

RESEARCH  
REPORT



ENVIRONMENTAL IMPACT  
ASSESSMENT OF WATER  
PROJECTS IN MEXICO

Cecilia Tortajada

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# **ENVIRONMENTAL IMPACT ASSESSMENT OF WATER PROJECTS IN MEXICO\***

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*Cecilia Tortajada*

## **ABSTRACT**

Mexico is well ahead of many developed and developing countries in many ways, especially in terms of the numbers of water projects constructed, successful transfer of irrigation districts and development of informal markets for groundwater. However, the deterioration of the natural resources of the country, water resources being one of them, due to improper management is not improving the lifestyle of the vast majority of the population in any significant way. Accordingly, extensive modifications in the planning and management processes, including consideration of environmental and social factors and stakeholder participation, are urgently necessary for the water sector. This paper includes an analysis of the environmental impact statements of water projects in Mexico which are under the responsibility of the national water authority. It concludes that the unsatisfactory quality of the EIS of water projects in Mexico represents a serious limitation for developing any post-project evaluation or impact management. The institutional arrangements necessary for implementing the proposed measures are not defined, and the costs of implementing any recommendation are not properly budgeted for in the cost tables. Finally, not only should the reports be critically analysed, but also the whole process of their preparation and approval should be objectively and critically reviewed. This analysis should indicate clearly the shortcomings of the process, and the outline what steps could be taken to overcome them in order to ensure the sustainability of water projects in Mexico. The emphasis should be on producing a streamlined and implementable process.

## **INTRODUCTION**

Mexico is the seventh country in the world in terms of the number of water projects constructed for irrigation purposes. There are 130 large dams, more than 1,200 medium-size dams, 1090 diversion dams, 77 000 deep wells, 68 000 km of canals, 47 000 km of drains, and 54 000 km of roads. One of the main achievements of the water sector is increases in water supply distribution and sanitation services of higher percentage compared with increases in population. In addition, through the National Programme on Clean Water, it has been possible to control the number of cases of cholera in the country during the last 10 years, in both rural and urban areas. Granting of water-use concessions and wastewater-discharge permits is regulated, as are the users' rights and obligations. A public registry of water rights is being established to ensure legal certainty of water rights, and to promote water markets. In the rural sector, by mid-1996, the Mexican government (through the National Water Commission of Mexico, CNA) had transferred more than 86% of the 3.3 million ha of publicly irrigated land in the country to joint management.

During the last 70 years, 1270 reservoirs have been constructed in Mexico, having a total storage capacity of 150 km<sup>3</sup> to regulate seasonal and annual variations. More than 700 km of aqueducts deliver over 36 m<sup>3</sup> per second of bulk water, which benefit more than 70 million people (Castelan, 2000). However, by 1995 (CNA, 1997a) more than 15 million people still did not have access to clean drinking water, and another 30 million to sanitation facilities. In addition, four million ha of land have yet to be irrigated, and 70% of the hydroelectric potential of the country has still to be developed.

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The costs of development of new additional sources of water are likely to be significantly higher in real terms in the future than have been observed in the past. A recent review of the domestic water supply projects carried out by The World Bank, which included a project for the Mexico City, indicated that the cost of development of each cubic metre of water for the next generation of projects is more than 1.75 times, and in many cases even three times higher than that of the present generation (World Bank, 1999). Thus, clean water will only be available in the country in the future at a much higher unit costs than estimated at present.

