to electricity, water and sewage. If the school is not connected to public networks, then specify the alternative system they are using and indicate the future possibility of connection.

vii) Characteristics of the land:
Indicate the total area of the land and if it offers conditions for future expansion. Indicate whether the land on which the property is located is public or private property, if leased, if given on a loan, etc. Indicate also the legal status of land (registration, prohibitions, contracts, etc.).

Table II: Characteristics of the School

Name and address of the school:
Date:

Buildings (Provide a Detail for each Premises)		
Building	**Current Area (m^2)**	**Condition**
Administrative areas		
Teaching areas		
Service areas		
Covered circulation areas		
Open air areas		
Total		

Educational Equipment (Provide a detail for Each Premises)			
Premises	**Type of equipment**	**Number of equipment in good shape**	**Number of equipment in bad shape**
Administrative areas			
Teaching areas			
Service areas			
Other			

Personnel	
Type	**Number of Staff**
Teaching	
Administrative	
Auxiliary / maintenance	

2.4.2.5 Administrative characteristics of the school

Regarding management features of the problem school, it is important to consider at the very least the following aspects:

i) Who is responsible for the administration of the school? The institution or agency that is in charge of the administration of the school should be stated. It will also be important to describe the most important features of its administration, if possible classifying them into ranges that allow comparisons.

For example:

Classify the management of the establishment as weak, medium-strength or strong management. The ranges for these classifications may be fixed by the authority of the education sector, either at national, regional or community level. It is important to emphasize the critical points in the management of the establishment.

Assume a basic school has more teachers (in number) than are required to meet its current enrollment. However, this school delivers no extra-program activity and students' results in the tests that measure the quality of education at the national level are bad. In addition, there is no community involvement in school activities and the operating costs are higher than those of comparable schools. Thus, it is clear that the management capacity of the management of this school should be classified as weak.

iii) Type of financing:
Specify the type of financing that the school has, i.e. if it is a public school or if it is a private school with a government subsidy (with shared financing), or if it is a totally private school with no government subsidy. In the case of shared financing, indicate how this financing is distributed and whether it is open or pre-assigned to certain budget items.

iv) Personnel:
List the school staff, specifying teaching staff (teachers), administrative (secretaries, accountant, administrator, etc.) and auxiliary/maintenance staff.

2.4.2.6 Type of education imparted in the school

Indicate the type of education currently being taught in the problem school. It is also recommended to specify if the school is delivering any additional educational program or other type of program supporting the traditional work of the school. It is suggested that special emphasis be placed on non-traditional initiatives; indicate whether they have the participation of the community, who benefits, who pays, etc.

2.4.2.7 Characteristics of the environment

When there is any feature of the environment that may be conditioning or limiting the operation of the school in one way or another, it is necessary to specify what it is and how it is affecting the school.

For example:

It is important to note if the school is located next to an industrial area that causes noise or air pollution, or if it is located in a restricted border zone, or in an area of certain cultural characteristics, etc.

Finally, it is worthwhile summarizing the information on the school, equipment and operating personnel in a table, as shown in Table III.

*** Educational Indicators**

Educational indicators are part of the educational service supply. They are representative values of a set of variables that show characteristics of the population and the industry that are of interest, such as educational, social, psychological and physical characteristics. Where possible, analyze the indicators differentiated by gender (male–female).

The analysis of the number adopted by specific indicators or groups of related indicators, can help to detect and measure problems of the coverage, efficiency and effectiveness of the educational system within the study area. The calculation of indicators is not always easy and in some cases it can be difficult to collect the required data. However, the usefulness that certain indicators provide for a proper diagnosis justifies the effort required to measure them.

Among the most important indicators for purposes of school infrastructure project evaluation are those that measure the improvement in a school's performance, the coverage of the system and those that help to analyze the location of infrastructure based on the area of influence (service area) of the schools.

Improving school performance can be regarded as the most general policy of the education sector, this is where the rest of the objectives concur. Performance is based on aspects such as improving learning, raising the level of culture, improving levels of socialization, increased competitive conditions for entering the labor market, etc.

The measurement of this variable is not a simple problem to solve. In practice, the only existing homogeneous and comparable indicator is the SIMCE.

Some suggested indicators used to measure school performance are:

- School achievement in standard tests (systems for measuring quality in education).
- Grade repetition rate.
- Student retention rate.

On the other hand, one of the overriding goals of sector policy for the decision to carry out educational infrastructure projects aims to reduce the deficit of educational attention of the school-age population, increasing coverage by consolidating infrastructure based on projects of different types.

Currently, education sector policies are aimed at improving the coverage levels at the pre-school, primary and secondary education. Achieving this goal translates into increased schooling of the population.

The measurement variable, in this case, is coverage, and the suggested measurement indicators are the following:

• Number of children enrolled (attended enrollment).
• Infrastructure capacity used (occupation).
• Parameters established by the actual regulations in education (classroom size, number of toilets, playground).

Finally, improving the school's infrastructure location based on the area of influence (service area) of the schools. In planning the educational infrastructure, it is considered relevant to guide the supply of educational services in accordance with the location of the target population. In practice, this translates, on the one hand, to decreasing the displacement of enrolled students and, on the other, to locating investments in the relevant influence area.

The consequences of poor planning in matters of school location are diverse, the most important being the possibility that the project beneficiaries, i.e. the children, do not attend the school, in addition to the increased family spending that occurs by traveling to a school that is far away. Finally, it is important to note that projects are not necessarily located in their respective municipalities. A project may have its own local area or it may have inter-municipal influence.

For the measurement of location, the suggested indicators are:

• Origin and destiny of students in relation to the area of influence of the project.
• Travel time.
• Travel costs.

2.5 Determination of the current and projected deficit or gap

The determination of the deficit or gap is given mainly by the comparison of the (current and projected) demand and the (current and projected) supply of the existing educational system in the area of influence with what is required according to current regulations and standards from the education authorities.

The deficit calculation is made based on what is currently being offered by the education system in terms of infrastructure, equipment, teaching, administrative and support staff, quality, etc., and the projected demand of the population, taking into consideration in this calculation the standards and regulatory conditions required by the authority of the education sector for each of the components.

If it is the case that the diagnosis identifies that the problem affects boys and girls differently, this aspect has to be specified in the analysis of the deficit or gap.

From this analysis there can be two types of deficit:

2.5.1 Deficit in the infrastructure (coverage) of the educational system.
2.5.2 Deficit in the quality of the education system.

2.5.1 Deficit related to the infrastructure (coverage) of the educational system

When there is a deficit in educational infrastructure, it is possible to distinguish two situations:

2.5.1.1 Deficit in coverage
2.5.1.2 Deficit because of the poor state of existing infrastructure or equipment

2.5.1.1 Deficit in coverage

Compare the potential population that is demanding the educational service in a given area of influence with the installed capacity of the existing infrastructure in the area. If this comparison shows that part of the population is not being served or remains un-attended by the system, there is a deficit in coverage.

2.5.1.2 Deficit because of the poor state of infrastructure or equipment

On the other hand, if as a result of the diagnostic, it is detected that a part or all of the population is being served by the education system, but in poor conditions according to the minimum standards required by the education sector, both in matters of infrastructure or equipment, there is an infrastructure deficit.

For the calculation of this deficit, take as a reference the potential population living in the area of influence and its characteristics. Infrastructure, equipment and staff requirements are estimated in order to provide a service for this population at the required standard. The difference between these requirements and the capacity of the existing infrastructure, equipment and staff is the deficit.

The results of the analysis must be reflected as illustrated in Table III.

Table III: Calculation of the Deficit

School name and address: Date:

BUILDINGS (provide details for each building)					
Building	**Current surface**		**Required surface**	**Deficit in coverage**	**Deficit because of poor state**
	Good shape	**Bad shape**			
Administrative area					
Teaching area					
Service area					
Covered-circulation areas					
Open-air areas					
Total					

EQUIPMENT (provide details for each building)						
Building	**Type of equipment**	**Existing**		**Required**	**Deficit**	**Deficit poor state**
		Good shape	**Bad shape**			
Administrative area						
Teaching area						
Service area						
Other						

PERSONNEL			
Type	**Current staff**	**Required staff**	**Deficit**
Teaching			
Administrative			
Auxiliary			

2.5.2 Deficit related to the quality of education

All those shortcomings that are in the educational system and that are not related to the infrastructure, equipment or staffing within the area of influence or in the existing school are classified as “deficit related to quality of education”.

It is very usual that most of the causes of the problems in education are attributed a priori to the lack of infrastructure, or its poor state, or its bad location, etc. However, these are often not the root causes of the problem, even though they may have a marginal affect on it. Among the most known and easy causes to detect are, among other things, the following: deficiency in the management of human resources and/or financial management, lack of maintenance, lack of training of staff and lack of special programs that encourage community participation, etc.

Typically, the detection of these causes is not easy at first sight, therefore it is advisable to "guess" that there may be something more than problems related to infrastructure. In such cases seek advice from experts in the field on the identification of root causes.

An objective way to detect this type of deficit is through the analysis of the educational indicators of the school, comparing those to the corresponding indicators of the municipality, province or country, where applicable (see Annex I).

3. Identification of alternative solutions

As a result of the diagnostic, you obtain the identification and sizing of the problem of the educational system in the area of influence. During this process, some initial ideas for alternative solutions are usually generated. It is frequent in the problem identification process that some stakeholders raise and defend one particular project alternative.

Thus, in order to solve the problem that was identified in the diagnostic, a set of alternative solutions are initially defined, and obviously each of them has its own specific characteristics. All of those alternative solutions should be detailed and analyzed systematically, without ruling them out a priori.

For example:

There is a boarding school that catered to the population of a vast, sparsely populated rural area, and it has been destroyed by fire. Stakeholders lobby for its reconstruction, arguing that it is the only alternative for the children in the study area. Even though this seems to be – at first sight – the only feasible solution, the analyst should consider other alternatives, such as:

a) Applying some form of distance education (e-learning).
b) Transferring students to other more distant boarding schools.
c) Reconstructing the school in a different place from that occupied before the fire.

