

**FINANCIAL MECHANISMS FOR
THE DESCONTAMINATION OF
THE BOGOTA RIVER**

FINAL REPORT
(Preliminary Version)

FEDESARROLLO
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Martin Maurer
Ursula Giedion

Bogotá, abril de 1993

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I. CRITERIA FOR GRANTING LOANS

This first part of the study provides general guidance for the granting of financial assistance to industries contributing to the pollution of the Rio Bogota. Financial assistance is to be provided in order to achieve the goals of the CAR Five Year Industrial Pollution Control Plan (referred to in this study as "the plan"). These goals are presented below in section I.A.

In general, the goals of the plan are stated in terms of percentage reductions in aggregate discharges to the river. Pollutants are divided into three categories labelled priority 1, 2, and 3. Priority 1 pollutants are to be completely eliminated from all discharger's effluent streams (100% reduction). Priority 2 pollutants are to be reduced by 80% and priority 3 pollutants are to be reduced by 50%.

For pollutants in priorities 2 and 3, it is necessary to state a year which determines the baseline volume of discharge from which the percentage reductions will be calculated. For the purpose of this analysis we assume that 1992 will be the baseline year since that is the date of publication of the plan. (Data availability may influence the actual estimation of aggregate loadings in 1992).

Since the goals of the plan are stated in terms of reductions in total discharges to the river, there is a great degree of flexibility remaining in the determination of which dischargers should install control equipment, the extent of controls at each point source and the timing of the installation of these controls. The criteria to be elaborated in this section are designed to guide the control strategy for the river as a whole according to the principles of economic efficiency, equity across polluters, and practical feasibility of control plans.

Section B describes the use of environmental auditing by industries in the watershed. This analytical technique involves a search within each polluting facility for any changes in factor inputs, production processes, product characteristics and treatment techniques that can reduce the production of pollution residuals at the point source. Only when all potential methods of control have been identified can the least costly be chosen. We recommend that all polluters be required to conduct environmental audits of their facilities as a condition of applying for financial assistance.

Section C discusses the application of point source control requirements to achieve the goals of the plan at the lowest aggregate cost to the polluting industries. This goal of "cost-effectiveness" is achieved by maximizing the amount of pollution

control per dollar spent. It will insure that the river is made as clean as possible for the amount of money available.

Section C describes a financial capability assessment. Firms that expect to receive loans or other assistance must be prepared to show that they need the assistance in order to comply with pollution control regulations. In addition they should demonstrate that the financial condition of the firm is good enough to insure that the loan will be repaid in a timely manner.

Section D describes a technical capability assessment. This criteria focusses on three aspects of the firm and its pollution control plan: management capability, appropriate production technology and feasibility of the proposed pollution control plan. The purpose of this assessment is to insure that the activities proposed for financial assistance will actually produce the desired reduction in water pollution.

A. Goals of the CAR Five Year Industrial Pollution Control Plan

The "Five Year Industrial Pollution Control Plan" specifies three specific goals for the reduction of water pollution discharges into the Rio Bogota. These are:

100% reduction of industrial toxic pollution stemming from contaminating substances classified under priority 1..

80% reduction of the existing industrial toxic pollution and 50% reduction of the chemical oxygen demand stemming from industrial residues classified under priority 2.

50% reduction of industry-generated total suspended solid load, classified under priority 3.

These goals are elaborated further in the form of the following priorities for industrial discharges:

Priority 1:

Industries discharging sanitary hazardous substances (toxic substances, heavy metals, pesticides, agrochemical material, etc.) or that generate hazardous solid residues during their production process.

The most representative industries in this category are:

Leather tanning, galvanoplastics and metal surface finishings, paints, oil byproducts, textile dyes, pesticide, fungicide, and

Priority 2:

Industries and activities generating high loads of chemical and organic pollution.

The following are the most representative:

Food processing plants, breweries, soft drink plants, dairy product factories, slaughter and cold storage houses, chicken processing plants and open pit garbage dumps.

Priority 3:

Industries generating high loads of solid waste and negative impacts on the aesthetic, landscaping and hydraulic qualities of receiving streams.

The following are the most representative:

Gravel, sand and similar pits; sand washing activities, construction material storage centers and coal processing plants.

B. Environmental auditing requirement

All firms that seek financial assistance should be required to carry out environmental audits as a precondition of acquiring a loan. These audits will reveal information needed to identify cost effective control strategies and may reveal potential cost savings that would reduce loan needs.

The purpose of an environmental audit is to discover all technically feasible methods for reducing the generation of polluting residuals. The traditional approach to pollution control has been to assume that a factory and its associated production process cannot be modified internally. Pollution control systems were then designed and constructed to treat residuals outside the facility. This approach can be called "end of pipe" treatment. It is a useful approach when an existing facility can not be modified, yet it precludes a variety of internal modifications and controls that might be of lower cost than external treatment.

The Problem can be summarized as follows:

1. Production and process engineers in private firms have been trained to focus on product quality and cost effectiveness of production.

2. Firm's objectives are usually short to medium term profit maximization.

3. Marketing specialists attempt to discover consumers' desires or influence tastes and preferences for consumption.

4. Environmental analysts in government typically focus on the quantity and toxicity of residuals as they are discharged from industrial facilities.

As a result, these groups of specialists rarely understand each other's problems and goals and so miss great opportunities for cooperative action.

An Environmental Audit is a systematic examination of all the interactions of any business operation and its surroundings. It is a cooperative venture in which experts on production from the firm share information and conduct analysis with experts on pollution damage and control to seek innovations in:

- monitoring and compliance procedures
- production techniques,
- input choice, and
- product design

with the goals of:

Reduction in the quantity and toxicity of residuals, and reduction or low increase in production costs, while maintaining acceptable product quality.

It may involve analysis of process configurations, pipe and flow diagrams, visual inspections of the facility and materials balance analyses of the input and output flows of the various processes.

At a minimum, the environmental audit should include the following four components:

First, the characteristics of the products of the facility should be examined to determine whether they could be altered in such a way as to reduce the pollution potential of the facility. An example is described below where eliminating the bleaching of certain paper products prevented the formation of dioxin, a toxic water pollutant.

Second, an inventory of all chemical and other material inputs should be developed and examined to determine whether less toxic or less damaging substances could be substituted for those currently in use.

Third, the audit should include an assessment by qualified engineers of potential process changes that might reduce the production of residuals. For example changes in the sequence of chemical treatments or washing cycles might reduce the quantity of wastewater resulting from a process. Certain materials might be recycled to reduce the total volume of toxic chemical used and released during a process.

Fourth, engineers should develop a complete inventory of all locations where residuals are or may be released to the environment. Each of these locations can then be examined to determine the most effective and lowest cost method available for reducing or eliminating the release of residuals.

These four stages of assessment can be carried out sequentially as described to complete a rudimentary audit. The overall goal is to identify places in the production process where pollution can be prevented rather than treated after it is produced. A more sophisticated audit can be conducted using the technique of a materials balance analysis. This approach involves a quantitative measurement of all energy and materials flows into, through and out of the facility. It includes use of mathematical models of chemical reactions and other transformation functions that occur within the production process. Whenever possible a comprehensive approach such as this should be used.

We emphasize that an environmental audit can often discover product or process modifications that actually reduce total production cost while reducing residuals generation. Therefore the firm may benefit in terms of increased profitability and the public benefits in terms of reduced pollution. Examples of cost savings are presented below.

A PRELIMINARY CHECKLIST

- o COMPANY POLICY

Do you have a clear, written environmental policy and the structure and staff to implement it?

- o COMMUNICATION

Do you have a public communication policy covering the environment?

- o STAFF TRAINING AND DEVELOPMENT

Do you train your staff to search for environmental effects and prepare solutions?

- o RAW MATERIALS

Are there raw materials which you could use which make lower demands on the environment? Could you use recycled materials from internal or external sources?

- o PRODUCTS AND PROCESSES

Do your products and services incorporate the most effective technologies to achieve minimum impact on the environment during manufacture and use?

- o ENERGY USE

Do you have a policy on energy efficiency and the search for energy use reductions?

- o WASTE AND DISCHARGES

Do you know what waste you produce, where you produce it and what it costs?

- o TRANSPORT AND DISTRIBUTION

Are your distribution systems efficient? Including the transport of workers to and from work? Do you take special precautions in the transport of hazardous materials?

o ACCIDENTS AND EMERGENCIES

Do you have emergency response plans in place including effective communications with the affected public?

CASE STUDY EXAMPLES OF COST SAVINGS FROM WASTE SEGREGATION

During an audit of a U.S. plant that polishes and grinds glass lenses, an environmental audit team found that the plant was disposing all of its glass sludge as hazardous waste because it contained residue from leaded glass. Due to strict rules on the handling and disposal of hazardous waste, this disposal practice was extremely costly.

Further investigation revealed that less than 30% of the residue came from leaded glass waste streams and that the remainder did not qualify as hazardous waste.

As a result of the audit, the plant segregated the residue into separate waste streams and instituted a procedure to dispose of the non-hazardous waste in a sanitary landfill. This change saved the company substantial money each year.

THE CASE OF DIOXIN AND PAPER BLEACHING

Significant concentrations of dioxin were being measured downstream of several paper mills in the U.S. even though dioxin was not a direct input into the paper production process.

Auditing and materials balance analyses determined that the toxic residual was being formed in the paper bleaching process.

Analysis of the industry's product lines and marketing program suggested that many products were being bleached white even though the white color served no functional purpose in the consumption of the product.

For example, cone filters used in drip coffee making appliances were traditionally bleached white. Following consumer preference testing and a national marketing campaign, paper companies introduced coffee filters made from unbleached paper. The light brown filters were immediately accepted by the consuming public and are now accounting for a large share of this product market.

The results:

- reduced toxic contamination of the nations rivers,
- reduced production costs,
- maintenance of product quality, and
- improved public relations for the industry.

Summary: Environmental auditing

The environmental audit is required in order to insure that each polluting facility has identified and measured all of its sources of pollution and searched for the lowest cost techniques of reducing its pollution both by preventing the formation of residuals and external treatment of residuals.

Individual firms should invest in pollution control activities in the following order:

First, the firm should invest immediately and without assistance in any control activities that reduce production cost. These activities benefit the firm and so should be undertaken for private profit motives regardless of the external benefit of pollution control. Some of these activities will require initial investment of capital and will only result in a saving to the firm over time as operating costs are reduced. In these cases, we recommend that the firm invest immediately in any activities that have a payback period of less than three years. In these cases long term financing would not be needed.

The second category of activities ~~in~~ include those that will eventually save the firm money but that have an investment payback period of more than three years. This second category of

activities also includes control investments or process changes that increase production costs by less than two percent. Two percent is the average increase in cost experienced by companies in the U.S., Europe and Japan due to compliance with pollution control regulations. This level of expense should not cause a significant decline in competitiveness. Activities in category two will most likely be needed to achieve the goals of the CAR Five Year Plan, but are subject to the interfirm comparison and rankings described in the next section. Not all firms will be required to invest in category two activities.

Category three control activities are those that will raise production cost by more than two percent. These actions should be deferred for the near term (approximately five years) to determine whether they will be necessary for achievement of the plan. As new production technologies are adopted in the process of apertura, it is likely that control methods will be come available that limit the increase in production cost to less than two percent.

This is the first step in designing a plan for protecting the Rio Bogota at the lowest total expense. In the next section we discuss the allocation of pollution control requirements across the various polluting facilities.

C. Cost effective control priorities

Even though the CAR Five Year Plan specifies exact percentage reductions in each category, there is still a great degree of freedom allowed concerning the extent of point source controls needed to achieve the aggregate targets. For example, a common and simple method for achieving an 80% reduction in aggregate loadings of a particular pollutant would be to require that all individual point sources reduce their discharges by 80%. This "equal percentage reduction" would achieve the aggregate target but it would almost certainly not be efficient.