In order to assure that the environment and natural resources would be protected during the construction and operation of the present and the future water projects, environmental impact assessment (EIA) legislation and procedures represent a critical need for the country. The EIA were made mandatory for major development projects in Mexico in 1988. Prior to this date, the creation of environmental units within the Federal Government Administration set the basis for the legal adoption of EIA. One of these, the "Intersectoral Commission for Environmental Sanitation" (Comisión Intersectorial de Sanidad Ambiental) designed the EIA procedural framework that was adopted in the Law of Public Works (Ley de Obras Publicas) in 1980 (CNA, 1996). It was after the promulgation of the Law of Public Works in 1980, and the Federal Law of Environmental Protection (Ley de Protección Ambiental) in 1982, that the then Ministry of Social Development (Secretaría de Desarrollo Social, SEDESOL) developed the guidelines for the preparation of Environmental Impact Statements (EIS). The General Law of Ecological Balance and Environmental Protection (Ley General de Equilibrio Ecológico y Protección Ambiental, LGEEPA) was promulgated in 1988, and amended in December 1996. By 1992, about 60 EIS related to water projects had been prepared (CNA, 1996).

The implementation of the LGEEPA has traditionally been poor. Heavy centralisation, absence of environmental expertise, lack of realisation by the management of the importance and relevance of environmental and social issues, lack of clear administrative processes, ambiguity in the type of project or activity which requires EIS, absence of modalities for social participation, etc., have all contributed to its poor implementation. Thus, main modifications to the LGEEPA (Section V) were related to the EIA problematic in Mexico, including its surveillance and implementation. (SEMARNAP, 1997). The LGEEPA defines, for example, the type of projects or actions that need to be authorised in environmental areas by the Ministry of the Environment, Natural Resources and Fisheries (SEMARNAP). It includes water projects, projects and activities in wetlands, lagoons, rivers, lakes and estuaries, as well as in littorals and federal zones; and the following activities: fisheries, aquaculture or agricultural activities which threaten public health or affect the preservation of the ecological balance and require environmental protection. The law also requires that EIS should evaluate both the positive and negative impacts of the projects, and not just emphasise on the negative ones, as it was the case earlier.

According to the LGEEPA, SEMARNAP can demand an EIS where activities could result in ecological imbalance or threaten public health and the ecosystems, even if they are not specifically required by in the legislation. The law stresses the importance of obtaining a legal permit from the appropriate authority before the construction of any project, or any activity which could affect severely the environment and natural resources. It links the EIA procedures to those of land-use planning and human settlements. When the local authorities develop plans for urban development and land-use planning, all the projects and activities should be included so that the Federal Government can evaluate them from the environmental viewpoint as a whole, and not individually.

Most importantly, the LGEEPA promotes public participation during conduction of EIAs. Before the amendments to this law, social participation meant that the general public could read the EIS submitted on the projects and activities, if they so wished. With the new modifications, there is an opportunity for the public to discuss the various projects and activities which could severely damage the environment, or

threaten public health or ecosystems. According to the law, any person, social group, NGO, or association can denounce to the Office of the Federal Attorney for Environmental Protection (Procuraduría Federal de Protección al Ambiente, PROFEPA) those activities or omissions which could result in ecological deterioration or threaten the environment or the natural resources, or which do not comply with the law. Those persons or institutions who turned out to be responsible for the damage, can be taken to court. For information on Guidelines to develop EIS in Mexico, refer to Tortajada (1999a).

## **REVIEW OF THE EIS OF WATER PROJECTS IN MEXICO**

This paper includes the analysis of the Environmental Impact Statements of water projects in Mexico which are under the responsibility of the CNA. There are Environmental Impact Statements (EIS), Environmental Diagnosis, ecological land-use planning studies, etc. (CNA no date, a-g; CNA, 1989; CNA, 1990, a-j; CNA/BANOBRAS, 1990; CNA, 1991, a-z; CNA, 1992, a-j; CNA, 1993, a-d; CNA, 1997, b, c). The list of the documents analysed can be found in Tortajada (1999a,b)