The following points should be considered in the definition of alternative solutions:

- Optimization of the base case, this is the “with-out project” (also known as the current situation)
- Identification of possible alternative projects
- Description of each alternative

3.1 Optimization of the base case or the “without project” / current situation

The first and most important step in identifying alternative solutions for a project is the optimization of the base case or the “without-project”/current situation. This consists of studying those measures that permit, using minimal or marginal resources, the improvement of the existing educational service to a point that it runs as smoothly as possible.

To do this, once you have clearly identified the root problem, an analysis must be made in order to find administrative or managerial arrangements that could improve the current situation. These changes could significantly reduce the costs of the current situation and therefore do not allow an overestimation of the benefits of the proposed project. Making these improvements should require only small or marginal investments.

Some typical measures that tend to improve the current situation are:

3.1.1 To optimize the use of the existing infrastructure

When the problem is related to the poor or the inadequacy of the existing infrastructure, it is advisable to study first how to better use the existing infrastructure. Some steps in this direction could be to change of destination of the buildings, enabling existing premises and/or finding alternative infrastructure that could be used at a low cost. When in the area of influence there are several schools, the possibility of bussing students from congested schools to other schools with available capacity should be considered.

3.1.2 To optimize the use of human resources

If the problem is related to a lack of trained staff, the optimization of the current situation could consider measures such as personnel exchange between schools (reinforcing weak schools and/or providing on-the-job training in another school for some teachers) or seeking parents and volunteers who could work and meet some change in shifts for better use of existing staff.

3.1.3 Optimizing the use of equipment

When the problem is related to poor condition or lack of education equipment, some measures that could improve the current situation without incurring major investments are to seek a more intensive use of the existing equipment through changes in shifts and schedules, or to seek the cooperation of the private sector and/or parents to repair or replace the old equipment, or even to involve students in the repair and maintenance of aged equipment.

3.2 Identification of Project Alternatives

When the optimization of the without-project or current situation does not fully solve the problem, it is necessary to identify possible project alternatives in order to solve it in whole or to a greater extent.

If it has been determined that the root cause of the identified problem is the existing infrastructure within the area of influence, the possible solutions should all be contained in alternative projects, all of them related to the improvement of the infrastructure of the educational system. However, if the root cause lies in other factors not associated with infrastructure, the alternative solutions will be contained in a program related to the improvement of the quality of the education.

In some cases, it could be that the root causes of the problem reside in the mixture of both factors (i.e. infrastructure and others). It is important to note at this point that each alternative should be aimed at solving the specific causes of a problem, so it will be necessary to treat each of these causes through separate initiatives, which must be complementary.

The Log-Frame Approach provides a simple and useful tool for displaying alternative solutions to a problem. This is the objectives tree, also known as the “tree of means & purposes/ends” (See Appendix). Just as the “problem tree” displayed the sequential, bottom-up chain of the causes & effects of the detected problem, the objectives tree is the interdependent chain of means & purposes/ends.

The tree of means & purposes/ends or the objectives tree is a logical consequence of the initial problem tree. For its construction, simply "invert or overturn" each of the causes & effects detailed in the problem tree.

For example:

If one discrete problem was “the lack of something”, inverting it becomes one specific solution, and that solution should be “the sufficiency of that same thing” (it is written as the opposite of the corresponding problem).

The problems that were identified as the “causes” of the main problem should become the “means”, whereas the “consequences or effects” should become “purposes”. The analyst should also identify those special causes that are not feasible to be modified (these are called “structural causes”). These structural causes will become unchangeable parameters; therefore, when building the “solution tree”, take good care not to change their formulation into positives.

After verifying the logic and pertinence of the resulting solution tree, the information it provides is available when searching for appropriate alternative projects that could solve the problem. "Fundamental means" are at the lowest level; these are the "roots" of the solution tree and around those the analyst should identify project alternatives[2].

3.3 Description of Project Alternatives

Once all project alternatives have been identified, those alternatives that solve the quantified deficit, either completely or partially, must be properly described.

From the total set of identified alternatives, some must be ruled out even before describing them in detail. This is the case when the analysis shows that some alternatives – given the actual conditions – will not be possible to implement. These conditions may be legal, administrative, economic, political, etc.

For each of the alternative solutions identified, the following aspects should be described in general terms:

- How and to what extent this alternative solves the problem.
- Number and characteristics of the beneficiaries of this alternative solution.
- Approximate costs and benefits associated with this alternative.

[2] Remember that the "fundamental means” of the solution tree are the exact opposite of the “root causes” of the problem tree. So when looking for actions that could implement those fundamental means, we are solving the root causes of the detected problem.

- Method for the implementation of this alternative.
- Operation mode of this alternative.
- Institutional aspects to be considered.
- Legal issues involving this alternative.
- A schedule of activities for its implementation.
- Achievement of the objectives of this alternative.
- Foreseeable acceptance or rejection of this solution by the community.
- Available financing for the implementation and operation of this alternative.
- Foreseeable restrictions for the implementation and/or operation of this alternative.

4. Definition of Project Alternatives

Like any other investment project, education projects generate benefits and involve costs (both CAPEX and OPEX). In general, a project becomes desirable from the point of view of society, when its benefits are greater than the costs that have to be incurred to implement and operate it. However, it is often difficult to identify all the benefits that a project will generate and even more difficult is the quantification and valuation of such benefits.

Normally for projects in the education sector the valuation of the generated benefits is so complex to calculate that an alternative and more pragmatic approach to the public investment decision is adopted. This approach consists of considering that investing in education is economically profitable and that this is a fact that need not be demonstrated, and that education should be considered a basic necessity that the state must provide its citizens. The only question for project appraisal then becomes: what project alternative is the cheapest in satisfying needs.

Each project alternative will have its own costs and benefits. Therefore, to select the best alternative it is necessary to study the costs and benefits of each. However, in the cost–benefit analysis, it is assumed that all project alternatives generate the same benefits, or that they are at least very similar, and that to select the best alternative the one with the lowest cost must be chosen.

4.1 Identification and quantification of the benefits of each alternative

The benefits generated by education projects are many and varied. However, they are usually difficult to quantify, and only in very special cases is it possible to value them in monetary terms. Many times, the practical result is that the cost and effort required to obtain a good estimate of the education benefits becomes higher than the cost and effort required for implementing the project. Given this situation, the basic needs approach has been adopted for the evaluation of education projects. This approach assumes that society assigns to the benefits of education projects a greater value than the costs of providing such services.

Even though we can't assess easily the benefits of education projects, it is important to identify, quantify and identify who receives them. In this sense, the benefits of an education project generally are:

- To increase the level of productivity of the beneficiaries and therefore their own income and the income of the employers who hire them.
- Increased personal satisfaction and self-esteem for the knowledge acquired.
- To improve the integration of the beneficiaries into society by allowing them to access new services and to reduce some anti-social behavior.

As it was already said, unfortunately it is not easy to quantify these benefits although they are real. Therefore, it is necessary to use some parameters; even though they are not benefits per se, they do have a direct relationship with a benefit. In other words, since it is difficult to measure the benefit by itself, we measure one or more variables (called "proxy" variables) and we anticipate them to have a direct relationship with the real benefits of the project.

It is assumed (although it does not always happen) that if these variables occur in the project, then the expected benefits shall materialize (this will only be known if good project monitoring is carried out and then an ex-post evaluation).

For example:

Consider the following use of a proxy variable.

A project aims to improve the management of educational institutions in a region through the provision of training for the school principals or directors in modern management techniques. This is expected to generate a better use of available resources and allows the delivery of better-quality education to students. In this case, it is not possible to estimate what positive impact this project will have on the future conditions of the lives of students, nor how much this project will increase the level of personal satisfaction of the trained principals and those working with them.

It is also very difficult to estimate how much the savings will be from better management of establishments. We cannot even estimate a priori how and by how much the management of each school will be improved. We can only know how many principals/directors we will train.

Thus, the number of trained managers could be accepted as a "proxy variable" of actual project benefits, assuming that the project has been well designed and that if we train more directors there will be future benefits.

Generally, it is assumed that the benefits of each project alternative could be adequately represented by all additional services it shall provide. However, only those services that each alternative is in fact going to provide to the beneficiaries should be rightly considered its benefits.

That is, we must first estimate the actual services that the beneficiaries are going to receive and not consider as benefits those potential services that a given alternative could provide in theory. While this may seem obvious, in practice it is common to see errors in quantifying the benefits of education projects when analysts confuse these two concepts.

A special case is those projects that do not affect the quantity or the quality of educational services, but reduce the costs of delivering those very same services. In this case, the benefits of the project are clearly identifiable, measurable and assessable. The benefits can be easily determined as the difference between the costs associated with the optimized base case and the corresponding costs of the alternative project.

4.2 Identification and quantification of the costs of each alternative

The cost items associated with each alternative will depend on their characteristics and on the type of project. As it has already been pointed out, basically we distinguish two types of projects, those that aim to increase or improve the infrastructure for the delivery of educational services, and those that aim to improve the quality of a service being provided. For each of these types of project the cost items receive a similar treatment, regardless of the project alternative.

The costs associated with each alternative education project can be classified under the following categories:

- Investment costs
- Operating costs
- Transportation costs

Regardless of the type of project or alternative in question, to quantify the costs associated with it the following steps should be followed:

4.2.1 Identification of the required cost items for implementation (Capex) and operation (Opex).
4.2.2 Quantification of required costs.
4.2.3 Estimated price of each item.
4.2.4 Calculation of the total annual cost of each item.
4.2.5 Preparation of a summary table of the costs of the project alternative.

4.2.1 Identification of cost items

The first step in estimating the cost of an alternative project is to identify all cost items that will be required for its realization and operation. It is important to note that all items should be identified, regardless of whether the analyst may think a priori that some of those cost items shall not produce a disbursement for the entity that executes and/or operates the project.