Equal reduction strategies are not cost effective because they do not concentrate the pollution abatement requirements where the cost of pollution control is lowest. The general rule for allocating pollution control requirements among different sources is to require the greatest control at facilities that have the lowest abatement cost per unit of pollution.

The unit cost of pollution control normally varies by a large amount across different facilities. Even if two plants use the same production process, the cost of pollution control will be different if the two plants are different sizes. Larger plants can take advantage of economies of scale to allow lower unit costs. Particularly in water pollution control, where the treatment

process involves the use of pipes, tanks, settling ponds and pumping systems, the larger the plant the lower is the per gallon cost of treatment. In addition, variations in technology, degree of existing treatment, age of the facility and location all influence the average and marginal cost of pollution control.

Recognizing the potential for cost differences, the environmental authority should collect control cost data from the polluting sources that they developed according to criteria one, above. Those facilities with the lowest unit cost of control should be given priority for financial assistance and encouraged or required to be the first to install controls.

This rule may appear to be unfair and in violation of the "polluter pays" principle, but in fact it can be accomplished fairly. Even though some firms may be asked to reduce their pollution more than other firms, they can be compensated for the extra effort so that the financial burden is shared by all polluting sources in a fair and just manner.

Table 1 presents a numerical example showing the difference in cost effectiveness between the traditional "equal percentage" control plan and a cost effective control plan. In this illustration we describe three pollution sources of different sizes, firm one begins with uncontrolled effluent of 500 pounds per day while firms

two and three have 1000 and 2000 pounds respectively. Due to economies of scale the smallest firms has the highest unit cost of abatement, \$3.00 per pound and the cost of abatement is \$1.50 and \$1.00 per pound at the larger plants. This pattern of sizes and costs is a realistic example of what would be found on the Rio Bogota. And the cost differences creates an opportunity for efficiency gains through use of innovative control strategies.

The overall goal on the river is to reduce effluent by eighty percent for a total reduction of 2800 pounds per day. A traditional strategy would be to require each firm to reduce its effluent by eighty percent. In the table this is shown as strategy one, "Equal Percentage Reduction". Firms 1 reduces effluent by 400 pounds at a cost of \$1,200. Firm 2 controls 800 pounds at a cost of \$1,200 and firm 3 controls 1600 pounds at a cost of \$1,600. The total amount spent on pollution control is \$4,000.

Strategy two, "Cost Effective Reduction Patter" places a greater control requirement on firm 3 since it has the lowest unit cost. In this strategy a total of 2800 pounds of effluent is eliminated and the overall goal is achieved but the total expenditure on pollution control is only \$3,200 for a saving of \$800 or twenty percent.

It is clear that for the group of three firms, strategy two is preferred. But we must also consider the equity of the efficient plan. In strategy two, firm does not spend any money on control and continues to pollute as much as before the plan was introduced thus saving \$1,200. Firm two spends the same amount in both strategies. But firm 3 must completely eliminate its effluent and spend \$400 more than it would have under strategy one. The simple solution is that firm one could compensate firm three for its extra effort. Firm one would be willing to pay any amount up to \$1,200 and it would still be better off than under strategy one. Firm three needs to collect only \$400 to compensate it for the extra control it has constructed. Hence a payment between \$400 and \$1,200 from firm one to firm three would leave all parties better off under strategy two.

This pattern of controls is recommended for the Rio Bogota in order to allow the greatest amount of pollution control for the least aggregate cost. There are a variety of administrative mechanisms that can be used to ensure that fair compensation is carried out when some firms are asked to control proportionately more than others. In granting financial assistance and in setting priorities for control, however, we recommend that firms with the lowest unit cost of control be the first to construct treatment systems.

TABLE 1

COST EFFECTIVE POLLUTION CONTROL						
				<i>Illustrative Example</i>		
Total Initial Effluent Quantity	3500	Total Cost Strategy One	\$4,000			
Total Reduction Goal (%)	80%	Total Cost Strategy Two	\$3,200			
Total Reduction Goal (pounds)	2800	Saving (percent)	20%			
Strategy One	EQUAL PERCENTAGE REDUCTION					
	FIRM 1	FIRM 2	FIRM 3	Grand Total		
Unit Abatement Cost (\$/pound)	\$3.00	\$1.50	\$1.00			
Initial Effluent Quantity (pounds)	500	1000	2000	3500		
Effluent Reduction (percent)	80%	80%	80%			
Effluent Reduction Quantity (pounds)	400	800	1600	2800		
Total Cost	\$1,200	\$1,200	\$1,600	\$4,000		
Strategy Two	COST EFFECTIVE REDUCTION PATTERN					
	FIRM ONE	FIRM 2	FIRM 3	Grand Total		
Unit Abatement Cost (\$/pound)	\$3.00	\$1.50	\$1.00			
Initial Effluent Quantity (pounds)	500	1000	2000	3500		
Effluent Reduction (percent)	0%	80%	100%			
Effluent Reduction Quantity (pounds)	0	800	2000	2800		
Total Cost	\$0	\$1,200	\$2,000	\$3,200		

In section 3 of this report, we will describe an economic instrument strategy, "effluent fees" that can lead to the cost effective reduction pattern illustrated by this example. The creation of fees that must be paid by polluters for each unit of effluent discharged into the river creates an economic incentive that automatically causes the lower cost polluters to perform the waste treatment and simultaneously transfers money from the higher cost polluters to those who build the treatment facilities and compensates them for their extra effort. The CAR might wish to create a system of effluent fees both for the purpose of raising extra revenue for public wastewater treatment and to achieve the kind of cost effective solution that is illustrated above.

Data needs for Cost effectiveness analysis:

For each individual polluting facility -

1. Type of effluent discharged into the river

(BOD, Suspended solids, toxic wastes)

2. Quantity of each discharge stream

(pounds per day, week or month)

3. Unit cost of control.

(\$ per pound per day reduced)

It is likely that at each facility there will be range of control levels or distinct control activities that can be pursued and each will have a different unit cost. The best data would consist of a cost function showing marginal cost as a function of percentage removal. Next best would be separate unit costs for each range of percent removal ie. \$1 per pound for the first 20% removed, \$1.50 per pound for the next 20% removed and so on. The last units removed (for zero pollution are typically the most expensive to control. In other words most facilities will exhibit an increasing marginal cost of treatment moving from no control to total control.

If data is not available for individual pollution sources CAR could work with the same data for groups of facilities that have similar pollution. For example, leather tanners as a group release x tons of BOD per day and face an average abatement cost of y dollars per ton reduced. With this information CAR could identify groups that should be given priority for treatment.

Summary: Cost Effective Control Strategies

Within priorities set in the five year plan, construct an inventory of point sources of pollution. Data should include the type of pollution, quantity discharged per time period and the nature of treatment systems that are already in place.

Identify available control technologies and costs by source based on CAR studies.

Establish cost effective locations (facilities and point sources within facilities) and levels of pollution control to achieve aggregate quality targets at the lowest feasible total cost. This will involve ranking point sources according to the marginal costs of further treatment.

D. Financial Capability Assessment

Under this criteria, applicants for financial assistance will be examined to determine; 1) whether they need assistance and 2) whether they represent a good credit risk.

Needs Assessment

In order to determine whether the applicant requires financial assistance to enable it to comply with environmental regulations

the Office of Environmental Finance should examine the external market conditions in which the firms operates.

Normally firms in a competitive industry would all face the same type of environmental regulations and compliance with these regulations would not put one firm at an unfair disadvantage compared with others. Any investments and expenses associated with operating pollution control systems, is considered a normal cost of doing business. As such it can be passed to consumers of the firm's products in the form of price increases. In other words it would cover these additional expenses in the same way that it would cover increases in wages, materials prices or taxes.

The ability of a firms to increase its product prices without losing sales is measured by the price elasticity of demand. If demand is inelastic, price may be increased without a large decrease in quantity demanded. If all firms in the industry (selling similar products) are simultaneously increasing their prices demand should be relatively inelastic. In this circumstance, there should be no problem covering pollution control costs increases through product price increases.

A problem may arise however, if firms on the Rio Bogota, are competing with firms outside the area which are not facing new environmental regulation. Specifically, if firms are producing for

an international market and other countries have less strict regulations, then compliance with the new pollution control rules may decrease Bogota firms competitiveness.

Each industry being regulated on the Rio Bogota should be evaluated according to this criteria to determine whether price increases due to pollution control costs would significantly affect its market share. If there is such a potential problem then subsidized financial assistance may be warranted.

GATT Violations

Any subsidy provided to a firm competing in world markets might be challenged as a violation of the General Agreements on Tariffs and Trade (GATT). However, the terms of GATT specify that countervailing tariffs and possibly subsidies may be allowed if it can be shown that competing countries have less stringent environmental regulations than the home country and that the regulations imposed in the home country are for the purpose of protecting health and safety of workers or citizens.

Recognizing that the plan for the Rio Bogota is clearly designed to protect health and safety, the subsidized financing could be defended if it can be shown that potential competitors employ less strict regulations. If this condition cannot be proved, then the

applicant should not be considered for subsidized financial assistance.

Internal Financial Condition

The second financial criteria insures that the firm is a profitable operation that is likely to be able to repay the loan. Existing firms should be prepared to provide five years worth of financial records consisting of annual income statements and balance sheets. Analysis of these records must show that the firm is earning normal profits and is growing or at least remaining stable in its sales and revenues.

If the company is publicly owned, it should show a record of stable or increasing dividends paid to shareholders, and stable or increasing prices for its equity securities. In addition, it should have prepared a market analysis supporting the case that it is a viable competitor in the markets that it expects to compete in during the next ten years.

The firm must also be able to show that it can support the credit being requested. An audit of the firm's credit history should show that it has paid on schedule the interest and principle due on other debt. Its ratio of debt to annual revenue and debt to equity must be within the range of other successful firms in its industry.

If the credit history of the firm does meet the criteria allowing it to issue investment grade bonds, then the city or national government should be prepared to guarantee the loan.

E. Technical Capability Assessment

Management Capability

The firm should show a record of sound financial and corporate management indicating the likelihood of successful operation during life of the proposed loan.

Appropriate production technology

The basic production technology should be competitive enough to support claim of continued operation during the life of the loan. If the production technology in use is economically outdated or not competitive with that used by the firms national or international competitors, then the proposal for pollution control should be integrated with a plan for upgrading the production technology.

This stage of the analysis should include an assessment of whether the Industrial Restructuring Program administered by the Banco de la Republica could be used to finance improved production technology.

The environmental audit described above will have provided information about changes in production technology, process inputs or product characteristics that could reduce pollution while improving the productivity of the overall plant.

Feasibility of proposed pollution control plan

The proposed pollution reduction plan should be based on the environmental audit conducted according to the criteria described above. The firm should introduce those process, product and input changes that will reduce residuals generation at the lowest cost. Only after internal design changes have been evaluated should the firm consider construction of external treatment systems. In all cases the proposed treatment systems should be consistent with the cost effective control strategy designed for the river as a whole.

The control plan should incorporate the best available control technology for the type of residuals involved. In particular, The firm should have conducted a search for vendors of the appropriate control technology and solicited bids for the design, construction and operation and maintenance of the systems. This phase of the planning process presents an important opportunity to solicit bids for cofinancing of the project.