The newly amended LGEEPA established the evaluation procedures for environmental impacts of different projects and activities as an instrument to ameliorate their negative impacts on the environment. The EIS should be a document which should be produced before a project or activities are carried out to evaluate the negative impacts and propose alternatives, from sites to general approaches for their management. However, there is no requirement in the legislation that stipulates that once the EIS is prepared, evaluated and approved, it should actually be implemented. The EIS as it is currently practised, does not actually represent a useful tool for environmental management, it is simply a document that is necessary to clear a project. Once the approval process is complete, that EIS is filed and never reviewed, or used thereafter. There is no regular follow-up of the mitigation measures that were recommended in the EIS, or post-evaluation of the projects or actions to verify that no other significant negative impacts have been produced and how they are to be ameliorated. Since there is no post EIA phase, it is not possible to determine the actual environmental, social or economic impacts due to the project, that could represent a lesson for future projects. It seems that every EIS is an individual activity, which has no relevance to similar projects either before or after. Any knowledge that results from the study remains with the staff who carried it out. There is thus no knowledge enhancement of CNA, and in spite of the legal requirements, the general public is basically ignored. For all practical purposes, even if they so wish, the public has no access to any EIS.

The LGEEPA established that post-project evaluations are mandatory, and that a legal system has been put in place to legally proceed against the developers of the projects or actions which do not comply with the legislation. However, the legislation does not have any instrument to force the developers either to utilise effectively the EIS they have produced at high cost, to follow it up, or to make post-project evaluations to actually assess both positive and negative impacts of the project, improve its implementation, and make this a experience for the future. The situation is unsatisfactory since the developer in these cases is an official government institution like the CNA.

The main problems found in the reports analysed will be discussed next.

### *Process to develop environmental studies*

In Mexico, the EIS/environmental diagnosis is regularly consistently cleared by the appropriate authorities, irrespective of the environmental and social impacts of the projects, or the quality of the statements. Since the reviewers are either convinced *a priori* that all projects are good and they have minor social and environmental impacts which can be ignored, or feel threatened institutionally that by taking a stand in rejecting very deficient EIS their own employment would be at stake, they routinely

approve all reports. The standard argument is that the construction of individual projects would improve the economic situation of the region (and thus of the country) and also the life-style of the population, consequent of which the emigration rate would be reduced. The overall process has thus become a paper exercise which satisfies the legal requirements but not the spirit and the objectives of the law. No serious attempt is made to determine what could be the overall impacts of the projects, what other alternatives could be explored, or what could be appropriate mitigation measures.

There are many water projects in the country in which the infrastructure deteriorates even before the project is totally constructed because of lack of maintenance (CNA 1990j; CNA 1991 f, k, m, p, x, y). The history of water development in Mexico indicates that proper planning has consistently been a main weakness of the government. The only real consideration thus far –that economics and engineering factors in the water sector were a priority- is over. It has been demonstrated that social and environmental issues can result in the failure or success of the best engineering projects. Construction of water projects is not enough: integral management is very much needed if a successful and stable water sector is expected, and if improvement of the environment, health, life-style of the population, etc. are a serious concern. The country lacks a culture of decision-making in the long-term.

Neither the environmental diagnosis nor the EIS includes an integral analysis which encompasses the potential social and environmental benefits and negative impacts of the projects. In general, the comments of the reviewers focus only on the ‘improvement in lifestyle of the farmers due to the operation of the projects’, which are automatically expected to happen for all water projects. The rural areas have historically been marginalized from the decision-making processes, which are concentrated at the centre of the country. Not surprisingly, extreme poverty has continued to plague millions of people. Until and unless these issues are identified as and perceived as big problems, they will not be solved, and the overall situation is unlikely to improve.

In addition, no environmental diagnosis analyses properly what could be the general benefits, if any, of the projects already constructed and in operation for the local and regional population. In the best cases, the reviewers just note that there has been ‘increase of agricultural production and improvement of the socioeconomic level of the population’. However, no facts and figures are mentioned to justify such conclusions, nor specific examples given which could scientifically prove the area has economically progressed as a result of the construction and operation of the projects.