To perform this task, it is convenient to search and analyze similar projects that have been implemented in recent years. If there is no previous experience in the education sector, the analyst may look at similar projects in other sectors; if there is no experience

whatsoever in the country then it is advisable to consult or hire an expert in this subject.

At this stage, it is sufficient to prepare a comprehensive list of assumed cost items and to classify them into the categories identified above (i.e. investments, operation, transport) and then briefly describe the cost item and its estimated frequency of occurrence.

4.2.2 Quantification of the cost items

The next step is to determine how much will be required of each of the identified items. For the operating and transport costs, indicate annual requirements, whether the project will operate for several years, or monthly, weekly or even daily, whether the project will be in operation for less than a year.

If the project is related to infrastructure, it is recommended when estimating construction costs to use the standards required by the authority of the sector as a base. Based on them, the analyst will know the total area required to meet the deficit that has been identified. In addition, at this stage it is convenient to use as a reference similar projects that have been recently developed, whether or not in the education sector. It is also advisable to resort to expert opinion, at least as a validation of the estimates that have been carried out.

4.2.3 Estimated cost of inputs

The next step is to assign a value to each item that will be required for the implementation of the project alternative. In performing this task, it is important to bear in mind the aspects detailed below.

4.2.3.1 All Inputs and Assets Should Be Assessed

Even though some project inputs or assets may be owned by the entity that will implement the project, or have been donated or provided at no cost, they should be valued anyway. From the society's point of view, all inputs that are used by the project could eventually have an alternative use in another economic activity; this alternative use must be forgone because the project will use the input or asset. Thus, when the input or asset is used by the project, the society stops receiving the benefits it would bring if that input or asset had been used by another project or alternative activity. This concept is the: "opportunity cost" of an input or asset.

4.2.3.2 Taxes Must Be Identified and Treated Separately

For society, the taxes associated with project inputs or assets are not a cost. Indeed, even though they must be paid to carry out the project or paid during its operation, those resources are used in other works. Therefore, from the society's point of view, a tax is just a transfer, not a resource cost. That is, it is assumed that cash subtracted from the project via taxes are used by the state (either at a national, regional or municipal level) in other projects with similar economic profitability. Thus, taxes on inputs of a project are to society just transfers, the equivalent of taking money from one pocket and putting it in another.

In the case of inputs that are taxed, you need to provide its price with and without tax. The price without tax must be used in the economic evaluation of the alternative project. The price with tax shall be used to develop the project's budget, which is used to determine financing needs.

4.2.3.3 All Prices Must Be Expressed in the Currency of the Same Date

Because of the existence of inflation, the purchasing value of money is diminished over time. Therefore, it is required that prices be in real terms, reflecting the value it had on a particular date. To bring prices of inputs to the same date, the procedure is as follows:

- Choose an indicator to make the correction in general price level; usually it is the consumer price index (CPI).
- Seek the CPI values corresponding to the dates of the prices we know for each input.
- Choose a date in terms of which all costs are to be expressed and the corresponding value of the index sought.
- Calculate the corrected prices or costs, i.e. expressed in the currency of the desired date, using the following formula:

$$Corrected\_Price = Known\_Price * \frac{Index_{corrected\_price}}{Index_{known\_price}}$$

Correct market prices and use economic (social) prices, where applicable.

When we eliminate tax from the market price of a project's input or asset, we are calculating the economic resource cost for society. However, in many cases this is not the only correction required. There are many other market distortions, different than taxes and subsidies, that make it necessary to adjust the financial (private) price of inputs. This is done by the use of specific conversion factors (CF). The CF is multiplied by its corresponding market price, and through this simple operation we transform market prices into the economic or shadow price. It is the economic or shadow price of a resource that reflects the actual value placed by society on this resource, whether it be water, time, clean air or something else. The most common CFs calculate the economic price of labor and the economic price of foreign currency. All these CFs shall be calculated annually by the Ministry of Planning and published in "Rules and Instructions for Public Investment".

Considering what is stated above, economic prices should be assigned to each of the identified inputs. Here are some suggestions for performing this task:

4.2.4 Calculation of the total cost of each input

The last step in estimating project costs is the calculation of the total cost required for each input. To do this, simply multiply the amount of input by the price and get your total cost for that input.

4.2.5 Summary table of the costs of the alternative

Finally, it is worthwhile summarizing all the information gathered in the previous steps in an auxiliary table showing the required volume of each input, its price and the total estimated cost for each item. Two versions of this auxiliary table should be prepared.

The first auxiliary table should be called “project’s budget calculation” and it should include all prices with their corresponding taxes (i.e. sales, VAT, etc.), but should exclude those inputs that are donated or provided for free to the project. Furthermore, since this budget will be used for the purposes of negotiating funding for the project’s implementation, it is appropriate to add an item to cover incidentals.

The second auxiliary table should be called “project’s economic evaluation” and it should present all prices excluding (i.e. without) their corresponding taxes (i.e. sales, VAT, etc.). It should also include any inputs or assets that are donated or provided for free to the project, valued at their market price. It should include all appropriate inputs, corrected at economic prices, such as labor, equipment if they are imported, etc. This table will be used for the purpose of making an economic evaluation of the project alternative.

I. Greenfield and Brownfield Projects

A “**greenfield project**” is when the project starts from zero, that is, when there is nothing in place before the project is implemented. For example, the project is to build a brand new school from scratch. In this case there is no base case.

A “**brownfield project**” is when a project adds something to an ongoing situation or base case, also called the “without-project” situation. In other words, the project is an incremental activity. For example, the project is to build a new building in order to extend the existing school’s capacity.

An important element in the investment appraisal is to examine the incremental impact of a project. That is, one should make the with/without distinction clearly and carefully so as not to include in the with-project scenario any benefit or cost that would exist without the project being undertaken. Note that the without-project situation does not mean that nothing is done to the current situation if the project is not undertaken. In this context, one should conceptualize two states of nature: one with the project and the other without the project. The former identifies the revenues and expenditures associated with the case in which the project is undertaken, while the latter refers to all relevant benefits and costs that would likely prevail if the project were not undertaken. Comparing the two, a project usually involves incremental net benefits in the operating phase. The incremental net cash flow (or net economic benefits) refers to the net of benefits minus outlays that occurs with a project less the corresponding figure that would have occurred in the absence of the project. This is how we calculate the change in economic well-being that can be attributed to a brownfield project.

II. Investment Costs or Capital Expenses (CAPEX)

Investment costs or CAPEX are all those costs that initiate the execution of the project until it is ready to be handed over to operations. That is, investment costs are all those incurred, starting immediately after the investment decision has been made and until the project is able to start providing the predicted services and benefits. Investment costs incurred in an education project are:

Land. This item corresponds to the cost of the physical space required to execute the civil works. For the sizing of the land, it is recommended that the surface requiring the civil works be taken into account, plus some open spaces and future expandability, etc.

The valuation of the land must always be made. This is obvious in cases when the land has to be purchased by the project, but also the land has to be valued when the project sponsor owns it, and when the land has been donated or if it can be occupied at no cost. Therefore, since there is always an economic opportunity cost for the land, the use of this land by the project involves an economic cost to society.

However, keep in mind that this opportunity cost should be considered only for economic evaluation purposes and must not be included in the budget when negotiating the financing of the project.

In the case of land being acquired for the project, the total acquisition cost should be considered, including all costs involved in the transaction (notary fees, transfer, legal fees, etc.). In the event that the land belongs to the project sponsor or is to be donated, the value to be imputed corresponds to the market value (value that could be sold assuming that there was no impediment to it).

Besides the initial cost of land acquisition, in the economic evaluation of the project we must also consider the residual value of the land. This corresponds to the estimated sale value of this land at the end of the project life. Usually urban land does not depreciate, (i.e. it does not lose its value); on the contrary, in many case the value of land increases over time. Thus, a conservative assumption is that, at the end of the project life, the land will be sold at the same amount at which it was acquired.

It is also necessary to include all the expenses required for land preparation, such as clearance, drainage, leveling and fencing. Also, if the land has no connections to the networks of basic services (i.e. electricity, water, sewerage), the analyst should incorporate all these connection costs into the economic evaluation, including the cost of the connection feasibility study.

Any cost that is a result of a tax (e.g. tax on property transfer) shall be included only for the purpose of the project’s budget preparation, but shall not be included for the purpose of economic evaluation.

In determining the cost of the land (and any costs in an economic evaluation of project alternatives), the analyst should consider the concept of opportunity cost.

For example:

Consider the case of a school construction project in which a deficit was detected of 566 m2 in buildings and 600 m2 of free area. Suppose that adjacent to this school there are two vacant lots, each of 600 m2. One is a municipal property and it is offered to the school for 100 years' occupation at no cost. The second is a private property that must be acquired at a market price of USD 125,000. In this case, for the purpose of economic project evaluation, the cost of land is USD 250,000. This is because the project initiators must pay USD 125,000 to the private owner and another USD 125,000 for the municipal land; even though this land is free it must be valued at its market price, which is given by the value of other similar land sales.

However, in the project's budget, to be prepared for project funding, the relevant cost is only USD 125.000, i.e. for the acquisition of the private land.

Construction costs:

The construction cost corresponds to the value of buildings and other necessary physical works needed to materialize the project alternative. It includes the costs of materials, transportation of those materials, labor, supervision, project management, counseling, and all other necessary expenses for the construction of the civil work.

At this point, we are referring to construction costs in generic terms, understanding that it could also be a repair, remodeling, expansion, etc. The important thing is that the assessment should be made taking into account the cost per square meter (m2) of "construction", differentiated between whether it is construction, remodeling, repair or other. Moreover, within the generic construction costs, the architectural designs and the detailed engineering studies should be incorporated as costs, if appropriate.

For the economic evaluation of the project, it may be necessary to correct some of the market prices of inputs in order to convert them into economic prices. This correction will include the elimination of taxes and possibly an additional correction due to other market distortions.