BOOT Contracts

Considering the shortage of long term financial capital in Colombia, firms should actively pursue and negotiate contracts in which vendors of pollution control facilities provide part of the financing needed for the project. One version of this approach is called a build, operate, own and transfer (BOOT) contract. Under this type of contract, a firm will provide full or partial financing of a facility, and retain ownership of it for a fixed term specified in a long term contract. During the term of ownership, the builder is responsible for operation and maintenance of the facility in return for previously specified fees. The contract may also specify that ownership of the facility is to be transferred to another party at the end of the service contract.

BOOT contracts have several advantages. First, the vender provides scarce financial capital needed to originate the project. Second, since the vender knows that it will be responsible for operation and maintenance, it has an incentive to build the plant in such a way as to minimize repair and maintenance costs and to allow for economical operation methods. Also the long term contract reduces the risk to the operator associated with of predicting revenues expected to flow from operation of the facility. Therefore the bids should be lower than might be the case in a free market competition.

Regardless of the type of construction contract proposed, the borrowing form should present a plan showing that they have arranged for appropriate technical staff for design, construction and operation of the pollution control facility. This may require that they have negotiated contracts for the provision of foreign design, construction or operations personnel. If any phase of the operation requires foreign expertise, the proposal should include plans for training local nationals to gradually replace foreign nationals so that Colombian expertise is increased and the plant ultimately is managed locally.

The overall purpose of these requirements is to assure that the proposed control plan will achieve promised pollution reduction targets. The Office of Environmental Finance should conduct an independent review of the technical plans to verify this objective.

Finally, the firm seeking assistance should have prepared a plan for ongoing development of better control techniques. This should include staff development programs, regularly scheduled environmental audits to be conducted in the future and a stated commitment to continuous adoption of improved technologies as they become available and whenever it is economic to do so.

II. ECONOMIC INSTRUMENTS AND INNOVATIVE STRATEGIES FOR POLLUTION CONTROL

This section describes various regulatory approaches to pollution control and evaluates them for use in controlling water pollution to the Rio Bogota. Traditional "command and control" techniques are contrasted with market based economic instruments. An argument is developed to support use of economic instruments.

A. Characteristics of Alternative Control Strategies

The traditional approach to pollution control is called "command and control". In this approach the government is responsible for collecting information about the sources of pollution, the damages caused and the available or potential control technologies and costs. The analysis typically focuses on the physical reduction of emissions to levels that are consistent with some sense of feasible controllability or with an ambient quality objective.

Following these analyses, the regulatory agency dictates control requirements to industry and monitors and enforces their compliance.

Command and control is applied in three basic forms: technological specification, physical emission standards and land and water use controls.

TECHNOLOGICAL SPECIFICATION

Industrial sources are required to install and operate specific types of control equipment or to use specified inputs or production processes. For example, a paper mill might be required to construct a biological waste water treatment plant to reduce loading of organic material (BOD) into a receiving river.

Specification of physical techniques is the least flexible of all approaches and leaves the industry with no freedom or incentive to design or adopt more effective techniques.

PHYSICAL EMISSIONS STANDARDS

Industrial sources are issued permits specifying that they may discharge a limited quantity of specific pollutants per time period or certain quantities per unit of production. This approach gives the industry some flexibility and incentive to devise efficient control techniques but only if the improvements result in lower cost to the regulated firm. On the other hand, firms may fear that development of better techniques will induce the government to apply stricter standards.

If standards are expressed in terms of pollution per unit of output, then there is no control over the aggregate amount of

allowable pollution and damage that may be caused over time. For example, automobile emission regulations in the U.S. restrict the average number of grams of pollutant emitted per mile driven and also require that each car be fitted with a catalytic converter to reduce emissions of partially burned fuel. These types of rules imply that as the number of car miles driven per year increases so does air pollution. Hence, despite strict enforcement of these regulations in the U.S. many urban areas do not achieve the national ambient air quality goals written into the Clean Air Act.

LAND AND WATER USE RESTRICTIONS

Geographic areas are classified or "zoned" such that certain activities are or are not permitted within the area. For example, a groundwater recharge area may be classified to prevent the operation of agricultural and industrial enterprises. A landscape with high erosion potential may be designated to prohibit clear cutting of trees.

This approach is most often used when there is low assimilative capacity in the area for certain pollutants or activities and the potential for damage is great. Under such circumstances, the government wishes to achieve a high degree of certainty that the damage will not occur. Outright restrictions in such areas provide

such certainty and are relatively easy to enforce if the area is not too large.

Advantages of Command and Control

The primary reason for using command and control (CAC) strategies is that the regulatory agency can be reasonably certain of achieving the desired reduction in pollution. Economic instruments create pressure on pollution sources to control their emissions, but the degree of response is difficult to predict. In most cases neither the regulator nor the polluting entity knows with precision, how much it will cost to achieve different levels of pollution control. For this reason, direct quantity or technical requirements are used when there is need for certainty of response.

Second, direct controls are most effective when there are few well defined sources and the appropriate control technology is known. In these cases, information requirements on the government are low and there is less to gain from indirect methods.

Disadvantages of Command and Control:

STATIC ECONOMIC EFFICIENCY IS GENERALLY IGNORED

The level of control is set according political goals or by reference to feasible techniques with little attempt to balance the costs and benefits of control. As a result the net benefits of regulation are lower than possible.

Example: United States "Superfund Program" --

Abandoned hazardous waste facilities must be remediated so that contamination is almost completely eliminated. Methods include soil incineration, ground water purification, transport and storage of chemicals.

The average cost of cleaning one facility is \$25 million U.S.

Typical sites are far removed from human populations and have caused very little damage to human health or welfare. Contaminated ground water typically extends no more than two miles from these sites and has not caused any significant water supply problems.

The level of control is distributed evenly across all pollution sources without regard for the differences in control costs in different facilities.

As a result for any given environmental target the aggregate cost of control is greater than necessary.

Example: United States "Clean Water Act"

Sixteen pulp and paper mills located on the Fox River in Wisconsin are required to install secondary wastewater treatment plants so that each plant achieves a 20% reduction in BOD discharges.

The cost of control varies greatly across the different mills. Nevertheless the mills with high control costs must achieve the same reduction as mills with low control costs.

The aggregate cost for the river basin was estimated to be \$22 million per year under the traditional command and control requirement. Under a more flexible plan, the river could have been equally clean at a cost of only \$16 million per year -- a 30% saving.

Administration, information and transactions costs are high.

Regulatory agencies need to collect large amounts of information on the details of industrial processes, control technologies and economic conditions in order to design feasible control standards.

In this circumstance, large government expenditures are required for information collection and analysis and long time periods are required for rule development. In addition, the burden of information collection and analysis falls on those least suited for it. Much of the knowledge about potentially effective control strategies lies within the regulated community.

An adversarial relationship exists between regulated firms and the government. Time and money are wasted when firms bring lawsuits against the government for "unreasonable regulation" and the government sues firms for non-compliance. "Transactions costs" are greater than necessary.

DYNAMIC ECONOMIC EFFICIENCY IS DISCOURAGED

When specific technologies are required, firms have no freedom or incentive to invest in research or development of new technologies that might reduce emissions at lower cost or with a greater avoidance of damage.

Under a system of standards, firms may prefer to avoid development of more efficient control techniques if they expect that the existence of such techniques will lead the regulator to impose more stringent control standards.

As a result, innovation is slower than possible and firms may keep secret their knowledge of superior control techniques. It should be noted that emissions standards give greater flexibility than technological specification and do create incentives for cost saving innovations. But even standards do not create an incentive for firms to devise technologies that reduce pollution if they are not also cost saving for the firm.

B. Economic Instruments

Economic Incentives are indirect regulatory strategies that create positive or negative pressure on polluting firms to reduce the environmental damage they cause; or that involve the creation and support of markets that in turn produce such pressures.

TYPES OF ECONOMIC INSTRUMENTS

FEES AND CHARGES.

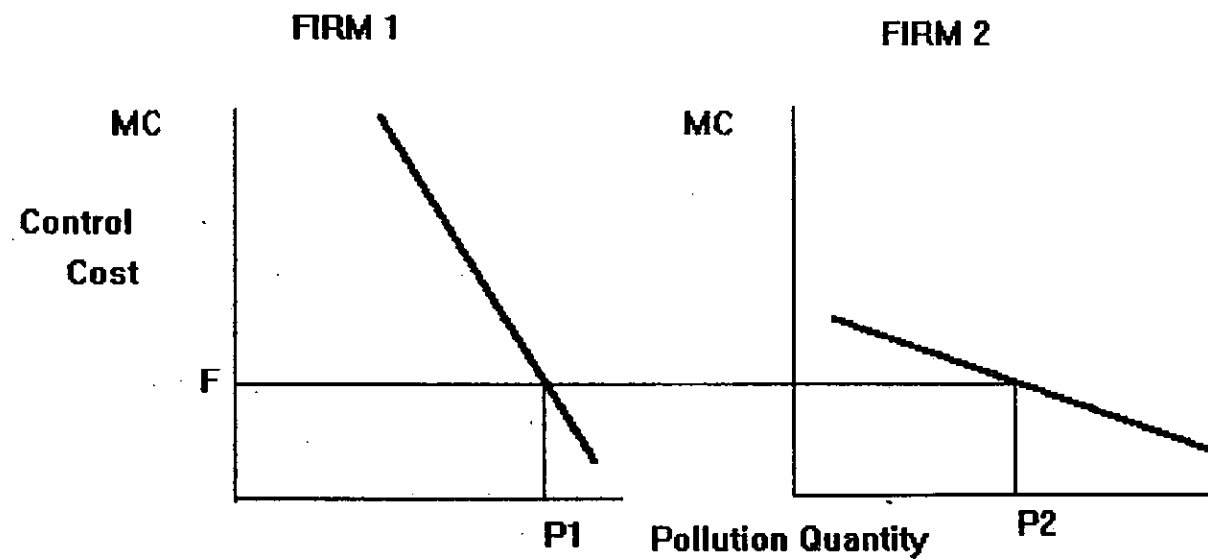
Effluent and emission fees -

Fees are levied by a government authority on industrial sources based on the quantity and quality of pollutants discharged into a water body, the air or onto land. They are often justified on legal grounds as a user charge paid by industry for the privilege of using publicly owned media (air and water) as a disposal sink for unwanted residuals. From this perspective, charging for use of the environment merely recognizes that it is a scarce and valuable resource with multiple potential uses. And if the fee is set properly, it ensures that the waste assimilative capacity of the environment is put to its most valuable use.

A schedule of charges can be designed to achieve aggregate discharge targets, ambient quality targets or revenue targets, or on the basis of the damage caused by the pollution.

A simple example is illustrated in Figure 1 below. In this case, the goal is to limit the aggregate quantity of emissions in a given geographical area. It is assumed that two dischargers are present, both releasing the same type of pollutant, but facing different

Figure 1
Emission Fees and Efficiency



control cost functions. Polluter 1 finds it very costly to reduce emissions while polluter 2 faces a lower control cost function. The regulator, knowing the aggregate control cost function, chooses a per unit emission fee of F to achieve an aggregate emission target of $P = P_1 + P_2$ where P_1 and P_2 are the equilibrium quantities of pollution that will be released by polluter 1 and polluter 2 respectively.

Each plant will reduce pollution so long as the cost of control is less than the fee. As a result, plant 1 controls very little and plant 2 controls a great deal. In the solution each plant controls up to the point where their marginal costs of control are equal to the fee and to each other. Therefore the aggregate reduction target is achieved at least cost.

Fees can be varied by geographic region and by time of discharge depending on the local severity of pollution damages or according to the assimilative capacity of the receiving environment. This aspect can lead to a complicated enforcement problem. If different point sources of pollution affect different places in the environment, or if they cause different kinds of damage, then a uniform fee per unit of pollutant will not be efficient. In general fee schedules should be designed so that each polluter faces a charge that represents his marginal contribution to the common damage.