The environmental diagnosis and EIS invariably note that the reasons for the government to open an area to irrigation following the construction of dams and canals is to increase the agricultural production, to improve the lifestyle of the local population and to decrease the emigration of the rural people to the United States. However, the reports never discuss how the irrigation projects are fulfilling the original expectations. Mexico has opened up millions of hectares to irrigation, but this has not improved permanently the lifestyle of the local people or their economic status, much less stopped emigration to USA. Thus, if these justifications are the main reasons why Mexico constructs so many projects, the policies themselves need to be strongly questioned and modified, since obviously the rural areas of Mexico have not improved very much only as a result of the construction of the water projects.

There are EIS which are basically copies of each other, such as those on Los Reyes and Jesús and Maria projects (CNA 1991n, o). Both EIS were prepared by the same company and they are located in the same state of the country. The approach, analyses and mitigation measures are identical. It is surprising that it never occurred to the reviewers as to how two different projects could result in identical mitigation measures, recommendations and conclusions. One suspects that the consultants simply made two copies of their report and submitted them under different titles. This is a striking example of the lack of interest and technical expertise of a consulting group and the reviewers. Not only the reports fail to make an

appropriate diagnosis in order to maximise the benefits and minimise the negative impacts of the two projects, but the reviewers failed miserably to ask the elementary question as to how two EIS could be identical. This is a clear example of a process that is deeply flawed.

There are common problems identified in all reports, and one of them is the deterioration of water quality. In all the cases, the quality of the water of the rivers is already poor mainly due to discharges of wastewaters containing oils, bacterial contamination, etc. Thus, based on their field visits, reviewers could make a good case on the status of the surface water pollution in the region and the necessity of having a functional water-quality monitoring network. An environmental diagnosis could be useful if it included an overall diagnosis of the water and agricultural policies in Mexico, based on such field experiences. These analyses could then be taken to the decision makers who could realise how their macro-level decisions made at the centre are affecting normal populations in the regions. For example, in the case of the project developed in Tanquién, San Luis Potosí (CNA, 1991p), bad management of the project from the government side, and misinterpretations of the agricultural and water policies from both the users' and the government sides, as well as vested interests, have risen to such an extent that contrary to what was expected at the beginning of the construction of the project, farmers have not benefited in anyway; on the contrary, they have abandoned their land, with a detriment to the local economy and social welfare. In this specific case, the consulting groups could have discussed in depth how the rural sector has suffered because of the inefficiency of the institutions and the lack of coordination between the different local groups.

A main constraint for the sustainable water management in Mexico is that neither the environmental diagnosis, nor the EIS or the studies, represent any usable and reliable source of analysis and information for the decision makers of any institutions at any level. This 'lose-lose' situation is due to a combination of unfortunate circumstances: lack of interest from the private consulting groups for preparing objective and critical reports which could be used by decision makers to improve the environmental conditions in the country; reluctance of and disinterest in enforcing the law and demanding good-quality reports, which could actually be used to make the projects sustainable and more beneficial to the population and simultaneously ensure less environmental deterioration; and the lack of interest from the civil society as a whole in getting involved in decisions that affect them directly.

A main failure in the LGEEPA is in the official evaluation of the diagnosis, EIS or studies on projects. The Article 35, IIIc, states that "the Ministry (of Environment) would take into consideration in the Environmental Impact Statements, ONLY the environmental implications of the projects or activities". The law does not clarify who then is responsible for the social and economic implications of projects or activities. This is a very dangerous gap, since legally, the projects or activities which could negatively impact upon social and/or economic issues, cannot be reviewed by the Ministry.

#### *Quantity and quality of the information*

Most of the reports are very badly written, including numerous grammatical and spelling errors. The pagination of the statements is often not consistent. Some of them do not have page numbers, some start pagination in each chapter, and in some the pagination is stops in the middle of the text. The reports are very superficial, and contain no detailed analysis of any issue. Many reports do not have an executive summary or even an introduction. Theoretically, this means that the decision makers have to read the entire document, which in many cases contains over 100 pages, in some cases over. It is clear that at present no decision maker would bother to read the reports, or take their conclusions and recommendations seriously. Regarding the objectives of the projects and the reports, in many cases they are very general, vague and not concise. In some of the reports, the objectives of the project are 'to improve the lifestyle of the population and achieve national food self-sufficiency.' This is such a general

and major objective that it could never be achieved with only one water development project.