Also, at the end of the project life we should consider the residual value of the buildings. This corresponds to the value at which the buildings could be sold at the time the project stops its operation. The analyst must not consider the value of the land in the calculation of the residual value of the buildings, because that would be double counting, given that the land has already been considered as a separate asset.

Finally, as in the case of land, the residual value of the buildings should also be valued at their market price. Any additional donation of work and/or supplies for the project's construction should also be considered in the evaluation, valued at their economic opportunity cost, even though this may not actually be paid.

Equipment costs:

This item corresponds to the value of all movable elements and other components necessary for the project to remain operational. For example, chairs, school tables, desks, blackboards, etc. The cost of the equipment should include the cost of installation, where applicable.

In the case of the construction of a new school or of the partial replacement of an existing school that involves the implementation of new construction works, the value that is to be assigned to the equipment should vary generally between 3% and 5% of the total construction cost. It is important to remember that in the case of the expansion or partial replacement of a school, the analyst should only consider the equipment that is actually missing, and not the full list of equipment that might be required for a school.

It is recommended in cases where the equipment is more complex (i.e. specialized equipment for technical education, libraries, laboratories, etc.) that a detailed list of the required equipment be made, with their respective technical specifications, and that two or three quotes are obtained from different companies.

The equipment shall be valued at its market price, inclusive of taxes, for the purposes of the project budget, but taxes shall be eliminated for the project's economic evaluation. If the equipment is donated, obviously it must not be considered for budgeting purposes. But for economic evaluation purposes the equipment must be valued at market prices, excluding taxes. In some cases, it may also be necessary to correct the market prices of the equipment to obtain their economic price.

For example:

If some of the equipment is imported, it will be necessary to correct the market price, applying the conversion factor for foreign exchange.

A cost that must not be forgotten is the replacement of equipment. Indeed, the life of the furniture and equipment is usually less than the life of the school's infrastructure. Consequently, during the period of the assessment horizon, the equipment will need to be replaced from time to time. This means periodic re-investments during the life of the project. Since the usefulness of these assets is different depending on its type, for each category there should be an estimation of when it should be replaced. This cost must be recorded in the cash flow of the project in the year in which it is estimated it shall occur.

Finally, some equipment may end up having a residual or scrap value at the end of its life, which must be considered cash inflow in the year in which the replacement is made. As the case is that of land and construction, the revenue from selling the equipment should be considered opportunity costs.

III. Operating Costs

Operating costs are all those expenses that must be incurred by the school in order to provide an educational service in a regular and ongoing way. However, it is important to note that in the case of a project that adds something to an already existing operation (i.e. a brownfield project), the relevant operating costs that should be considered for economic assessment are only the incremental costs. The quantification of operational costs is usually done on an annual basis.

Operating costs in education projects generally include the following:

Remunerations:

Corresponds to the cost of the salaries and wages of all the necessary human resources of the school, the staff that delivers all administrative, auxiliary and educational services. This cost item is recorded in the accounting books as teachers' salaries and the wages of administrative and auxiliary staff; it includes social security costs, gratuities, bonuses and others.

This cost item should detail total staffing requirements, specifying whether they are for professionals, technicians, secretaries, assistants or others. In addition, it must be specified if the hire of qualified personnel is necessary in a given subject (e.g. an international expert).

For the purpose of identifying the economic costs associated with this item, the analyst must consider all incremental personnel involved, that is, all those that produce an additional expenditure for the entity that shall operate the project. In other words, the analyst should not consider the cost of the existing staff (i.e. the staff of the "without-project" situation, those who remain working in the school regardless of whether the project is implemented or not).

When making an economic evaluation, the salaries of volunteer personnel working in the project should be calculated as if they were hired at market wage-rate in order to take into consideration their opportunity cost for society.

In the economic evaluation of the project, it will be necessary to correct market wages in order to calculate the economic price of labor. Suffice it to multiply the estimated remuneration cost, separated by skill levels, by the corresponding conversion factor. In the case of the education sector, teachers, principals or other professionals are all considered skilled workers, while secretaries, inspectors, clerks, etc. will be classified as semi-skilled workers, and all those who work as janitors, cleaning staff, etc. are considered unskilled workers. It should be noted that in the case of projects aimed at providing a specific educational service, usually the wage bill is the most important cost item.

Inputs costs:

This corresponds to the value of the essential elements that allow the proper functioning of the school. These include, among others, cleaning materials, clothing, fuel, office supplies, support materials, etc.

As in the previous categories, the analyst should only consider the incremental costs attributable to the implementation of the project alternative. In those cases, where some current inputs might be replaced for new ones in the project alternative, the economic evaluation should only consider the net incremental cost. That is, the cost of new inputs minus the cost of those old inputs that are going to be replaced.

The price of inputs required for the project can be estimated based on the experience of other schools or projects developed by the sector. However, more accurate and updated prices are usually obtained if a comprehensive list of the necessary inputs is quoted at the market. These prices must include transportation costs to the project site. The relevant taxes to be paid must be indicated separately.

Basic services costs:

This is the cost of all services required to operate the school. These services include, for example, water, electricity and in some cases heating fuel. It is important to note that, as in the previous case, only incremental costs involving the project should be considered. Both in the case of basic services and in that of maintenance, the relevant costs are only those incremental costs that are absent from the without-project situation.

To determine the price to pay for basic services, it is generally sufficient to make contact with suppliers and public–utility providers and ask them for the cost. If this is not possible and some of the services must be supplied by the project by itself (e.g. an electricity generator), it will be necessary to resort to entities that provide this service and find out the cost of doing this.

Maintenance costs:

This is the expenditure required to maintain the capacity to generate the benefits of movable or immovable property, preventing deterioration or premature failure. This corresponds to expenses such as painting and minor repairs of buildings, periodic maintenance of vehicles and equipment, repairs and painting of furniture, etc. Generally, this value is estimated as a percentage of the value of the goods subjected to the maintenance. As a rule of thumb, consider between 2% or 3% per year; this will obviously depend on the type of asset, the use it has been given and if it has received maintenance.

Rentals costs:

This item corresponds to the payment of rentals for buildings, land, vehicles and/or equipment required for the operation of the project. The economic evaluation should consider the total cost of the lease, including commissions but excluding any tax-shield effect. If the issuance of a guarantee is necessary, this must be reflected in the cash-

flow statement, as an output when the money is put aside to guarantee payment, and as a cash inflow when the money is recovered at the end of the leasing period.

To estimate these costs, the calculation should be based on the costs incurred by the cost incurred in recent similar projects in recent similar projects or on quotations requested from potential suppliers. The rental agreement can also be estimated as a percentage of the value of the leased object.

Other operating costs:

Within this item, all other operating costs necessary for the functioning of the educational establishment should be detailed. Some of these are communications, printing and publishing, insurance, etc. Only consider incremental costs from project implementation and consider incremental costs from project implementation when making the economic evaluation.

IV. Transport Costs

In many cases, the implementation of a project alternative implies that the school population should move daily or modify their current travel habits. Both are in the case of the project alternative contemplating providing a bussing service, as incremental transportation costs should be estimated when travel times and distances are modified by the project.

Time and cost of transfer:

If the alternative project significantly modifies distances, travel time, or the travel costs of its students, it is advisable to estimate these costs. This may be the case when the project alternative is the construction of a new school, or the transfer of an existing school, or the closure of an existing school, or the merger of two schools, etc.

To estimate these transportation costs, the analyst must study the map of the influence area. In this map, one or more geographic points may be considered as the centers of gravity or as representative of the location of the target population. The time required and the cost of travel are then estimated, considering the use of the means of transport mostly utilized by the students from each point to the school. This must be done both for the without-project situation and the with-project situation. These costs and times are then multiplied by the annual number of trips that the target population needs to make. This is how total cost and total travel time is calculated (see example). In the case of small children that need to be accompanied to the school, the cost incurred by their companions should also be addressed.

Transportation of students and/or teachers:

If the alternative project includes providing a bussing service then the total cost of that service should be incorporated, including the remuneration of drivers, fuel and lubricants, tires, maintenance and service of buses, financial capital cost invested in

buses, etc.

Also, the analyst should try to estimate the additional cost (or savings) involved in the transfer for students and/or teachers. For this, it is necessary to calculate the average general cost of travel, i.e. including travel and time.

5. The Evaluation and selection of project alternatives

5.1 Evaluation criteria

Education infrastructure projects are currently evaluated using of the Cost-Efficiency Method. In particular, the project appraisal guidelines provided by the Ministry of Planning for the formulation of educational infrastructure projects, request that the project analyst calculates the: Equivalent Annual Cost per Benefit (i.e. EAC/Benefit) to evaluate alternative projects.

5.1.1 Cost-efficiency method

In those cases, where it is not possible to express the benefits of a project in monetary terms, or the effort to do so is too great or complicated to justify (as usually happens in education projects), the second best alternative is to use cost-efficiency methods. The purpose of these is to determine which alternative design achieves the desired objectives at minimum cost (i.e. which of the project alternatives is the most efficient).

5.1.2 Minimum cost (Present Value of Costs: PVC)

The minimum-cost method is applied to compare project alternatives that generate identical benefits. If the benefits are equal, project alternatives will differ only in their costs. Therefore, we can choose the one that allows us to achieve the desired goal with the least resources. However, since the costs of various project alternatives can occur at different points in time, the comparison must be made in present-value terms. For this purpose, the following formula is applied:

Where: PVC = Present Value of Costs
Ci = Project Costs in Year i
r = Discount rate

$$PVC = \sum_{i=0}^{i=n} \frac{C_i}{(1+r)^i}$$

5.1.3 Cost Per Unit of Benefit

The previous present value of cost is a minimum cost method and it is only applicable in cases where the benefits of the various alternative projects are equal. However, it often happens that different alternative projects generate unequal benefits. When this is the case, but the alternatives differ basically in the "amount of benefits" generated (measured this through a "proxy" variable of benefits), the cost per beneficiary can be used as a valid criterion for selection of alternative projects. Or, in more general terms, the cost per "unit of benefit " produced can be used to this end.