User Charges -

Charges are direct payments to reimburse government for the costs of providing collection, treatment and disposal of waste, or for other services such as laboratory testing, monitoring, and permit issuance.

Charges are most frequently used in the collection and treatment of municipal solid waste, for commercial and hazardous waste and for discharge of wastewater into municipal sewage treatment facilities.

Product Charges -

These are fees imposed on consumer products that cause pollution either in the manufacture or use of the products. Product charges and the factor input charges, described below, are indirect methods of setting a price on pollution damage. In ideal circumstances, prices should be attached directly to the commodity being rationed. In the present discussion that means the pollutant as it is discharged in to the environment. For many pollutants however it may be difficult to measure quantities at the time of discharge and to design a system of fees based on such measures.

A second best alternative is to set a fee on the commodity which is most closely related to the generation of the pollutant. For

example, measurement of pesticide residues as they actually run off from farms in irrigation water is not feasible. Hence rather than set a fee on discharges it may be more reasonable to charge a fee at the time of purchase of the pesticide product.

If the product is such that it can be contained during use and brought to a proper disposal site, then a combination of product fee and refund upon return may be appropriate. This system is referred to as a deposit-refund strategy and is discussed further below. Lubrication oil for motors is a possible candidate for this system. For example, all members of the European Community, except Denmark, have established a product charge on lubricating oils and an associated subsidy for recycling used oil.

Factor Input Charges -

Fees can be imposed on inputs to production process which lead to harmful residuals either in the manufacturing process or in consumption or disposal of the final product. For example, toxic chemical used in leather tanning could be subjected to a fee that creates an incentive for reduced consumption and use of less toxic chemical inputs.

Tax Differentiation -

Different tax rates may be applied to products which cause different amounts of environmental damage. This strategy is logically the same as product and factor input charges noted above. But it deserves separate analysis because it concerns adjustment of tax and fiscal policies that already exist for purposes other than pollution control.

MARKETABLE PERMITS

Under this system, the governmental authority determines an acceptable level of total emissions of a pollutant usually calculated for a specific geographic region or watershed on the basis of a target ambient quality.

The authority then creates and distributes a certain number of permits for discharge that sum to the target total emission level. Permits can be auctioned or distributed for free. Thus the system can be used to generate revenue or as a revenue neutral program.

Once distributed, permits can be traded (bought and sold) among the dischargers in a free market. The demand and market price of permits is dependent on the marginal cost of abatement among the various dischargers as the discharger will treat his waste as long

as the marginal cost of treatment is less than the cost of buying a permit.

Cost effectiveness and the incentive to innovate are the same as with pollution fees. The equilibrium market price of permits acts as a price signal to potential polluters just as the emission fee does in the example described above and illustrated in Figure 2. Either strategy can achieve a cost effective solution for either an ambient quality target or an aggregate emissions target.

Tradeable permits are distinguished from fees in that the quantity of emissions is fixed by the government authority and therefore the degree of environmental protection is more predictable. In addition, the government is able to achieve its control target without having to collect information on the control cost function. This can represent a great reduction in information costs for the government, and the differences between fees and tradeable permits are discussed in more detail in the next section.

DEPOSIT REFUND SYSTEMS

Deposit refund systems are useful in cases where the problem consists of many small and widely distributed individual sources of pollution, typically involving individual consumption items or common industrial toxic inputs. This system is also appropriate

when the pollutant is persistent or toxic so that no discharge to the environment is desired. Finally it is useful when prohibition of improper discharge is difficult to prevent. In these cases it may be a good strategy to create a positive incentive for holders of the pollutant to voluntarily bring it to a proper disposal point.

In such circumstances, application of disposal standards, emission fees or tradeable permits is not feasible because of high transactions, monitoring and enforcement costs.

To resolve these difficulties:

Rather than attempting to penalize improper disposal, this strategy draws in units of pollution to central collection points where they can be managed.

Consumers pay a deposit at the time of purchase and receive the payment as a refund when they return the item to an authorized recycling or disposal center (often the original vender).

Common examples include:

Beverage containers (such as for beer and soft drinks)

Deposits of five to ten cents (U.S) per container have resulted in 80% to 90% return rates in the U.S., Sweden and Finland.

Automobile tires, engine oil and batteries

Some states in the U.S. charge a \$5 deposit on automobile batteries and 90% of these lead acid batteries are returned for proper disposal

Automobiles

Pesticide containers

The benefits of this strategy include:

- o Ease of administration
- o Creation of a market in which scavengers collect non-returned residuals to collect the deposit as profit
- o Generation of revenues from unclaimed deposits collected by the government for use in managing the waste material
- o Support for recycling and resource conservation

LIABILITY RULES

Strict liability holds the polluter responsible for damages caused by pollution even if there has been no showing of intent to harm or negligence. Weaker forms of liability require a showing of negligence in order to hold the polluter responsible for damage.

Liability requirements are useful when property owners can take action to prevent environmental damage but if damage does occur it may not be observed easily or until after a time lag. For example, industrial facilities may deposit toxic residuals on their property and over a long period of time drainage from the site may contaminate ground water. The resulting damage may be extensive and very expensive to remediate even though prevention might have been easy and inexpensive.

In this case if the firm is aware that it may be liable for damages in the future if they are discovered, it will feel an incentive to manage the property appropriately and prevent the contamination. Thus liability rules can be used to enforce the maxim: "An ounce of prevention is worth a pound of cure".

Enforcement of such a program can be carried out by requiring examination of commercial real estate at the time of sale and

transfer of ownership. Title transfer can be prohibited until the property is certified to be free from potential contamination

GENERAL ADVANTAGES OF ECONOMIC INSTRUMENTS

STATIC EFFICIENCY

Economic instruments allow and promote cost-effective techniques for pollution control and reduction. For any given ambient quality target or aggregate emissions target, use of economic pressure induces adoption of the most effective control techniques across the regulated polluters.

First, by setting a price on allowable pollution rather than restricting activity directly, instruments provide flexibility to polluters to choose the most efficient combination of process changes, input choice and use of pollution control technologies.

Second, the price signal conveys to polluters how much control each should achieve in order to distribute the control efforts most efficiently across different pollution sources. Sources with low control costs are induced to control more while higher cost control efforts are avoided. In an efficient outcome each polluter will control emissions, or contributions to ambient quality up to the point where marginal costs are equal. This is the signal of the

efficient "production" of environmental quality by a group of polluters.

DYNAMIC EFFICIENCY

By establishing a price for the right to discharge waste into the environment, firms begin to view the environment as a scarce and valuable resource. As with other costly inputs, there is an incentive to conserve the resource and to reduce its contribution to overall production costs. In this way economic instruments stimulate research on and development of innovative pollution control technology. It is particularly important to involve the private sector in this effort because that is where there is expertise in the area of production technology and the capital available to fund such research and development activities.

Moreover, when waste discharge is treated as a purchased service it enters business accounts as a cost of doing business and is then reflected in the price consumers pay for goods and services. In this way consumers also see the incentive to change consumption patterns to reduce pollution.

One of the most important ways that economic instruments encourage dynamic efficiency is that they encourage firms to examine their products and processes to find new control techniques not limited

to "end of pipe controls". This process of environmental auditing was described earlier in section 2.

ADMINISTRATIVE FEASIBILITY

Use of economic instruments greatly reduces the need for governmental agencies to collect detailed information on control technologies, feasibility and cost. The type of information that is needed does vary across the different forms of instruments however.

REVENUE SOURCE

Certain instruments can generate revenue for governmental use. Fees for services performed by government are properly used to cover the cost of provision of those services. Examples include fees for testing the safety of food products, as from pesticide residues, fees for treatment of industrial waste in public water treatment plants and fees for processing and monitoring permits and compliance schedules.

Other instruments such as effluent fees are designed primarily to influence the behavior and operating characteristics of polluters but they may generate revenue as a side product. Frequently such

revenues are used to fund other environmental programs or resource restoration activities.

DISADVANTAGES

STATIC EFFICIENCY

Economic instruments do not remove all information requirements.

The most important limitation of economic instruments is that they do not automatically solve the "full efficiency" problem. Because the services provided by a clean environment are mostly in the form of public goods, neither real nor artificial markets are capable of revealing the value of a clean environment. Therefore these strategies cannot be used to determine how clean the environment should be according to economic efficiency criteria. As noted above, determination of an "optimal" level of pollution and ambient quality remains the most difficult question in environmental management.

Consequently, the government must still take responsibility for setting overall pollution and quality goals. This responsibility involves estimating the aggregate pollution control cost function, estimating the damages avoided by (benefits of) pollution control, and choosing an overall quality target based on a balancing of these costs and benefits.

In addition, the government must be responsible for monitoring discharges and enforcing compliance with the control strategies.

Economic instruments cause uncertain results. Because these approaches rely on economic pressure, or incentives, the effectiveness of the control is not as easily predictable as with traditional approaches.

Subsidies make pollution control cheaper, but the response of firms is also determined by competitive pressures and expectations of the future. Emission charges will cause the firms to increase pollution control up to the point where the marginal cost of control is equal to the charge. But unless the regulator knows precisely what the control cost function looks like, it cannot predict exactly how much control will result.

A symmetrical type of uncertainty occurs with the use of tradeable permits, the regulator issues a fixed number of permits and they will be bought and sold among potential polluters. The equilibrium market price will reflect the marginal cost of control at the aggregate amount of pollution reflected in the total number of permits issued. But again, unless the regulator knows in advance the exact shape of the aggregate control cost function, the equilibrium price cannot be predicted with certainty.

This discussion is very important for the choice between tradeable permits and emissions charges. In a world of full information about control costs, either instrument will lead to a cost effective solution for a chosen aggregate pollution target and the target will be achieved precisely. But normally neither the government nor industry knows the exact shape of the control cost function. Therefore emission fees allow the regulator to be sure of the cost of control but not the amount of pollution reduction. Conversely tradeable permits allow the regulator to be sure of the amount of pollution but not the cost of achieving it.

In order to choose between the two types of instruments, it is necessary to know something about the damage function. For example there may be concern that beyond a certain level of pollution, the damage function becomes steep. This may be the case when ecological systems have a limited capacity to withstand disturbance and beyond that limit may suffer a large scale collapse of the system. In this circumstance the regulator would want great certainty that the limit will not be exceeded and so would choose a permit strategy instead of a charge strategy.

Certain types of indirect controls require sophisticated regulatory institutions for monitoring and enforcement. For example, tradeable permits defined in terms of actual emissions as well as emission charges both require monitoring of emissions to determine

compliance by individual sources. In situations where institutional controls are not well developed it may be necessary to design second best strategies that are easier to administer. For example, taxes on fuels or other production inputs may already be in place and provide a more feasible basis for influencing polluting activities than fees on actual emissions.

Industry structure also influences the applicability of some types of instruments. Tradeable permit systems will reach an efficient outcome only if there are enough trading partners to form a competitive market. Geographical distribution is relevant also. Firms subject to economic instruments should be producing similar kinds of pollution in the same region so that their damages are commensurable. As diversity of sources increases so does the complexity of design of the control instrument.

C. Recommendations for the Rio Bogota

1. Conduct industry wide environmental audits -

General information useable by all plants with similar production technology can be made available to individual firms. Since the audit of a general industrial process can provide results useable by many firms, industry councils should undertake this action.

One strategy could be to identify a representative firm in each industry to serve as a pilot case study. CAR in cooperation with the industry council could provide a subsidy to cover the expense of this pilot environmental audit. In return the case study firm would agree that all information revealed in the audit would be shared with other firms in the industry.

This initial general audit would also collect information about alternative inputs, production processes and treatment techniques that have been used in other countries or locations outside of Bogota. It would also identify firms that design and sell pollution control equipment that might be used on the Rio Bogota.