All the reports include chapters on physical, biological and socioeconomic conditions, but never an integral analysis of these three issues so that an overall perspective on the impacts due to the construction of the project can be obtained. In all cases, studies, EIS and environmental diagnosis, the potential impacts are defined based on matrix methodologies, mainly the Leopold matrix which was devised some 30 years ago. The chapters on environmental impacts are invariably descriptive. Not even a single report reviewed included any analysis or discussion of the predicted impacts. Many diagnosis are very poor in terms of quality. However, it is not surprising that they do not contain any analysis, since they do not even have the relevant data on the project. In many reports, the 'analyses' of the impacts are limited to statements such as 'the impacts are of different magnitudes, both positive and negative.'

In some cases such as the one on the diagnosis on the La Fragua project (CNA, 1991 m), the quality of the report is so bad that it is basically useless for any purpose. One thus wonders who is primarily responsible for this sad and serious situation: the consultants for preparing them, or the institutions for reviewing the diagnosis and not demanding modifications to improve its quality so that these could be usable.

If the construction and operation of the water projects have in general the same positive and negative impacts, the Mexican institutions should have already identified the main problems as well as the benefits of the projects during the construction, operation and maintenance phases, to improve the overall implementation of the projects. For example, all the diagnosis and EIS mention that water quality and soil monitoring is needed, but no long-term monitoring programme on water quality has thus far been formulated, let alone implemented. Improper use of agrochemicals has been recognised as a major problem for more than 20 years, but again no programmes have been developed in consultation with the farmers and the private sector. No agreements have been reached between the public and private agricultural sectors to initiate training programmes at national and regional levels to evaluate the real and imaginary needs of the farmers, and to educate them on the appropriate use of different agrochemicals so that problems are kept to a minimum.

A study on agrochemicals and their impacts in the environment was carried out in 1991 by CNA (CNA, 1991e). The background information includes an interesting description of the rural areas in Mexico. The overall objectives of the study were to identify the main negative impacts resulting from the use, application and disposal of agrochemicals in rural agricultural areas; to develop solid criteria to reduce these impacts, propose alternatives for a better surveillance and follow-up actions; and to develop a manual addressed to the several public institutions. The study was based on fieldwork carried at in several areas, to determine both municipal and industrial discharges, as well as the quality of the receiving bodies of water. The report included interviews with farmers, visits to several irrigation districts, identification of negative and positive impacts based on the factual use of agrochemicals, overall assessments on health and agrochemical-related issues, visits to universities and research centres to identify research programmes on the use of agrochemicals, interviews with sellers of agrochemicals, etc. The recommendations of the study for the best management of agrochemicals were as follows: 1) management programmes on the use and management of agrochemicals, including security measures, 2) training of workers, farmers and technical staff on the agrochemicals and pesticides, and doses in which they have to be used, 3) training of workers, farmers and technical staff on the proper storage, 4) disposal of containers and pesticide residues, and 5) strategies to protect water, land and crops. A study like this to identify the main problems and the alternatives available to manage agrochemicals is very much needed. It would be useful to find out if the manual was ever written and distributed, if the recommendations were implemented, and if so, what were the results.