To do this, the analyst must calculate the PVC for each project alternative and divide it by the "benefit " it produces, as measured by a "proxy" variable. Generally, that proxy variable is the number of beneficiaries.

$$C/B = \frac{VAC}{N^{o}\ Benef.} = \frac{\sum_{i=0}^{i=n} \frac{C_i}{(1+r)^i}}{Numero\ de\ beneficiarios}$$

Where: C/B = Cost per Beneficiary

5.1.4 Equivalent Annual Cost

Another way to compare alternatives that generate identical benefits is using the method of equivalent annual cost. This is to express all costs of the project in terms of an annual fee whose present value is equal to the PVC of the alternative project. For its calculation, the following formula applies:

EAC = PVC * CRF

EAC = Equivalent Annual Cost
PVC = Present Value of Cost
CRF = Capital Recovery Factor, this is defined as:

$$FRC = \frac{r*(1+r)^n}{(1+r)^n - 1}$$

Where:
r = Discount Rate
n = Number of Years

6 Submission of the selected alternative

Once each of the possible alternative projects has been thoroughly analyzed and evaluated, the next step is to select the best alternative project to be executed. The selected alternative project may be a project related to the coverage of the educational system or a project related to the quality of education.

The selected alternative project must be submitted to the authorities that must approve their execution and/or provide its funding. Also, in some cases it may be convenient to present the chosen project to the community, indicating why it was chosen and the benefits and costs associated with it. For this purpose, it is necessary to prepare a project document whose structure is suggested below.

6.1 Guideline for the presentation of the project profile

6.1.1 Summary and conclusions

The presentation of the project should start with a good summary of the most significant issues identified during the study. Thus the reader will have a clear overview of the problem under analysis and the alternative solutions proposed to solve it.

This summary must take account, in the first place, of the problem that has to be solved, either totally or partially, and show the area of influence to which the project will be limited. It is important to mention the main features of the problem and the study area, both geographical conditions and its population.

Secondly, we should mention the result of the diagnostic of the current situation (deficit or surplus), with particular reference to the target population that needs to be addressed by the project.

Finally, it is important to explain the outcome of the economic project evaluation, along with mentioning the various alternative projects analyzed, indicating the most relevant aspects that led to the selection of the alternative project to be implemented.

6.1.2 Diagnostic of the current situation

At this point, present a summary of the main aspects analyzed in the diagnostics of the current situation. The summary should include all the relevant variables in order for the need or the existing problem to be clearly seen.

6.1.2.1 **Area of Influence.**
It will be necessary to attach the location map where the area of influence, along with its main features, should be clearly identified.

6.1.2.2 **Current Demand.**
Here the analyst must detail the target population that requests the solution, indicating the following:

Case a) When there is no educational establishment.

i. Population in the area of influence and its location:
- Location map
- Identification of the age group of interest

ii. Population characteristics:
- Socio-economic
- Income Level
- Cultural aspects

iii. Characteristics of the area:
- Accessibility
  - Existence of access roads
  - Conditions of access roads
  - Means of transportation
- Economic geography
- Weather conditions

Case b) When there is an educational establishment.

i. Total enrollment focus on the establishment of problem:
- Composition per level/grade
- Number of courses in each grade
- Number of shifts and working days
- Number of teachers per grade

ii. Origin of student enrollment:
Locate the school on the map and identify where the enrolled population comes from.

iii. Characteristics of the enrolled student population:
- Socioeconomic level
- Level of education of parents and/or guardians
- Predominance of t traditional culture

iv. School population in the influence area:
Include a summary of the analysis of the remaining area of influence, basically the age group of interest: population of that group, location and where it is being attended.

Projected demand. At this point you must specify:
- Population by age group per year x
- Characteristics of the area considered in the projection

6.1.2.3 Current Supply.
This section must summarize the history related to the characteristics of the supply of the educational system in the area of influence of the project.

Case a) When there is no school:

i. Characteristics of existing schools in the area of influence:
- Geographic location of each school.
- Year of construction and materials used in each school.
- Type of administration and finance.
- Existence and availability of land.
- Existing surface and status of each of the existing buildings in the area.

ii. Characteristics of the area:
- Availability of basic services.
- Conditions of public safety.
- Conditions of access.

iii. Features of educational services:
- Type of education provided within the area of influence.

Case b) When there is a school

i. Geographical location of the school (show location on the map).
ii. Features of the infrastructure:
- Year and construction material of the buildings.
- Original destination of the buildings.
- Installed capacity of buildings.
- General status of the buildings.
- Equipment.
- Availability of basic services.
- Legal characteristics and property rights of the buildings.

iii. Administrative features:
- Who is responsible for school administration?
- Type of financing it receives.
- Staff and personnel.
- Ownership and legal situation of the land.

iv. Type of education provided.
v. Characteristics of the environment.

6.1.2.4 **Educational indicators**.
This section should present the summary of all those representative values of the variables analyzed in the course of the study.

6.1.2.5 Deficit
As appropriate, it shall include:

a) The deficit related to the infrastructure of the educational system.
i. Deficit in coverage.
ii. Deficit because of the poor state of infrastructure or equipment.
b) Deficit related to the quality of educational services.

6.1.3 Identification and Definition of Alternative Solutions

At this point, you should summarize each of the alternative projects that have been analyzed that can solve the detected problem.

6.1.3.1 Optimization of the Current Situation.

Where possible, indicate the improvements that can be achieved to the current situation, either in matters of coverage or quality of service through simple administrative and management measures (i.e. requiring minimum investment).

6.1.3.2 Description of Each of the Alternatives Analyzed.

Prepare a brief description of each alternative project that has been analyzed, indicating the main physical and operational characteristics of each.

6.1.4. Evaluation of the design of the alternative project

Present in summary form all the associated benefits and costs for each of the alternative projects that have been analyzed and the criteria and variables that influenced the selection of the chosen project alternative. It is suggested that the following aspects be summarized:

- Identification and quantification of the benefits of each alternative.
- Identification and quantification of the costs of each alternative.
- Criteria for selection and analysis that justifies the alternative project chosen.

6.1.5 Presentation of the selected alternative project

Finally, the document must account, in summary form, for the description of the project, with emphasis on its associated benefits and costs and an implementation and operation plan for the selected alternative project.

6.1.5.1 Benefits

This point should summarize all those benefits, both measurable and un-measurable, identified for the alternative project that has been selected.

6.1.5.2 Costs

At this point, the analyst should detail each of the cost items associated with the selected alternative project, with their respective units of measurement and amounts. If appropriate, the following items should be included:

a) Investment Costs

i. Land
ii. Construction (summary of the architectural program with its construction costs per m2)
iii. Equipment
iv. Advertising

b) Operating Costs

v. Remunerations
vi. Supplies
vii. Basic services
viii. Maintenance
ix. Rents
x. Other

c) Transportation Costs

xi. Time and cost of transportation
xii. Transportation of students and/or teachers

6.1.6 The “with-project” situation

At this point you have to sum up the situation as it would with the project, with the points raised below:

- The problem to be solved with the project.
- Specify the expected demand to be met with the project, i.e. justify the target population.
- Specify the supply to be met through the project.

For example:

If, in the diagnostic of the current situation, the analysis has identified that there is a significant number of young girls who are teenage mothers or who are pregnant, it is suggested that special actions be incorporated to support their retention in the school system. For example, nurseries could be implemented where young mothers could leave their babies, aged from six months to three years, with trained staff.

- Proposed architectural program, where appropriate.
- Cost summary.
- Investment program.
- Schedule of activities.
- Specific project indicators.

6.1.7 Annex and attachments

It is recommended that any document needed to support and justify the situation be included as an annex to the project profile. Among the recommended documents for inclusion are the following:

- Map of the school location that was drawn during the course of the study, where the following is indicated: The area of influence, sectors where demand is located, schools that constitute supply, distances and travel times, etc.
- Architectural drawings, where appropriate.
- Engineering design, where appropriate.
- A detailed project budget
- Certificates of the legal status of the land that the project shall occupy.
- Certificates, supported by a competent authority, attesting to the feasibility of financing the recurrent operating costs that shall be generated by the project.
- Commitments of the community to the implementation and/or operation of the project.
- Feasibility of connection of the different basic services.
- Photographs that graph the situations presented.
- Technical reports substantiating the proposals.

For the aforementioned annexes, as well as for the other sections of the document, it is suggested that the charts and tables produced in each of the points in the document be referred to.

ANNEX 1

1. Tools for identifying education problems

Here is a description of some tools that facilitate and make more efficient the task of detecting problems in the education sector. Some of the tools presented are complex to implement and rather expensive (especially if done on a national scale); however, there is a consensus within sector authorities that their benefits outweigh their costs and therefore their use is highly recommended. It is greatly recommended to use more than one instrument for problem definition where possible. The analysis should be performed in a complementary way, superimposing the information that each tool provides in order to identify new areas of interest.

1.1 Objectives and sector policies

An important starting point for the identification of a given problem is to place the analyst within the general framework given by the goals, objectives, policies and guidelines of the education sector. To this end, it is very important to know the priorities of the sector at the national and sub-national levels, and the strategies developed to implement public policies. In addition, it is necessary to keep updated on the new technologies and elements that are being incorporated or may be incorporated into the education sector in the country. Thus, by comparing the expected situation in the education sector in a given locality or governorate with the desired pattern given by the national and subnational objectives and policies, it is possible to detect gaps and problems that prevent the achievement of the desired goals.

1.2 Information on schools gathered from the field

One of the simplest ways to detect a problem at the local level is to listen to the demands of the school board, the educational community or any grass-root community organization. What are generally seen in these cases are problems in terms of coverage, overcrowded schools, saturation of existing capacity, renovation of buildings, etc. To check if there is indeed any deficiency, it is necessary, if possible, to travel to the school and verify the situation at the site, talk to the different stakeholders and identify possible causes.