Through these actions the industry council and CAR would construct a library of technical information that could serve as the basis for pollution control planning in the rest of the industry.

On the basis of this library of information and the experience of the pilot study, technical assistance could be offered to the remaining firms in the industry.

2. Establish procedures for multifirm treatment systems

A major barrier to pollution control in the Bogota watershed is the predominance of small and medium sized firms. Not only is their

capacity to borrow limited but they also operate at inefficient scales. Particularly in the construction and operation of water pollution treatment facilities there are great opportunities for cost reduction through economies of scale.

It is not feasible nor costs effective to expect several small leather tanning firms to each construct individual treatment plants for removing DBO from wastewater. In such cases the unit cost of treatment will be much lower if several small firms cooperate to collect their waste water and send it to a large central treatment plant.

CAR should provide mediation services and possibly create an independent corporation that can serve as the legal and financial vehicle for constructing and operating multifirm treatment plants. Specifically, CAR could negotiate an agreement with several firms located in close proximity with each other to enter into a long term contract with a treatment corporation. The contract would specify sources of financial capital, commitments to send certain quantities of wastewater to the plant and a fee schedule specifying charges to paid by dischargers to the treatment corporation.

Three possible legal structure could be used. One would consist of an independent company that contracted with dischargers to treat specifies quantities of waste. The treatment company would then

seek its own sources of capital and negotiate with engineering firms for the design construction and operation of the plant.

A second form would have the dischargers be the owners of the treatment company. Each firm would provide capital in proportion to the amount of waste water it produced. The dischargers would then have representation on the board of directors of the treatment company and they would hire outside firms for design, construction and operation.

A third variation would follow the outline of a BOOT contract. In this approach, a vender of pollution control systems, would provide all or part of the financial capital needed for construction of the treatment facility. In return it would own the facility and charge fees to the dischargers as specified in a long term contract.

3. Provide technical assistance for negotiation of partnerships between polluters and vendors of pollution control systems

To encourage financial participation by vendors of pollution control equipment, CAR should provide technical assistance to individual dischargers large enough to justify dedicated treatment plants or to groups of smaller firms as described above. This assistance would include technical evaluation of treatment needs,

financial analysis and consulting services to help in the negotiation of long term contracts for BOOT type agreements.

This assistance is particularly needed in the case of small and medium size firms that may not have access to the kind of technical and legal advice that is needed to negotiate with multinational engineering firms. The needed advice includes design of long term construction, operation and maintenance contracts; obligation or option for one party to purchase or assume ownership of the treatment facility after a specified term; financial participation of the outside vender and provisions for penalties in the event of non-performance.

4. Design and implement a system of effluent fees

The simplest and most effective economic instrument that could be tried on the Rio Bogota is an effluent fee. The legal basis for charging fees already exists and the monitoring needed for enforcement of such a system is the same as would be needed for a more traditional pollution control strategy.

In general, CAR would have to establish a system for measuring the amount of pollution being discharged from each point source located on the river. Then a fee is charged to each firm for each kilogram of waste discharged into the river. Firms are free to either pay

the fee or to reduce the flow of pollution into the river. As described above they will do whichever is cheaper. The result will be that firms with low treatment costs will reduce their discharges and those with high treatment costs will pay the fee. A cost effective pattern of treatment will be the result.

In addition, the fee system will generate revenues. These revenues could be used to fund the technical assistance programs recommended above and they could also be used to cover part of the cost of municipal sewage treatment, wetlands restoration, river parks or other related environmental programs.

A theoretically correct fee would be set equal to the marginal damage caused by pollution in the river. But since these damages are nearly impossible to estimate completely in money terms, an alternative approach is recommended.

To achieve a cost effective pattern of treatment across the various dischargers it is only necessary to set the fee equal to the aggregate marginal cost of treatment at the point on the cost curve coinciding with the CAR priorities. Even without knowing the exact treatment cost function, this point can be approached by creating a schedule of fees that rises over time until the river reaches the desired state of water quality.

CAR could consider two fee schedules, one for DBO and one for toxic waste. Since DBO can be assimilated into the river if it is not discharged in quantities too great, a fee strategy makes sense, and is described below. Toxic wastes present a different problem.

Since toxic wastes vary so widely in the amount of damage they cause a uniform fee is not appropriate. CAR could consider designing a three part classification for toxic wastes. The most harmful wastes covered under the CAR priority 1 are to be completely eliminated from the river. Thus no fee would be created and any firm that discharges these wastes would be subject to criminal prosecution.

Other toxic wastes might be allowed into the river in small quantities but the damage they may do is difficult to predict. For example, persistent chemicals may accumulate in sediments and be released in high concentrations during flood periods. Persistent chemicals also will travel to the Magdalena and cause further damage far from Bogota.

For these reasons we do not recommend use of effluent fees for pollutants other than DBO at this time. With further study it may be determined that the fee strategy could be expanded to certain pollutants other than DBO. But we do not have sufficient

information about these pollutants to justify experimenting with fees currently.

DBO and TOTAL SUSPENDED SOLIDS -

UNIFORM FEE SCHEDULE INCREASING OVER TIME

Waste that is organic in nature, non-toxic and which consumes oxygen as it degenerates in the river is called DBO. The damage it causes is limited to a reduction in the concentration of dissolved oxygen in the river. The lack of oxygen in turn creates a poor environment for plants and fish. The Rio Bogota above the Salto de Tequendama within the city limits is nearly completely lacking in oxygen thus making it a dead stream. Suspended solids also are non toxic and reduce the quality of the aquatic environment. The description below is stated in terms of DBO but it applies equally to the control of solids.

Although the distribution of DBO is not uniform along the river, a practical strategy would be to assume that DBO from all discharge locations is equally harmful, and so a uniform discharge fee is justified.

Since DBO is discharged by almost all dischargers, this fee will be comprehensive. To begin the program it is necessary to identify

the average cost (per kilogram) of removing fifty percent of the DBO from the wastewater of typical dischargers. The fee per kilogram is set equal to that average cost. Firms that have treatment costs above the average are free to pay the fee and continue to discharge DBO into the river. Firms with treatment costs below average will find it profitable to build a treatment plant and avoid paying the fee.

The calculation of specific fees is beyond the scope of this project but the detailed plan can be designed without much further analysis.

As part of the program, the government must announce that the fees will be increased according to a planned schedule until the desired water quality on the Rio Bogota is achieved. For example, the fee could be reviewed every five years and an increase imposed if needed. Of course the fee schedule should always be maintained in real terms. That is each year an adjustment for inflation will be made in addition to any real increase planned for five year intervals.

Monitoring and Enforcement

Firms can be allowed to install monitoring devices at their river discharge points and to report the daily discharge to CAR.

Periodic random spot checks of the equipment should be conducted to ensure honest reporting. Measurement of discharge flows and concentrations of the appropriate pollutants is not technically difficult or expensive. Moreover, the same monitoring activity is needed for any form of pollution control whether based on permits or fees.

To encourage honest monitoring and reporting a system of fines should be established as a penalty for misreporting. A simple method for this system is to set the fine equal to a multiple of the money that firms saved by non-compliance. For example, if the firm is discharging 1000 kilograms per day of DBO and the normal fee is \$x. Then it is discovered that the firm has only been reporting discharges of 500 kilograms per day. So by non-compliance it has been saving $500 * \$x$ per day = \$Y per day. The fine could then be set at five times \$Y for each day that the firm was in non-compliance.

III. FINANCING THE DECONTAMINATION OF THE BOGOTA RIVER

A. Capital Market and Environment

1. Introduction

An increasing interest in environmental issues and the alarming situation of Río Bogota has led CAR to consider the establishment of an independent private financial entity specialized in credit extension to the industrial sector responsible for much of the pollution of the river. Despite of a steady growth of the possibilities of the financial sector in Colombia, the increasing diversification of functions of the different financial entities and a general move against specialized and subsidized financial institutions, there might be a need for the design and the establishment of a financial entity or a environmental foundation specialized in the decontamination of the river. The identification of this need, its evaluation and the consideration of additional options is the object of the present study.

The need and feasibility of an eco-credit institution is suggested by similar entities in some OECD-countries (see appendix I) and efforts and discussions in some Latin American countries. Such a comparison is to be accepted with great care only. As discussed in more details in Appendix I, the Eco-credit institutions in Europe

are of minor importance, although they do function. There is, however, a trend within traditional financial entities to offer special services which take into account the environmental priority of its clients. These services are higher priced or have a lower rate of return. Second, the eco-credit institutions, too, have to take great care not to limit their activities to a particular business in order to be able to diversify the (generally higher) risk.

Also, it has been argued that the CAV are an example of a specialized, market oriented system of financial entities which was of tremendous success. To take the CAV-system as an experience to be duplicated¹ in the case of environmental technologies is equally problematic. The CAV system is based on the UPAC which links the demand for long-run credits with the supply of rotating short-run funds on the one hand, and the need to channel such savings to a particular sector, the construction. The construction sector in itself has two advantages. First, the construction of housing is a profitable business (and does not have as principle effect an increase in costs as the introduction of new technologies) and, second, it produces a fairly valuable guarantee to the lending entities: buildings. Moreover, until very recently, the CAV had a

¹ The comparison of a specialized environmental financial entity and the CAV system has been suggested on several occasions by CAR executive authorities.

monopoly to raise savings, and still does have a monopoly in offering a protection against inflation. It is in no way conceivable (and even less desirable) how and why an eco-credit institution should be assigned the monopoly to finance environmentally clean technologies (apart from the difficulty to define what exactly is an environmentally clean technology).²

This is not to say that a new financial entity, specialized in financing environmentally clean technologies, is absolutely impossible, but care in its design is needed. Models and experiences in other countries and other sectors can give important insights, but they are not valid as models, readily been taken over into another context.

To assess the feasibility and viability of a new financial entity, three types of institutions shall be discussed.

- the setting up of a new private bank specialized in environmental issues. This institution (eco-credit institution) would manage all financial aspects related to the

² One lesson can be learned from the CAV-system, however. Some institutions - the BCH for example - have had some problems due to their difficulties in diversifying their assets in housing in different areas. Many of the bad-risk low-guarantee segment of the market are clients of mixed or government institution, which have problems in recuperating the outstanding debt.

decontamination of Río Bogota. Its possible that its margin of action will increase with time and gradually include the financial handling of environmental aspects in general.

- the setting up of a private non-credit institution which focuses on other forms of long-term involvement to assure the decontamination of the Río Bogota. As will be discussed, a fiducia would be the most appropriate form.
- the setting up of a "Fondo Ambiental" which offers some well-defined services.

2. Incentives and Information - Some Theoretical Considerations

Before discussing the structure and size of a new financial entity and its advantages and disadvantages, three aspects have to be discussed on which the analysis is based (Table 1) The first two aspects are of general nature, whereas the third aspects is of importance for a credit institution only.