In the EIS of the Canoas project (CNA, 1991ñ), the report notes that the environment has already deteriorated as a result of a project constructed earlier, but miraculously, “in future, there would be almost no negative impacts in the environment, and the economic and social benefits would make a difference in the area, improving the socioeconomic conditions, and decreasing the emigration rate.” The recommendations include appropriate use of fertilisers, pests control, salinity control, integral management of the region, etc. The report does not explain the rationale of the assertion that the new project would not harm the environment, even though the earlier one did. It appears that the main objective of an EIS is to state there would be no adverse environmental impacts, irrespective of the high probability of their occurrence. The project would be cleared on the basis of the report. It is a damning indictment of the present process that neither the institutions nor the consultants engaged are really interested in protecting the environment, nor do they consider their respective task seriously. Furthermore, the document is a diagnosis of a project that had been partially constructed. Accordingly, it should have been possible to assess reliably the environmental, social and economic impacts of the project that have already occurred and analyse the implications as to how adverse or beneficial the project is likely to be in realistic terms. However, unfortunately, there was no serious attempt to carry out an in-depth analysis of the positive or negative impacts of the project, also its short- and long-term implications.

In the case of the Tanquien project (CNA, 1991p), the partial construction of the infrastructure had permanently affected the environment and had displaced the native flora and fauna, and the land was subjected to erosion. Contrary to most of the diagnosis and assessment, in this case, the consultants actually conducted some interviews with the users of the irrigation district. Most of the farmers were aware of the importance of the construction of the project, and were willing to cooperate in the construction, maintenance and operation of the canals. However, there were severe conflicts between them. If this was the case, and the opinion of the community was sharply divided regarding the operation of the project, it is highly likely that the project would not achieve its objectives, and thus its construction should have been questioned. The diagnosis should have included an objective analysis of this important issue, so that appropriate decisions could have been taken.

In some cases, the diagnosis and statements have been prepared by a group of consultants. In the case of the Las Burras project (CNA, 1991r), the introduction is a copy of the introduction in other reports prepared by the same group. However, this report is one of the very few diagnosis or EIS which proposes alternatives for the construction of dams. The decision taken was based on the existing infrastructure and on the investment costs. The report does not mention whether there would be any difference in the environmental aspects between the different alternatives.

One of the main problems in Mexico is the poor maintenance of infrastructures, which contributes to the deterioration of canals, drainage systems and roads. Among other shortcomings are increasing infestation of aquatic weeds, deterioration of public health because of over-use of agrochemicals, employment generation is often a temporary condition, and the population working on the projects, normally live in poor and unhealthy conditions. The consultants invariably affirm that the local and regional economy will improve in the near future with the construction and operation of the projects. However, in all the reports reviewed, there is no justification as to how and why this improvement could be a reality since the past performances indicate otherwise. Infrastructure always deteriorates because of poor maintenance, and this is unlikely to lift people out of extreme poverty. It would have been much preferable if the consultants had analysed the reasons for the earlier failures to avoid the same situation being repeated.

Several reports mention that ‘the project would not affect the environment significantly, provided financing is made available for the mitigation measures.’ Provision of funds has never been the strength of the Mexican system, which ensures that if the EIS are not reliable, the environment will deteriorate,

and accordingly, and as result, the area is unlikely to improve -which after all is the main objective of the project. Advanced planning, management, administration and training are fundamental issues for the sustainability of the projects, but unfortunately, they are not considered as real requirements in Mexico.

*Approach towards social and environmental issues*

Mexico has environmental legislation and institutions, which indicates that it is concerned about the environmental and the social issues. The amended LGEEPA stresses the importance of the conservation of the environment and natural resources during the construction and operation of all projects. The reality, however, is totally different. No environmental study, diagnosis or statement of water projects currently makes any serious analysis of the associated environmental and social issues. Nor do the authorities legally responsible for the environmental preservation take their tasks seriously.

All EIS/diagnosis should include a chapter on social issues related to the community where the project or activities is to be carried out. This chapter should include information on social issues such as education, public health, etc. The objective should be to present a base-line information of the pre-project social conditions, reviewing the living conditions and quality of life of the population, from which it should be possible to determine the extent of the benefits due to a project after its implementation. At present, such a chapter provides some random descriptions of the age of the population, education, etc., without any coherent or logical framework. No integral analysis is ever made which would enable the readers to appreciate the current situation of the communities, what their needs are, and how these can be met. It is very difficult, if not impossible, for any decision-maker to make any decision on this type of information and analysis.