Other useful elements at the local level are school statistics, which the school manager must collect. For example, if the registration of an establishment is progressively decreasing or if the dropout rates have increased significantly over the last period, this normally is a clear indicator that something in that system is not working well. Generally, these signs are researched together with the school management, with the parents and guardians and with the local community.

1.3 Location Maps

For purposes of detecting coverage gaps and/or problems related to the location of schools, you should use the educational-system location maps. These are simply maps of a given geographical area that show the location of all existing schools, specifying their type and level of education, their existing capacity and the current enrollment for each. L

Some maps provide even more detail, displaying the type of school, years since its construction and a description of its overall infrastructure. The analyst can also combine the existing census information with the use of a geographic information system (GIS) for the development of community-oriented maps detecting poor households and the section of the population with unsatisfied basic needs. In the case of the education sector, the census information on location and the distribution of the age structure of the student population can be compared with the

enrollment or supply of openings provided by schools in that area; thus gaps, unsatisfied needs and problems can be easily detected. However, those findings must be verified through other means in order to determine the existing deficit.

1.4 Polls and Surveys

There are other more sophisticated instruments such as questionnaires, polls or surveys that help, among other things, to identify gaps where the educational system or other services do not reach the target, or if they do, do not deliver their service in a satisfactory way. On the other hand, these questionnaires allow a focus on the benefits to the specific target group of the project, as well as helping to verify how resources are being spent and providing insight into the perception of the people (i.e. the beneficiaries) of the benefits that are being granted to them.

Examples of these instruments are the social protection file and the national socio-economic characterization survey. The information provided by these two instruments is used by all social sectors. Particularly in the education sector, that information can be used to focus the target population, to analyze the focus of the investment initiatives under operation, and to identify any deficiency in the delivery of some goods or services, among other things.

1.5 Systems of measuring the quality of education

One of the most recurrent and complex subjects in the education sector is the quality of education, simply understood as the ability of the education system to generate the expected benefits. Just as it is difficult to discuss the subject of the quality of education, so this is true of its measurement. Generally, problems in the quality of education are analyzed and discussed at higher levels by the senior authorities of the sector.

However, there are tools such as the educational quality measuring system that provide, on a regular basis, information on indicators[3] (i.e. input indicators, process indicators, outcome indicators and context indicators).

This information on the quality of the education received by students attending schools is provided mainly to school boards and directors, teachers and parent's centers. With this information, each school can obtain its own indicators that account for the quality of the education provided, and compare their own results with those obtained by other schools with similar characteristics. They can look for factors that explain these results and then evaluate the impact of the actions that have been undertaken.

The purpose of the educational quality measuring system is to collect objective and reliable information about student performance and other relevant aspects of their training from every school in the country, in a systematic way. Once processed, the information is delivered to all the agents in the educational process.

To measure the quality of education, the educational quality measuring system uses the following estimates:

[3] There is an exhaustive set of education indicators, categorized according to input, context, process and output framework and recognizing the hierarchical nature of education systems (distinguishing a national system, school, classroom and individual student level). Specific attention is given to outcome indicators. Outcome indicators are further differentiated as output, outcome and impact indicators. Output indicators are seen as the more direct outcomes of schooling, often measured by means of standardized achievement tests. Outcome indicators, also described as ''attainment indicators'', are summary statistics of participation and graduation rates. Impact indicators refer to the social status of students having reached certain levels of schooling.

Personal development:

These indicators are intended to inform on the perceptions that the student has of him/herself in various aspects of school life, such as self-concept (as s/he sees him/herself), self-esteem (satisfaction with his/her image) and self-ideal (as he/she would like to be). Each of these variables relates to four important factors in child development: physical maturity, school performance, peer relationships and school adjustment.

Acceptance of educational work:

Surveys targeted to students, their parents or guardians and a sample of teachers systematically measure the degree of satisfaction of the aforementioned groups in the educational work performed in the school.

Achievement of academic objectives:

This corresponds to the level of proficiency that students have in fundamental cognitive objectives in the official curriculum. To measure this, national math and language tests are performed (including reading and writing skills), as well as tests in history, and geography and natural sciences.

School efficiency:

The key performance indicators (KPIs) that are used to calculate these estimators are the following: the promotion, repetition, retirement rates and the average number of years that it takes a student to finish the cycle under analysis. The information used is the one that is managed by the Ministry of Education through its usual procedures and statistics. On the other hand, the sector authorities can use this information to guide their policies for improving the quality of education and reducing inequality.

ANNEX 2

Education Indicators

A series of indicators are here presented that can be very useful when analyzing in detail the detected problem, especially in order to determine the type of existing deficit and its quantification in comparison to other school districts, governorates and/or the national level.

(1) School precocious advancement:
This is the percentage of school students that are under the normal age of a certain school level.

(2) Average attendance:
This is the ratio of the total attendance of students in a school, type of teaching or course in a given period of time, and the number of days worked during the same time period.

(3) Coverage:
This is defined as the percentage of the school-age population that is served by the educational system (see example on the next page).

(4) Average age:
This is the weighted average of all ages of students at a given school level (i.e. in high-school, it would be freshman, sophomore, junior, senior). It is obtained by multiplying the simple average age by the annual registration for that age. Those are then added together and this sum is divided by the total enrollment at grade level.

(5) Internal schooling:
This indicator is the weighted average of the years of study of all the students enrolled in the system. It is assumed, for the purpose of the calculation, that students have as much schooling as the degree to which they are registered; for example, students in grade 1 are considered to have had one year of schooling, those at grade 2 to have had two years of schooling, and so on.

Example: Calculation of Coverage

To calculate coverage, the following methodology can be applied. Obtain:

a) The enrollment figures by age, obtained from the registration forms handled by the school or the Ministry of Education.
b) The population by specific age, as provided by the publications of the National Institute of Statistics.

To calculate the basic school coverage, the following formula can be applied:

$$\frac{\text{Total enrollment + basic education} \quad \text{Total enrollment + special education}}{(A + B + C + D + E - F - G)}$$

Where:

A = Population from 6 to 13 years of age
B = Basic education enrollment for those less than 6 years old

C = Basic education enrollment for those over 13 years of age
D = Special education enrollment for those under 6 years of age
E = Special education enrollment for those over 13 years of age
F = High School education enrollment for those under 14 years of age
G = Pre-school education enrollment for those over 5 years of age

In the numerator we must consider total enrollment in primary and special education. Whereas in the denominator we have the entire student population from 6 to 13 years of age, plus the enrollment of some “extra ages” (i.e. those students who are beyond the ideal age for their grade, in this case students who are older than 13 years of age and are still in basic education). This is done for both basic education and also special education. Then we must subtract the enrollment in high school of those students who are 13 years of age or less, and the enrollment in preschool education of children over 6 years.

For high school coverage, the following formula can be applied:

$$\frac{\text{Total enrollment in high school (including all types: i.e. Humanistic–scientific and technical–professional education)}}{A + B + C - D - E - F - G}$$

Where:

A = Total population from 14 to 17 years of age
B = High School enrollment for those under 14 years
C = High School enrollment of students over 17 years of age
D = Basic Education enrollment for those from 14 to 17 years of age
E = Special Education enrollment for those from 14 to 17 years of age
F = Adult Education enrollment for those from 14 to 17 years of age
G = Higher Education (university) enrollment for those from 14 to 17 years of age

In the numerator we must consider the existing total enrollment in high school. In the denominator we must consider total population between 14 and 17 years of age, in addition to the enrollment of the extra-aged from high school (over 17 years of age), less enrollment in primary education, special education, adult education and higher education, because those students are being served by other levels of the educational system and they also correspond to the population aged between 14 to 17 years of age.

(6) Schooling average of the population:
This indicator is the average of the years of effective schooling of all the inhabitants of a country, region or city.

(7) Initial registration:
This is the actually recorded enrollment on a stipulated date by the educational authorities for all schools. It is done at the beginning of the school year every year and is based on the official records of each school.

(8) Final registration:
This is the registration recorded at the end of the school year. It is obtained from the records of initial enrollment, plus those of students admitted after the date set for the initial enrollment, less the number of transferred and withdrawn or retired students over the year.

(9) Higher cost incurred:
This is the ratio expressed as a percentage between the time of exit from the school system and the number of grades of each school cycle (i.e. pre-school is 2 years, basic school is 8 years, high school is 4 years, etc.). This indicates how much time was spent in excess for the students in each cycle.

(10) School normality:
This indicator corresponds to the percentage of students of normal age for every school grade.

(11) School retention:
This is the end result of the school's evaluation of each grade of the school system, and is expressed in approval rates, failure rates and drop-out or abandonment rate.

(12) Approval:
This is the number of students who successfully passed their assessments during a school year. Therefore, it is understood that the approval rate is the relationship between the number of approved students and the student universe under evaluation.

Approval Rate = (Nº of approved students) / (Total Nº of students)

(13) Failure rate:
This is the number of students that did not satisfactorily pass their assessments in one school year. The failure rate is the relationship between the number of unsuccessful students and the student universe under evaluation.

Failure Rate = (Nº of unsuccessful students) / (Total Nº of students)

(14) Drop-out or abandonment rate:
This corresponds to all those students who by formal retirement couldn't be evaluated. The dropout rate is the ratio of students who withdrew from the system and the universe evaluation.

Drop-out Rate = (Nº of drop-out students) / (Total Nº of students)

(15) School Delay:
This is the percentage of students of higher-than-normal age in a given school grade.

(16) Illiteracy rate:
This is the percentage of the population aged 15 years and over who are unable to read and write a short paragraph. This data is usually obtained from population census.

(17) Timely success rate:
This is the relationship established between the number of students who graduated in the exact number of years from a given cycle. It is expressed as a percentage.

(18) Overall success rate:
This is the relationship established between the total number of students who started in a given cycle and those who graduated even if it took them longer than normal to finish that cycle; it is also expressed in percentage terms.

(19) Retention rate:
This is the relationship between the number of students who remain in school at each grade level to an initial group who started first grade in a given year; it is expressed in percentage terms.