Table 1: Three basic axioms underlying the study

-
- 1) CAR IMPLEMENTS AND ENFORCES A SEVERE ENVIRONMENTAL POLICY SO THAT THE USE OF NATURAL RESOURCES IS PRICED
 - 2) THERE EXISTS A CONFLICT BETWEEN ENVIRONMENTAL, SOCIAL AND ECONOMIC GOALS
 - 3) CREDITS ARE NOT THE MAIN PROBLEM (NEITHER EXCESSIVE INTEREST RATES NOT LIQUIDITY CONSTRAINTS)
-

a). The Need for an Environmental Policy

Without an environmental policy which puts a price on the use of environmental goods and natural resources, no firm whatsoever will have any interest in asking for a credit for industrial decontamination (unless it is directly affected by its own pollution, as for example, the leather tanning industry, see Durana, 1993), be there or not credit problems in the capital market. A new financial entity is only feasible, if CAR (and other entities) implement a system of economic instruments to price the use of natural resources. In the case of the Bogota River, CAR has the authority in its jurisdiction to enforce such an environmental policy (CAR, 1992, p.10). In what follows the implementation of such a policy is taken for granted.

b). The Conflict Between Different Objectives

There exists a potential conflict between economic efficiency, the environmental objective set by CAR and the social impact of a drastic structural change. There will exist a considerable number of entities which can neither bear the costs of a technological change nor pay the fee for not complying with the CAR standard. To reach the CAR-standards, these firms will have to stop producing. There might exist social reasons why one does not want these firms to stop producing. Without ignoring the social aspect of protecting inefficient economic structures, it should be stressed that there are economic costs in supporting each and every firm, since extending credits to inefficient firms ties up funds which would have a higher return elsewhere. Moreover, the default risk will increase substantially, such that some resources will be lost.

3. Market Failure in the Credit Market

The problem of the credit market for SME's³ is not so much the level of interest rates, but the oligopolistic structure of the market and the existence of credit rationing due to asymmetric information and the high costs of risk evaluation.

³ As will be shown later, the potential demand for credits for industrial descontamination will almost exclusively come from SME's.

CAR, 1992, and Orluando, 1993, in its comments on the CAR-document foresee and recommend subsidized interest rates, assuming that the difficult access to credits is due to too high prices and not to rationing. In a competitive market⁴, this implies that a firm which cannot pay for the pollution it causes does not produce efficiently. Its full production costs according to the polluter-pays-principle are higher than the market price - and it should be driven out of the market (given all other aspects being efficient).

The Colombian capital market, however, can hardly be characterized as competitive⁵. This leads to non-competitive prices and quantities. The Central Bank⁶ locates the problem in within the interbank market itself: Surplus entities do not transact sufficient means to deficitary financial institutions to smooth out supply and demand disequilibriums. The interest rate is then above

⁴ Under these circumstances, high interest rates may be the result of a restrictive monetary policy. It seems however that this is not the case in Colombia where the increasing amount of international reserves has led to a moderately restrictive credit policy (see Revista del Banco de la República, august 1992).

⁵ See Estrada, 1992, for some concentration indices for the banking sector. Imperfections on the credit market are also caused by interventions of Government and Central Bank. Interest rate limits will affect the amount of credits extended, and minimal reserve requirements impose a shadow price on the bank. The high spread between deposit and credit rates are - at least by bankers - explained by such costs (see Herrera, 1989, for a calculation of such costs).

⁶ See Revista del Banco de la República, August 1992.

and the total amount of credit available below the values prevailing in a competitive market, the difference depending on the exact oligopolistic structure of the market. In such a market lower interest rates (due to government credits and/or subsidies) would, then, not necessarily imply subsidising inefficient producers.

However, a similar effect would have the entry of a new credit institution. If the oligopolistic market structure is such that the existing entities use a strategy of tacit collusion (each entity accepts tacitly the market segment of the others and abstains from any politics to enter another entity's segment), the entry of a new credit institution into a new market segment can indeed be a profitable and welcome step. Existing institutions might very likely not enter this new segment, unless it is highly profitable and does not interfere in the existing balance of sharing the market. From this point of view, one cannot disregard a new eco-credit institution as a priori entirely impossible.

There is some evidence, however, that the principal problem in some segments of the Colombian credit market cannot be traced back to oligopolistic tacit collusion behavior, but to credit rationing due to incomplete and asymmetric information. These information problems induce different types of costs. There are some arguments related to the demand side:

- There is some evidence that small firms anticipate information and transaction costs of demanding a credit of being too high. These costs consist of negotiating for a credit in an alien environment, filling in formulas, providing guarantees etc.
- Apart from several documents they need a written approval of a guarantor (JICA, 1990). Thereby the credit institutions externalize the default risk. The importance of guarantees is documented in Valencia, 1992, although he analyses mainly short term credits for small and medium sized enterprises. The bank in question asks for a guarantee of 100% to 130% of the credit sum, if the personal guarantee is not sufficient.⁷ The issue of a guarantee excludes certain firms from the credit market. Microenterprises usually neither offer a guarantee which covers the indebtedness, nor do they have sufficient liquid means to participate in the financing of the new technology.
- The costs to identify the best (decontamination-) technology - given the environmental standards set by the government - can be very high. Collecting and processing information is costly.

⁷ For such guarantees (and if a credit is repaid in real values) the value has to be adjusted for inflation. This, however, is a purely technical, and fairly easy, problem (see e.g. Ortiz, 1992).

These costs are lost if it turns out that the best practice technology cannot be implemented (sunk cost). Typically, enterprises shy away from assuming such costs. If they need to pay advisory assistance to evaluate best practice technologies, they have to increase their credit demand. A higher credit demand, however, implies a higher default risk for the bank, and diminishes the firm's probability to receive a credit.

The more fundamental side of credit rationing can be identified on the supply side:

- Financial institutions do not so much evaluate projects, but rather the profile of the borrower (Valencia, 1992, Alonso, 1992, Cabal, 1989). This constitutes a bias against new applications and applications with a bad credit history. Furthermore, they seem to limit the loan sum to a certain percentage of the deposit of the borrower, which lowers drastically the volume of a credit a SME can borrow.
- The costs for the bank to evaluate credit demands by small firms are high and increase therefore the cost of administering credits for this target group. Moreover, the costs associated with the risk of extending credits to smaller entities is high.

- Credits are subject to adverse selection. If the bank increases the interest rate, "good risks" will withdraw and leave the bank with the riskier clients. The banks may, therefore, prefer not to extend a credit, even if the borrower is prepared to pay a high interest rate.

The experiences of some financial institutions in Colombia confirm these points, as appendix I shows. There is some, though not much, empirical evidence on the size of such credit rationing in Colombia. The studies by Tybout, 1981, and more descriptively by Valencia, 1992, and Alonso, 1992, (among others) suggest that there exist difficulties for smaller firms to receive credits, be it because of the oligopolistic structure of the capital market, be it because of credit rationing.

The existence of credit rationing does not imply that all small firms are bad risks. In fact, if this would be true, the problem of risk evaluation would be a fairly easy one, since the size of a firm would be a good indicator for its economic viability. The problem of credit rationing stresses the fact that some small firms which have a very sound economic basis do not receive credits because it would be too costly for the bank to identify whether this particular firm belongs to the class of low or high risk. As the experience of some of the foundations working with small and microenterprises shows it is possible to identify good risks, and

consulting activities, management support etc. can substantially improve the economic base of a firm (and therefore its quality as a debtor). However, the cost of such activities per extended credit are very high. Together with the oligopolistic structure of the formal credit market in Colombia (and its defensive behavior in entering in new markets) inhibits the extending of financial entities' activities in this segment. This point will turn out to be crucial in the design of the financial entity to decontaminate the Río Bogota.

4. The Cost of Decontaminating the Río Bogota and the Demand for Financial Services

Before discussing the adequate entity and its likely financial structure, some assumptions about the demand for its services and the volume of its activity have to be made. In CAR, 1992, the program to decontaminate the Río Bogota is estimated to cost US \$ 500 millions over 5 years. It is very difficult to estimate such costs - in any case the amount seems very high, but it will be accepted here, since any other estimate is subject to the same deficiencies.

In estimating the likely demand, two points have to be mentioned. First, the costs of decontaminating the Río Bogota will not be equally distributed over the five years as suggests the

calculations in CAR, 1992. In the first years, the contaminating entities will wait with taking measures of decontamination to see whether CAR will implement its new policy and impose the costs of contamination on the entity. An increase in the demand for financial services is to be expected only from the moment in which the new environmental policy imposes major costs on the contaminator and in which CAR has acquired the reputation of pursuing such a strict policy. It is, therefore, to be expected that it will take some years until the demand for financial services reacts to the new environmental policy.

Second, only part of the costs would be financed by credits. Some firms may have a sufficiently large cash-flow to finance the required technological change without external capital, or ask credits by their "house bank". Other firms may prefer to pay the fee and produce with the existing technologies. Some firms may even decide to stop producing altogether. Also, if CAR succeeds in imposing the legislation on the polluters, other financial entities, particularly IFI and CFD, will enter this market. They will very likely attract a large share of the demand for credit. These reasons lead to a lowering of the credit volume which might be captured by a new specialized entity.⁸

⁸ The volume is not only determined by the amount of credit demanded, but also by the length of the credits and the quality of the borrowers. One can assume that these credits are middle- to long-term. The implications of

5. Cost Considerations for the Entity

Three cost aspects which the entity has to take into account shall be distinguished. Some of these costs are related to credits and, thus, only relevant for the eco-credit institution, and not for the other two options.

- (a) costs of funding
- (b) placement costs
- (c) administrative costs

a). The costs of funding

The costs of funds refer to the interest rate on deposits, on the costs of emission of bonds etc., but also on the transaction costs of negotiating international loans or credit lines. These costs may differ for different institutional options, simply because the different institutions do have different experiences, negotiating powers etc. for different types of funding. In table 2 the different sources of funds for a financial entity are listed.

this will not be discussed in detail. The existence of competing banks, of high cash flows etc. influences also the structure of the credit demand which in turn changes the risk diversification and the costs of credit evaluation. These points will be taken up later.

Table 2

Sources of funds

1. *State entities* (national, departmental and municipal governments)
 - Expected amount of funds: insignificant
2. *External credit lines* (IDB lines, WB credits, Eximbank loans, etc.)
 - Expected volume: important
 - Placement of funds: at market conditions
3. *National capital market* (CDT's, bonds)
 - Contribution: marginal
 - Placement: at market conditions
4. *Investment group interested in descontamination*
 - Important contribution
 - Placement: at market conditions or slightly preferential
5. *"Green" groups*
 - Expected amount: insignificant
 - Placement: at preferential conditions
6. *Resources from fines*
 - Amount: unpredictable

b). Placement costs

One of the fundamental differences between an eco-credit institution and the other two options is the risk of default associated with the credit business. With asymmetric information about the risk involved in extending credits, these default costs change in accordance with the ability to correctly evaluate the risk. Risk analysis is largely a matter of experience - usually banks draw conclusions from similar, known cases. If a specialized bank can derive conclusions from other cases, or in other words, if the different cases are not completely singular, but show general patterns, then a specialized bank has a cost advantage. It is, then, very likely that institutional forms without such knowledge have higher costs of risk management, be it that they need much more information about the quality of the borrower, be it that they assume too high (or too low) risks.

Experience shows that there exist such informational economies of scale. However, they are usually related to a sector (evolution of demand, market structure, competition, prices, influence of exchange rate etc.) and not to specific technological aspects of a different firms in different sectors. As far as they exist with respect to the individual clients, they are lower than the risk costs implicit in extending credits. A significant difference between the eco-credit institution and the other two options is

that the other two options can separate these two aspects. As will be discussed they can use the specialized knowledge without being burdened with the credit risk.