The chapters on 'environment' and 'social issues' do not provide any clear picture of the current situation and the overall needs of the local population, or the relevance and importance of the project to improve the lifestyle of the people, or how the project, potential impacts, and mitigation measures all fit together, and how they would affect the long-term sustainability of the project. The environmental aspects also represent other problem. There are long and unnecessary descriptions of ecosystems, without any conceptual framework as to how such information is provided, or its relevance to the study. There are no analyses whatsoever of the whole scenario which includes the project itself, expected economic and social benefits, environmental impacts (both positive and negative,) etc.

There are several statements (for example, Zocoteaca, Huajuapán de León, Río Verde) wherein it is said that since 'the environment of the project area has deteriorated very badly already, the project cannot result in any further negative impacts.' The studies basically conclude that 'the situation is so bad that it cannot get worse', and accordingly any future impacts can be ignored since they could not worsen the situation any further. Clearly such a hypothesis is fundamentally flawed and is completely wrong. The environment can always get worse. In any case, such justification of projects on negative grounds can never be accepted. The sad fact is that the internal reviewers of such analyses should have found them totally unacceptable. The fact that such analyses are being routinely accepted indicates the incompetence of the reviewers, lack of appreciation by the top management that environmental issues should be seriously considered and continuation of a deeply flawed process.

Poverty is a very complex issue and its alleviation has proved to be very difficult. In the rural areas, improvement of the quality of life of the local and regional population depends not only on water for irrigation: integrated planning combined with better living standards, higher education and training, properly planned irrigation systems, etc., would result in the improvement of the project areas and even of the region, rather than the short-term vision and lack of planning that has characterised the irrigation sector in the country for many decades. The conclusions of many reports are that no serious environmental impacts are expected during the construction and operation of the project concerned, only

benefits for the population at present living in extreme poverty.

According to all the reports, the impacts of the projects are overwhelmingly positive, irrespective of their overall social, economic and environmental impacts. The analyses take a very narrow approach, and focus primarily on the direct and indirect jobs that may be created during the construction phase of a project. They conclude that the economic situation of the workers would improve 'significantly', even though, as every one knows, the construction jobs are temporary in nature.

The overall neglect of social issues represents a very serious problem in terms of future sustainability of projects. The environmental reports on dams do not consider resettlement as an important issue, or even note the social, environmental and economic consequences of resettlement. The reallocation and compensation issues are mentioned very briefly. Unless one reads the reports very carefully and thoroughly, it is impossible to realise resettlement is an important issue. It is mentioned within a single paragraph, and clearly not considered to be important. No mitigation measures are considered for resettlement. Accordingly, one can only conclude that for the analysts and the governmental institutions, resettlement of displaced population and adequate compensation is basically a non-issue. This is indeed very surprising, especially as resettlement has turned out to be the most serious environmental and social problem associated with dam construction.

#### *Mitigation measures*

The legislation stipulates that the mitigation measures should be presented in such a way that the negative impacts of the project and activities could be ameliorated. However, irrespective of the type of project that is being assessed, the mitigation measures recommended are always very general and similar. All the statements/diagnosis invariably recommend mitigation measures, which can best be described as a 'laundry-list' of activities. Priority measures are not identified, and no indication is given as to the potential costs of implementing any measure. Generally, issues such as reforestation and water quality receive some attention; others are either neglected or noted in passing.

Regarding the mitigation measures recommended, it is possible for them to be somewhat similar for some types of water and agricultural projects. However, it is difficult to see how the mitigation measures of all types of water projects in the entire country can be similar. Surprisingly, there are no project-specific recommendations. For example, a project that will be constructed in the northern part of the country, with specific hydroclimatic and soil conditions, and people with certain culture and social traditions, must have a different sets of impacts (in terms of types, magnitude and extent) compared with a project in the southern part of the country, where the technical, social, environmental and economic conditions are very different. An in-depth review of all the reports indicate that both the analysts and the appropriate Mexican governmental institutions consider, at least implicitly, that the entire country is homogeneous, and accordingly the remedial measures for all the projects are similar.