(20) Time of exit:
This is the weighted average of the number of years it takes for a student to graduate from the system with a degree or at a certain level or having completed a cycle.

ANNEX 3

Problem Analysis: The Problem Tree Methodology

The Logical Framework Approach (LFA) is a methodology mainly used for designing and monitoring international development projects. Variations of this tool are known as goal-oriented project planning (GOPP) or objectives-oriented project planning (OOPP).

This technique starts with the use of the “problem tree”, also known as the “tree of causes and effects”, which is an excellent and simple tool for identifying the chained implications of a given problem and the root causes that triggered it in the first place. Graphically, the problem tree displays in its upper part the effects that have been identified as the consequences of the problem (i.e. the effects tree) and in its lower part the causes that produced the problem (i.e. the causes tree).

The characteristics of this method are as follows:

- It is one of several methods applicable.
- It is a flexible procedure.
- Its efficiency and effectiveness depends on the participants.
- It generates a consensus of opinion in the planning process.
- It requires a realistic application.

The general process for the construction of these trees consists of the following steps:

1. Identify the problem.
2. Examine the effects of the problem.
3. Identify possible causes of the problem.

The Problem Tree

4. Define the objectives tree (or the means-and-ends tree) for the solution of the problem.

The Tree of Means and Ends

5. Develop alternative actions to solve the problem.
6. Set feasible and relevant intervention alternatives.

The Tree of Alternatives

In the process of preparing the diagnostic, only the problem tree is built. In the following steps, the problem tree is revisited in order to prepare the objectives tree (or means-and-ends tree) and the identification of alternative interventions.

The problem tree specifically allows the identification and visualization of the causal factors that affect the generation of the problem, the relationship between those causes, and the effects or consequences that the problem generates on those who are affected.

The distinction between the causes and effects of the problem is essential in the formulation/preparation of a project or program, since the actions of the project or program must take place at the level of root causes, not just at that of symptoms or consequences or effects, otherwise it will be difficult to have an influence on the real situation.

The information needed for the elaboration of the problem tree comes from different sources, first from a literature review, then obviously from the perceptions and experience of those stakeholders that are directly affected, and lastly from the analysis that was performed of those variables that have been identified. The diagnostic information processed is then introduced into the problem tree, according to the hypotheses that explain the existing problem.

Because the problem tree is build by successive approaches or iterations (error and trial), it is important not expect to finish the problem tree in the first instance of a brainstorming session or collective work.

The schematic relations in a problem tree are constructed following these simple rules:

- The central problem lies in the middle, in the trunk or in the stem of the tree.
- The chained effects are to be located upwards, and they constitute the branches of the tree.
- The chained causes emerge from the trunk downwards, and they constitute the roots of the tree.

The following are the specific steps for preparing the problem tree:

Step 1: Identifying the Central Problem

The central problem is identified and placed at the tree trunk or stem. This must be written as a concrete but negative state and its spatial dimension (i.e. location) must also be specified.

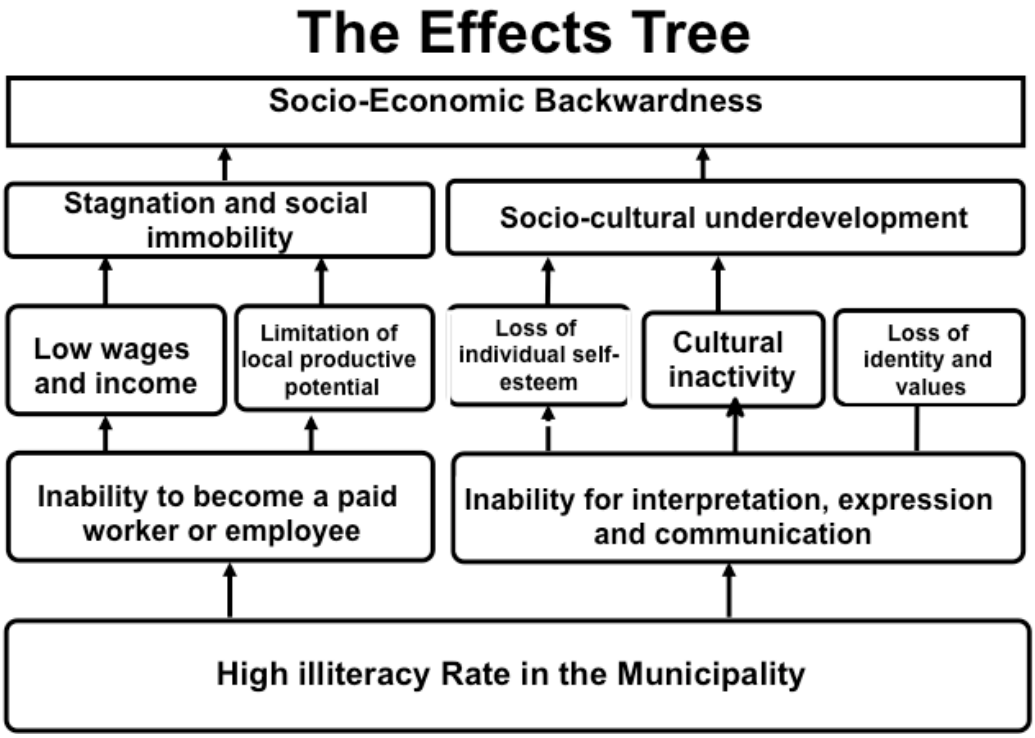
Step 2: Examine the Effects of the Central Problem

The effects are the branches of the problem tree. Start with the direct or immediate or primary effects that this problem causes. Each direct or primary effect is written inside a box that is connected through an arrow starting from the problem or trunk of the tree.

For each direct effect (that is directly linked to the problem), the analyst has to wonder if there are some other, secondary effects that may arise from it. These secondary effects are placed at a second level in the diagram, linking them through arrows from the bottom up with direct or primary effects, or first-level effects. In a way, these primary effects operate as the causes for the secondary effects.

And so on. If a secondary effect causes effects (tertiary effects) further downstream, the diagram needs to have a third, fourth or fifth level of effects. The effects are therefore chained as effects or consequences of previous effects or consequences. The highest level of the upper part of the problem tree, or its top branches, have to do with the geographical or institutional environment in which the project sponsor has competence or authority to intervene in the problem.

Figure 1) The Effects Tree (example)



Step 3: Identify the possible causes of the central problem

The causes are the roots of the problem tree. Starting from the central problem, the immediate or primary causes are represented through boxes and arrows. In turn, those primary causes may have secondary causes that explain why they exist in the first place; these are the causes of the causes. As with the branches of the problem tree, there may be many layers or levels of causes. Thus the entire root system of the problem tree is built.

It is very important, initially, to unleash creativity in generating plausible causes. A good definition of the central problem, with its chained causes, will increase the chances of finding successful alternative solutions because of the possible interventions that emerge to solve these causes.

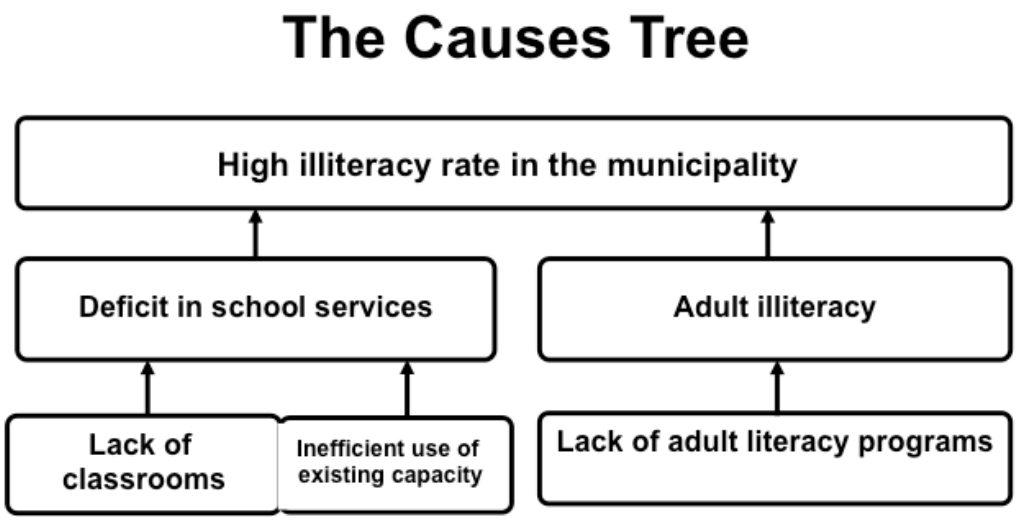
The causes tree must be read starting from the primary or main causes downwards to the secondary and tertiary levels of cause. This allows for the logic of the relations established between causes at different levels to be checked. One way of finding the logical relationship is to ask why such a cause occurs. The answer to that question will become a lower-level cause.

The degree of depth of the causes is given by the characteristics of the diagnostic made. In this regard, it is important that the causes be based on information obtained in the diagnostic and the relationships established in it. If new causes that were initially not considered in the analysis appear, they must be incorporated and analyzed in terms of their impact on the central problem.

Finally, each cause may become a possible reference for the allocation of resources in a future intervention. Among the causes, we must distinguish those that may be modified through the intervention according to the authority and mandate of the project sponsor, and those causes

that are not going to be influenced by the project or program. The latter, however, must also be recognized, as they are the ones that will condition the achievement of the ultimate goal of the project or program.