Two further cost problems are valid for all three options. First, collecting and processing information is costly. These costs are lost if it turns out that the borrower is not creditworthy (sunk cost). Such sunk costs are to be expected, if a large number of potential borrowers are expected to be of a high risk class, as it is surely the case of the firms along the Río Bogotá. To accept such costs is only justified if a "risk data bank" can be sold. Second, if the firms to which the credits are extended have a similar risk pattern, any form of risk diversification is excluded. The current problem of Caja Agraria (El Espectador, El Tiempo, La República, 17.11.1992) can be traced back exactly to this problem. Table 3 provides a summary of the main placement costs of a financial entity.

c). Administrative costs

The third class of costs are the operating costs. Such a system needs staff first to evaluate the proposed technologies and second to handle the financial aspects. The two aspects can in principle be separated; the first providing a necessary information for the second. There is some empirical evidence that there exist some

Table 3
<u>Placement costs</u> <ol style="list-style-type: none">1. Costs arising from risk concentration in SME's2. Costs arising from extending small amounts of credits to firms with a high default risk3. Costs arising from lack of guarantees

economies of scale in the Colombian banking sector (Suescún, 1987, Ferrufino, 1992) and in the other segments of the financial sector (Ferrufino, 1992). This implies a cost advantage of having the financial aspect of the system being handled by the existing financial institutions - mainly personal banks and investment banks (corporaciones financieras) - over the setting up of a new specialized financial institution. One has to add, however, that these scale economies should not be expected to be very large. Table 4 shows the most important administrative costs arising from the establishment of a specialized Eco-credit institution.

6. The Supply of Funds

a). National and regional Governments

The pollution of the Bogota River is clearly a local public bad. In accordance both with an extended understanding of the Polluter-Pays-Principle and with the experience that international loans are more difficult to get if the negative externalities do not affect the country which pays, one would be led to conclude that the funding of the financial entity is primarily a problem of the City of Bogota and the Department of Cundinamarca, and second of the Central Government of Colombia (given the negative externalities felt in other departments, for example along the Magdalena River).

Table 4

Administrative costs

1. High costs arising from low transaction volumes (lack of economies of scale)
2. High technical evaluation costs
3. High financial evaluation costs
4. Some possible cost advantages in technical and financial evaluation if there are comparable structures among different firms

The national government will not be able to participate to a large degree in the costs of decontaminating the Rio Bogota. CAR proposes a program of US \$ 100 annually over five years. The Colombian Development plan for 1990-1994 foresees an annual spending on environmental issues and environmental improvements of the infrastructure of between 56 and 89 millions US\$ yearly between 1992 and 1995 (Presidencia de la República, DNP, 1991, p. 589). The whole investment volume is, thus, less than the estimated annual cost which means that public finance cannot provide the necessary funds for the industrial decontamination.

The situation of public finance in the departmental and municipal entities does not allow a too extensive involvement in funding a new financial entity, either. In particular, given the critical financial situation of the City of Bogota and the relatively small budget of the Department of Cundinamarca, one cannot expect large funds from neither the department nor the City. Similarly, other departments or entities like EAAB or CAR which have a strong interest in the decontamination of the Rio Bogota are for sure not sufficiently well-endowed to participate in the funding of an entity in a significant manner.

The relatively weak financial stand of the different governments does not imply that they are not able and are not interested in participating in the equity capital as minority shareholders. This

would give them the possibility to influence the credit policy of the financial entity.⁹

The power of government agencies to finance the working capital (and even the equity capital) of a new, specialized entity can be considered as negligible. There exist, however, significant experiences in Colombia with special funds, administrated by the Central Bank (or other official organizations) and financed by either national or international credits. The two most important institutions are IFI and CFD (see appendix I.), which also intermediate credits by the World Bank, IDB, but also national funds like FONADE. IFI is especially important for loans to large borrowers, but also channels funds through the CFD to SME's.

⁹ In O'Neil et al., 1992, the dilemma for an entity which at the same time receives the income from a fee and sets its value to seek maximal revenues (and not the economic most efficient solution) is mentioned. It is, therefore, suggested to separate the political instance which sets the fees from that one which receives the income. In other words, if CAR has the juridical power of setting the fee, it should benefit from these revenues. CAR, 1992, suggests to channel these fees through the new eco-bank. As far as such a private financial entity can also extend credits to other clients, such a scheme would be distorting, since the eco-bank receives financial resources at low (or even zero) costs.

b). Credit Lines from International Organizations and Governments

Given the presumed amount required for the industrial decontamination of Río Bogotá, it becomes very clear that the government entities will not be able to take over the main share of funding. The major part of the financial burden has to be assumed by local investors and using international credit lines, offered by IDB, the World Bank and foreign governments (US, Netherlands, Japan, Germany etc.) The importance of these international credit lines results not so much from particularly favorable borrowing conditions than from their medium and long term character. As these credits are scarce in Colombia, they fall into an important segment in the national capital market. As can be seen from Table 5 there are substantial capital flows from international agencies and foreign governments. The rediscounted long term credits amounted in november 1991 to US \$ 200 million, 68% of which corresponded to external credit lines. The expected costs of US \$ 500 millions of the program¹⁰ would then represent about 3.5 times this sum. This means that only a very small part of the expected cost for the industrial decontamination could be covered by the external credit

¹⁰ The document does not include detailed information how this cost is calculated. However, these costs seem to be extremely high.

Table 5

FONDOS FINANCIEROS INDUSTRIALES Y LINEAS EXTERNAS
ADMINISTRADOS POR EL BANCO DE LA REPUBLICA
CARTERA VIGENTE
NOVIEMBRE 1990-1991
(\$ Millones)

LINEA DE CREDITO	NOVIEMBRE 1990	NOVIEMBRE 1991	VARIACION PORCENTUAL
FFIC-Línea Ordinaria	24.844	23.503	-5.4
FFIC-Línea Bienes de Capital	1.362	3.140	130.5
FIP	21.449	28.708	33.8
FCE	9.972	8.802	-11.7
SUBTOTAL FONDOS FINANCIEROS	57.627	64.153	11.3
BID	24.978	47.683	90.9
BIRF	43.954	59.023	34.3
EXIMBANK JAPON	5.523	29.426	432.8
SUBTOTAL LINEAS EXTERNAS	74.455	136.132	82.8
TOTAL	132.082	200.285	51.6

Fuente: Banco de la República

lines which are at moment the most important source of long term credits.¹¹

Another form of looking at external flows consists in analyzing the total outstanding medium and long term debt. On December, 1991¹² it amounted to US\$ 14'462 million; US \$ 3'728 millions are owed to the International Bank for Restruction and Development and US \$ 2'427 million to the Interamerican Development Bank. Overall, the US \$ 500 million project would be 3% of the total debt; however, it would be 13% and 21 %, respectively, of the two main creditors debt. For 1993, BID assigned a credit volume of US\$491 to Colombia¹³. Given the US \$ 100 million annual costs estimated by CAR to decontaminate the Río Bogota, this would use up 25% of this credit.

It cannot be excluded that a certain substitution effect would take place; the Rio Bogota credit line would attract money away from other projects. Given that international credits should be allocated efficiently, it is doubtful whether international

¹¹ Based on an exchange rate of 700 pesos/dollar.

¹² See Revista del Banco de la República, June 1992

¹³ These resources will be assigned basically to environmental and microfirm projects. Some resources will also be used to finish studies and projects, see La República, 2.3.93.

organizations are willing to support such a project: the Bogota river contamination is a locally very circumscribed project.

With respect to the conditions at which the credits are extended, one observes that IDB and World Bank credits do not consider any subsidization of their credits, but require that borrowers accept the market rate. Generally, the only prerequisite is a maximum interest rate the "first-tier" institution can ask for credits from their customers.

c). International Credit Lines Assigned Exclusively to the Environment

The analysis of these credit lines provides a general idea on the potential international resources for industrial decontamination of Río Bogota. The entity in charge of channeling most international resources in Colombia is the "International Cooperation Unit" of the Colombian Planning Board (DNP). This unit evaluates the applications of credits. Moreover, they have made a considerable effort to organize information on environmental projects. The analysis of approved projects or projects applications in evaluation gives an adequate image of amounts and destination of international resources for the environment (table 6).

Table 6

Environmental Projects Approved (1991) or in Process for Technical Cooperation (Millions of dollars)

	1991-1992	1992
International Cooperation	40,532	66,535
National Counterpart	32,882	60,615
TOTAL	73,414	126,968
Total number of projects	25	32
Projects related to local pollution problems	5	7
Maximum amount (%) of international resources assigned to one single project	22.20% ¹⁴	24% ¹⁵

Source : Colombia Program , 1992

¹⁴ GEF project on biodiversity conservation in the Choco biogeographic region.

¹⁵ Rehabilitation of channels and lagoons of Cartagena

Between 1991 and 1992 the amount of total international cooperation for environmental projects amounted to approximately 40 million dollars, and the national counterpart to 44 million dollars. As the field of environment projects covers a variety of areas, money spent on industrial decontamination can represent only a small part of total international financial resources. Out of the 25 projects approved in the period 1991-92, at least 8 were clearly related to environmental problems of global concern¹⁶. They alone used up approximately 60% of total international resources whereas the 5 projects that can be related directly or indirectly to the rehabilitation and control of environmental quality¹⁷, used 17% of the total resources. None of the projects addressed directly a problem of industrial decontamination.

¹⁶ The projects directly related to global environmental problems are the following : Development of techniques for the use of Amazonian botanical resources, biodiversity conservation in the Choco biogeographic region, study and publication of the flora of Colombia, Choco biogeographic zonification, ecological management project of the Cienaga Grande de Santa Marta fishery, conservation strategy for the tropical forests of Sierra Nevada, forestry management plan for the Amazon region, sustainable rural development for communities in tropical rain forest areas.

¹⁷ These projects are : basic sanitary assistance in the Cucuta sub-urban areas, integrated recovery plan for "La Yesca Creek", rehabilitation and conservation of the rio Guatiquia high and middle bassin, comprehensive management of the Risaralda river bassin, control and diagnosis of environmental pollution.

None of the approved projects amounted to more than nine million dollars. In other words, even though resources from international cooperation exist, they do not represent overwhelming sums and they are distributed over a wide area of issues. As to projected future international cooperation for the environment, spending is classified according to 11 separate categories¹⁸. The one of concern to us in the context of industrial decontamination of Río Bogota is "rehabilitation and control of environmental quality". Planned total expenditures (Colombia Program, 1992) over the next five years have been estimated at 256 Million US\$. Only 20 Million US\$ (8%) are tentatively assigned (the information is not definitive) to rehabilitation and control of environmental quality. Even though the data used is preliminary only, it suggests to be careful in considering the potential for international finance for the industrial decontamination of Río Bogota: international resources for the environment are scarce, particularly if taken into account that resources for industrial decontamination programs will only constitute a small "share of the pie".

¹⁸ The areas are: coordination; research; integrated planning and management; protected areas and conservation; rehabilitation and control of environmental quality; alternative production and energy systems; infrastructure of support for environmental projects; management instruments; education, training and participation; environmental management in ethnic territories; special ecosystems.

Based on this not at all to optimistic picture, the following hypothesis can be put forward: External resources are mainly directed towards environmental issues of global concern, as the reduction of CO₂, the decontamination of international waters, the rainforests, biodiversity etc. A very clear example of such international environmental funds is the GEF (Global Environmental Fund) created in 1990. Responsibility of this fund is shared by the World Bank, UNDP and UNPE. The projects to be financed have to address one of the following four global environmental problems : Climate change with special reference to programs to the emission of gases that may produce global heating (CO₂), contamination of international waters, destruction of biodiversity, reduction of the ozone layer. The program amounts to a total of US\$ 1.300 Million for investment and technical assistance during the period 1991 to 1994. This sum is not really impressive considering that it has to be shared globally. It has to be mentioned, though, that the biggest sum of money assigned to a single project in Colombia between 1991-92 comes from the GEF¹⁹.

¹⁹ The project obtained financing for 9 million dollars and concerns biodiversity conservation in the Choco biogeographic region.

d). The National Capital Market

A possibility to finance the activities of an eco-credit institution would be the emissions of CDT's. They represent by far the largest market in Colombia. As far as CDT's would be used to finance the eco-credit institution's activity, long-term credits would be financed with short-term funds. This as such would not be that much of a problem for the bank itself, if it can fix a mark-up between the asset and liability rate and readjust the former depending on the movements of the latter. However, it puts a high interest rate risk on the borrowers. Although it has been stated before that credits are not very interest sensitive, fluctuations in the rate will influence the credit demand negatively.