The mitigation measures should include identification of monitoring programmes for soil and water quality to avoid their contamination from return flow from the agricultural areas; programmes for the appropriate management of agrochemicals; regulation to restrict the use of agrochemicals; reforestation; awareness programmes addressed to the users on public health issues; and efficient irrigation management practices to prevent development of salinity and waterlogging.

The projects are normally authorised by the government, based primarily on their positive impacts. However, not even a single environmental diagnosis or EIS review considers whether the expected or actual social benefits are worth the cost of the environmental damages they would cause since at present the mitigation measures proposed have never been questioned, or fully implemented. Assuming the

mitigation measures were the most appropriate for the project concerned, the fact that CNA and INE (SEMARNAP) clear and approve the EIS or the diagnosis, does not necessarily mean that the budget for mitigation measures will be approved, or that it will be adjusted with time in terms of financial requirements.

There is a water-quality monitoring network in the country which is 40 years old (Biswas *et al.*, 1997; Ongley & Barrios, 1997). The mitigation measures generally recommend the need to monitor the water quality that may be affected. However, the analysts ignore the fact that there is already a network, or how useful the network could be for the projects under consideration, what the weaknesses are of the existing network, and how these could be overcome. There are some projects that even include the estimated cost of monitoring to determine the water quality. However, not a single analysis considers how to develop an *ad hoc* water quality monitoring in a certain specific location and for a limited period could be linked to the existing monitoring activities, or even how this monitoring network could be enlarged and improved. The main comment appears to be that water quality may deteriorate and hence monitoring is necessary. No consideration is given as to what parameters should be monitored, at which locations, for what periods of time and by whom. The real cost of monitoring is never estimated. Without such definitive analyses, general recommendations like how water quality should be monitored are of little value to the decision makers.

## CONCLUSIONS

Mexico faces major development challenges at present. Among these are issues such as population growth rates which have been higher than the GDP since the beginning of the 90s, lack of investment, increasing environmental degradation, etc. Such shortcomings make integrated development, based on water resources development, a most difficult task. The availability of water in Mexico is severely limited not only because of its quantity, but also due to continuing deterioration of its quality.

Regarding the environmental impact assessment, in Mexico is still a very weak policy-related instrument. In general, the EIS of water projects are descriptive rather than analytical and predictive. The analyses are of questionable value, for decision makers as well as for follow-up studies and monitoring. Mitigation measures proposed are based on generalised principles and are not supported by specific analyses or findings. The statements do not include any monitoring programme to test predictions and facilitate impact management. They also lack any detailed social or environmental analyses. Participation and involvement of the public is mostly absent. The unsatisfactory quality of the EIS of water projects in the country represents a serious limitation for developing any post-project evaluation or impacts management. The institutional arrangements necessary for implementing the proposed measures are not defined, and the costs of implementing any recommendation are not properly budgeted for in the cost tables. Finally, not only should the reports be critically analysed, but also the whole process of their preparation should be objectively and critically analysed. This analysis should indicate clearly the shortcomings of the process, and then outline what steps could be taken to overcome them in order to ensure the sustainability of water projects in Mexico. The emphasis should be to produce a streamlined and implementable process.

Sustainable development for Mexico in terms of water resources planning and management cannot be ensured without a comprehensive analysis of both the legislative and institutional frameworks. Regional development in the country, which to a significant extent can be triggered by efficient water resources management, would undoubtedly be dependent on the modifications of the contradictions in the existing policies, laws and regulations, and their implementation. Other important factors should be considered as well, among which are a well-planned and implemented process of decentralisation, and the development

of the appropriate cadre of trained and experienced professionals from different disciplines, who together should be able to manage water resources of the country on an integrated basis.

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