Figure 2) The Causes Tree (example)



Finally, joining the Cause Tree (branches) and the Effects Tree (roots) shall generate the complete Problem Tree, as shown

Figure 3) The Complete Problem Tree (example)

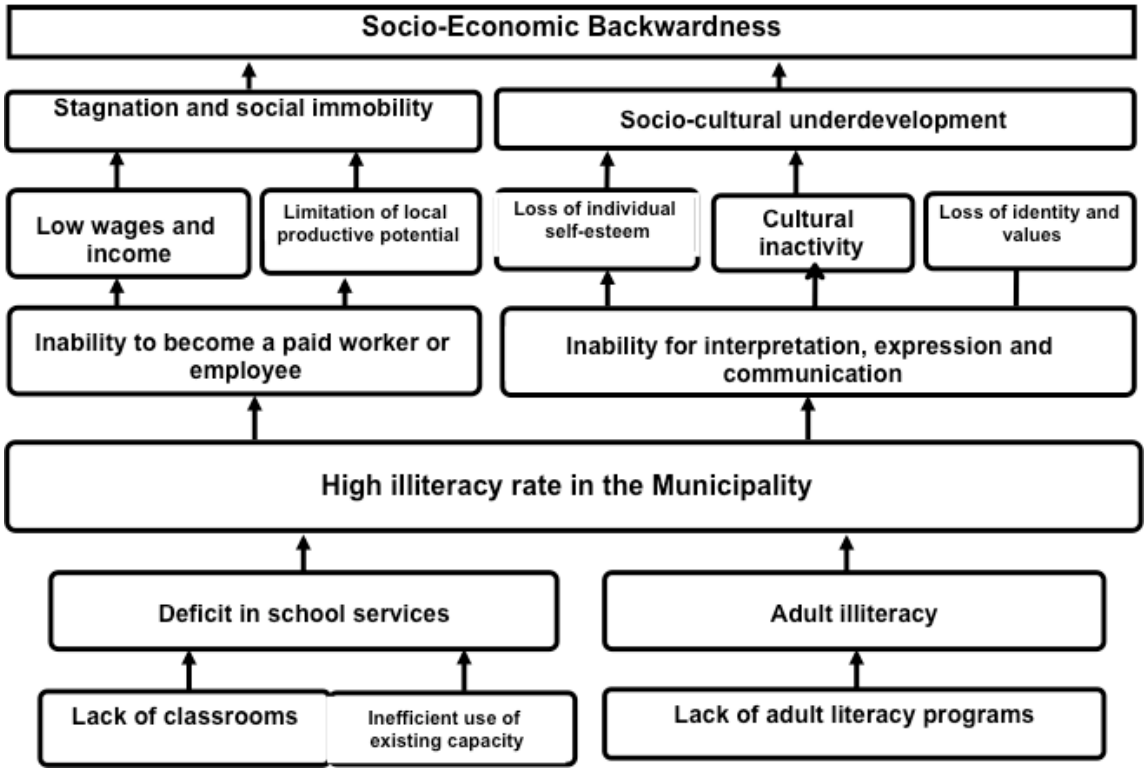
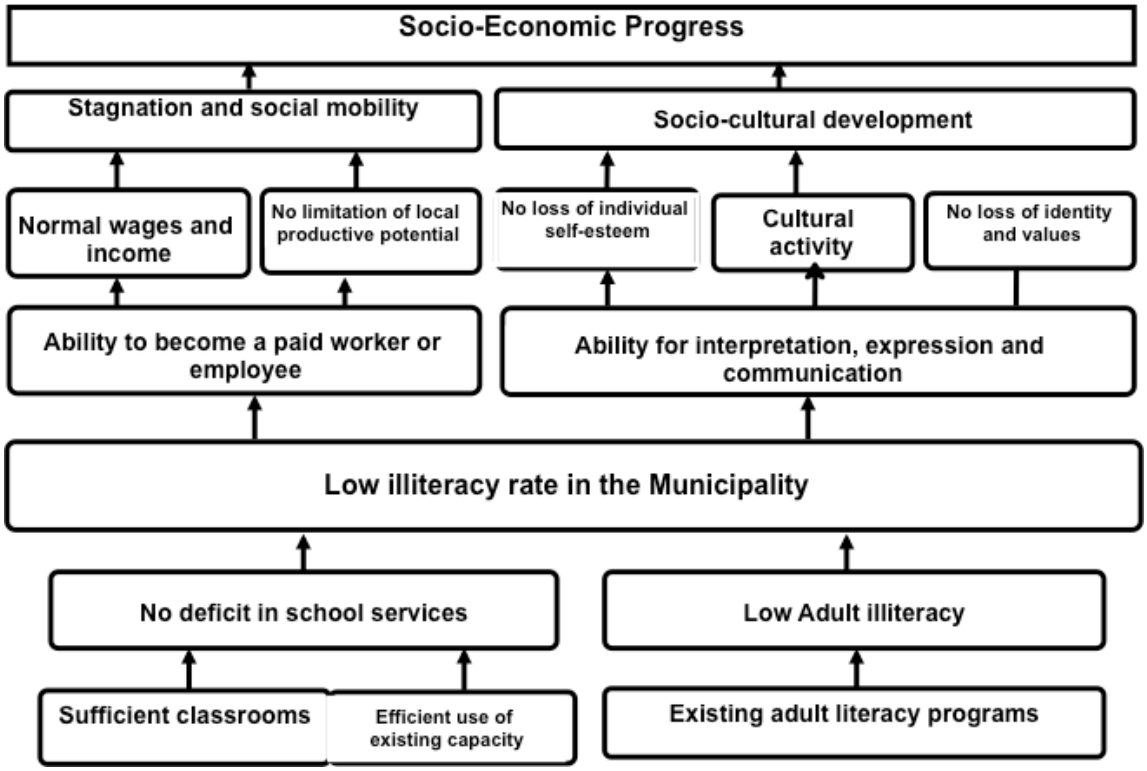


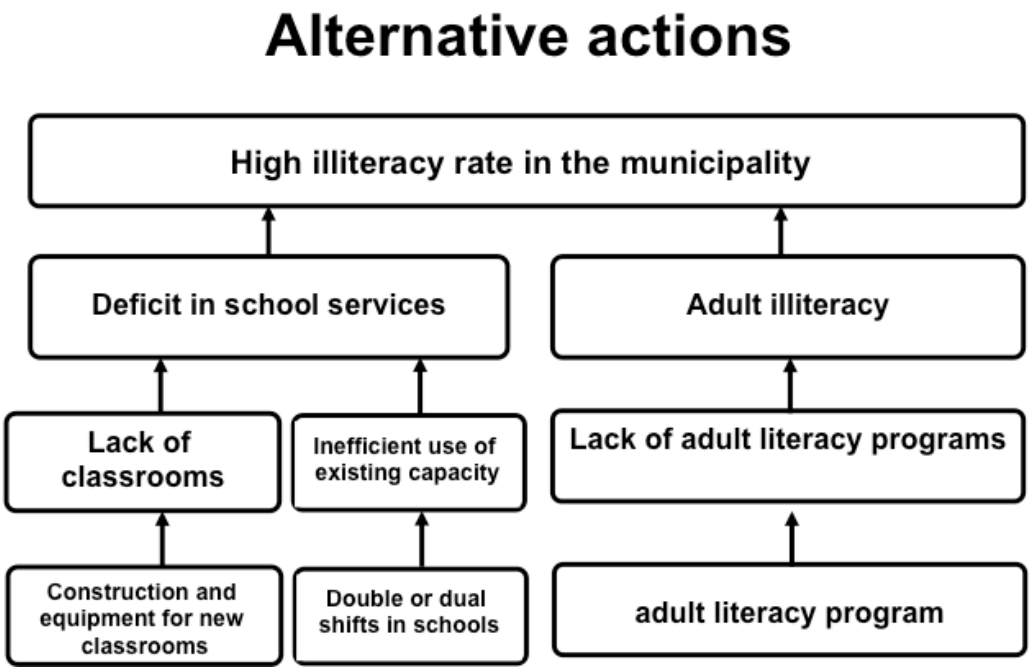
Figure 4) The Solution Tree or the Means (Resources) and Ends (Objectives) Tree



Once the problem tree has been completed, the solution tree will be exactly the opposite of the problem tree. In each box, the analyst must write the exact opposite. For example, if in one box of the problem tree it says, “Bad use of existing capacity”, in the corresponding box of the solution tree it must say, “Good use of existing capacity”. This must be done for all the boxes in both the branches and roots of the tree. The ‘negative situations’ of the problem tree are converted into solutions and expressed as ‘positive achievements’. These positive achievements are in fact objectives, and are presented in a diagram of objectives showing a “means to ends” hierarchy.

At the base of the solution tree are the means or resources. The analyst should creatively seek some concrete actions that could be effectively put into practice. The analyst needs to find an answer to the following question: What are the strategies or actions that could enable the lower means or resources of the solution Tree?

Figure 5) Formulation of alternative actions



The following aspects of each proposed action must then be examined:

a) Estimate the level of incidence in solving the central problem. Prioritize those actions with the highest percentage of estimated incidence.

b) Check the preliminarily feasibility (physical, technical, budgetary, institutional, cultural) of the proposed actions.

c) Check the degree of interdependence between the proposed actions and group all those together that seem to be complementary. Each grouping or set of complementary actions can become a separate alternative.

If, during the estimation of level of incidence, the analyst finds out that two or more proposed strategies are not mutually exclusive, it is likely that each may reinforce the other/s, making the achievement of the expected result more probable. Therefore, they should be seen as complementary components of the proposed alternative.

Note that the process of analysis is iterative or requires feedback. The doors should never be totally closed; it should always be possible to incorporate new alternatives or integrate new actions that are still considered complementary components of the solution.

In the example of the previous figures, two alternatives could be formed:

ALTERNATIVE A: Constructing and equipping new classrooms to meet the unsatisfied demand of the school population (Action 1) and developing a program of workshops for adult literacy (Action 3).

ALTERNATIVE B: Making more efficient use of the existing capacity by increasing school days (Action 2) and developing a program of adult literacy workshops. (Note that this alternative makes the following hypothesis: the number of classrooms is sufficient to meet the deficit, and the problem is the inadequate utilization of current installed capacity.)

The alternatives are considered in practice to be mutually exclusive: A is done, or B is done. Actions 1 and 2 are discussed in the example as exclusive for the purpose of school literacy. Action 3 is the only proposal for the adult literacy target and therefore it must be a component common to both alternatives A and B.