A second form of raising funds are saving deposits. By Decreto # 2179 de Diciembre 31, 1992 financial corporations are now, as banks and CAV's, allowed to offer saving deposits which increases the funding possibilities for these "investment banks". How the public will respond to such deposits is difficult to estimate. Whether the savings will be hold as long-run savings, depends on basically on the interest rate (and on the income).

e). The Stock Exchange and the Bond Market

Another, generally available form of funding are long-term municipal bonds. However, the bond market - both private and public - is only emerging in Colombia. In the past, the Government has financed its long-term financial needs through forced investments but recently the government started to finance its deficits with treasury bonds²⁰

Table 7 characterizes somewhat the Colombian capital market. Papers with flexible and fixed rates have a roughly equal share in both the primary and the secondary market. The secondary market has increased lately, and has a volume of about twice the primary market.

Public and private bonds, however, do not count for a high percentage of transactions - neither in the primary nor the secondary market. However, as the external debt bond issues in september 1992 shows, there exists a possibility to place new emissions.

²⁰ With law 45/90 the forced investment system began to disappear. After the constitution of 1991 was established, the government started to finance itself with treasury bond D-545-91.

Table 7: Volumen de Transacciones en Acciones, papeles de rentas Fijas y Bonos en los tres bolsas del país (millones de pesos)

Año	Total Acciones y Rentas Fijas	Total Rentas Fijas	Total Bonos	Bonos en% Rentas Fijas y Acci.	Bonos en% Ren. Fij.
1987	376896	356376	3050	1	1
1988	430813	409708	5984	1	1
1989	567808	536235	42075	8	7
1990	1'022310	977962	23665	2	2
1991	2'720866	2'562131	60228	2	2

Source : Revista del Banco de la República, Diciembre 1991

From the 60228 millions of pesos of transactions in bonos, roughly 95% are "Bonos de la Deuda Externa Pública", and only a very small part private and public bonos, as can be seen from the Carta Mensual de la Bolsa de Bogotá, for example.

The bond market is still very small; however, the general condition does not exclude to consider the emission of a "Green Bond" as a viable option. Such a bond can be envisaged particularly for any

private-public partnerships for projects trying to decrease the environmental impact of a group of producers. Since such a project is very likely too large for one single financial corporation, one could try to launch a syndicated emission, probably under the lead of a government bank or institution (IFI or CFD) to raise the necessary capital.

In fact, given the growing importance of institutional investors the condition of successfully placing an emission can be considered as good, if such a bond promises a good rate of return. Moreover, such a bond would be a good possibility to attract capital from firms and institutions which have an environmental interest or image, particularly if the bond can be turned into shares. However, the issuing entity has to be an absolute first class debtor. Unless it has a very good credit history, such bonds might be extremely difficult to place.²¹

B. Feasibility of an "Eco-Credit-Institution"

1. The Funding of an Eco-Credit Institution

As analyzed in the previous chapter III, sources from foreign government are not as ubiquitous for industrial contamination

²¹ A recent district bond could only be placed to about a third of the value.

projects of local character as is often expected. Furthermore, investments or grants to institutions are even more scarce. International agencies, particularly IDB and World Bank, and their respective investment banks CII and CIF, are very cautious in investments in institutions. Both banks have some involvement in Colombia, both in private and in mixed companies. However, it should not be taken for granted that either agency participates in the launching of an ECI; once an institution has been running successfully (both in terms of economic efficiency and fulfilling its objectives) a participation to increase the equity capital might, however, be feasible.

With similar caution one should evaluate the probability that any government agencies will participate. The City of Bogota and Cundinamarca lack the financial means to participate in any decisive degree. Whether the national government will be involved in a entity which is designed to resolve a problem which is caused regionally (however, which effects are felt in several regions) is more than questionable, given the discussion of decentralisation of responsibilities.

The only government involvement - which is politically significant, but unlikely to be of a major financial importance - are the regional environmental entities (CAR, DAMA and EAAB in Cundinamarca and Bogota). There might be an interest of similar institutions of

regions which suffer from the polluted river in participating in the entity to influence its policy. The direct participation would also ensure that these entities are part of the board of directors and can influence the entity's policy.²²

International foundations - ecological funds, particularly - can indeed be a source. However, the local character of the problem makes it unlikely that large funds can be attracted. Moreover, financial resources from these sources are to be expected only if the objective can be fulfilled. Moreover, it is considered as very doubtful that eco-credit institutions in some OECD-countries are a source of finance.

An ECI has to be able to either raise a considerable amount of its funds at the credit lines managed by the Central Bank and/or IFI (the Banco de Comercio Exterior as another "second-tier" institution will hardly be involved in that scheme) or try to fund itself with (costly) savings. In Annex II a feasibility analysis for the funding of the bank is undertaken. It is concluded that the funding of a bank with total assets of US \$ 20 million should be possible. This bank, however, will not be able to meet a credit demand which comes close to the annual US \$ 100 million costs of

²² If a participation is not possible, one could envisage a environmental council to the Board of Directors, which incorporates institutions like CAR, DAMA etc. but also private environmental agencies and university institutes.

decontamination. As has been argued, the demand will be much smaller.

The institution's equity capital will have to be founded largely by private, national sources. This should not be seen as entirely disadvantageous: First, it is more in line with the intention to found a private bank, operating as a profit maximizing or at least profitable entity. Although capital is a scarce resource, it should be possible to find local investors, if the problem is as big as assumed and an interest in solutions as strong as suggested. Second, given the local public bad character, the founding of such an entity with private investors allows the integration of the polluter, as foreseen in CAR, 1992.

This latter point is ambivalent, however. Integrating the polluters in the entities' ownership structure has the advantage of getting very good information on pollution, risks and economic potentials of different firms. The readiness to participate might be a signal that these firms commit to produce environmentally cleaner. On the other hand there is the real danger that these firm (or their associations) try to use the financial entity as a source of cheaper or better conditioned credits.

are not profit maximizing, but have as their main objective the financing of the development of the SME and microempresas hesitate to take over these costs, but pass it over to foundations. Similarly, Serfindes (see appendix I.) uses external consultants to evaluate risks. But in both cases, the evaluated borrower is either not a microfirm, or is known to the evaluating entity of which he is usually a member of. CFD pays a bonus for each successful evaluation. Serfindes in some instances asks that the borrowers buy a guarantee at FOMENTAR²³, which is based on joint-application and -responsibility.

The third costs are even more difficult to cover. IFI, together with FONADE and DAMA, intends to offer a credit line (with lower interest rates) to realize studies on environmental technologies. These credits are then linked with a credit for a project which results from such a study. Since IFI does not lend to small firms, the eco-credit institution could intermediate, putting the costs of the feasibility study on the borrower. Of course, this solves to a certain extent the problem for the bank, but makes the risk aspect more pronounced. First, the bank has to get the money from the customer, even if the technical evaluation is negative, and, second, the loan has to be bigger which also rises the default risk. The problem is, of course, even more pronounced for credit

²³ FOMENTAR is a non-profit NGO specialized in the provision of guarantees for SME's.

evaluations which cannot take advantage of the better conditions offered by the IFI-credit line.²⁴

3. An Eco-Credit Institution for the Decontamination of Río Bogota ?

The evaluation of the different aspects shows

- No evidence that lack of credits is the main impediments of the decontamination of the Río Bogota. The main problems are a policy setting correct incentives for the contaminating

²⁴ Compared to solving the problem of risk evaluation and high administration costs, the further procedure to extend the credits are standard banking practices and do not have to be discussed in further detail. The term of the credit depends on the individual customer, will however, in general vary between three and six years, with some credits even longer. The fixing of the interest rates depends on, first, whether credits are extended using some international credit lines or funds from the private capital market. In general, there is a mark-up (up to about 6%, in special cases higher) which uses the DTF as reference. The mark-up, however, may change, since a large customer who is a good risk will obviously bargain for better conditions. Inflation adjustment is a relatively minor problem and affects mainly the position "Bienes recibido en pago", the company's investments and its fixed capital (incl. depreciation), the "cuentas en orden" and the "patrimonio". Foreign exchange risk is virtually no problem, since all activos and most pasivos are in national currencies. International credits are channeled through the Central Bank (as the relevant "second-tier" institution) which therefore takes over the exchange rate risk. The small remaining part - due to the Central Bank's monetary policy exclusively in US \$ - has a very small impact; the position "ajuste de cambios" is less than 1/2 % of the total balance sum.

firms, and in many cases other forms of long-term engagements, like training, consulting services, guarantees etc.

- No significant cost advantage in raising funds on the local capital market or through international agreements over existing financial entities for an Eco-credit institution, although the funding of a small Eco-credit institution can be considered as feasible.
- A relatively low demand, mainly of smaller credit volumes by clients which consist a relatively high risk. The pooling of these risks puts high costs of administrating these credits, of securities against bankruptcy of the respective firms and of evaluating the applications. The Eco-credit institution would very likely either not be viable, or turn into a non-specialized financial entity.
- The impossibility of extending credits to all firms which apply for it. Therefore, the mere existence of an Eco-credit institution will not guarantee the compliance of the CAR standard, since some firms' credit demand will not be met.

It is, therefore, concluded that the foundation of an Eco-credit institution is not the adequate step to proceed in the decontamination of the Río Bogota. Given the first of the four

aforementioned points, two options are suggested which would serve the objective in a more effective way.

C. Feasibility of two additional alternatives, an "Eco-Fiducia" and an "Industrial Environment" Fund

The evaluation of different cost aspects shows no significant advantage in founding an Eco-credit institution, be it an Eco-bank or an Eco-CF. The disadvantages in both the risk structure of the credits and in the administrative costs are considerable. With the ongoing liberalization, it is to be expected that competition for deposits, but also in credit market, will be increasing. Furthermore, there is no clear evidence that the decontamination of the Río Bogota is best tackled with extensions of credits. On the contrary, many firms, particularly SME's need certain forms of long-run involvement, be it other forms of long-term financial engagements, be it training, guarantees etc.²⁵ Assistance in management and information on adequate technologies may also be of utmost importance.

²⁵ In conversations with PROPEL (an NGO assisting the SME sector) it became clear that even though the SME sector blames the lack of financial resources and government actions for causing its problems, severe management problems are preeminent. Solutions to the problem of reducing the level of contamination may rather be found in the reorganization of the production structure than in the extension of a credit for a new environmentally clean technic.

The analysis suggests, then, to envisage two different alternatives that respond to these considerations :

a) An Environmental Financial Institution (Table 8) with a multiplicity of functions such as credit intermediation (second-tier institution), extension of guarantees, technical assistance, investment, leasing etc. According to this wide range of functions and the required flexibility, the institution will presumably be organized as a fiduciary (from now on "Eco-Fiducia"). It will fund its activities with second-tier banks and on the Colombian capital market. It offers credits to other financial entities, invests directly in firms through venture capital, offers leasing and technical assistance. It can also fund its own "Fondo de Garantía" or strengthen the existing ones (basically the FNG and FOMENTAR).

b) An environmental fund (from now on IEF, Industrial Environmental-Fund) with activities limited to three basic functions: guarantee provision for SME's, promotion of use of resources for adoption of clean technologies, and provision of environmental auditing facilities (see Table 9). This institution will not provide any credit facilities. The "Environment Fund" is not a financial entity, but a flexible form through which different donors and investors can channel funds towards the activities which have been identified as particularly problematic in the process of cleaning up the Río Bogotá.

Table 8

OPTION 1

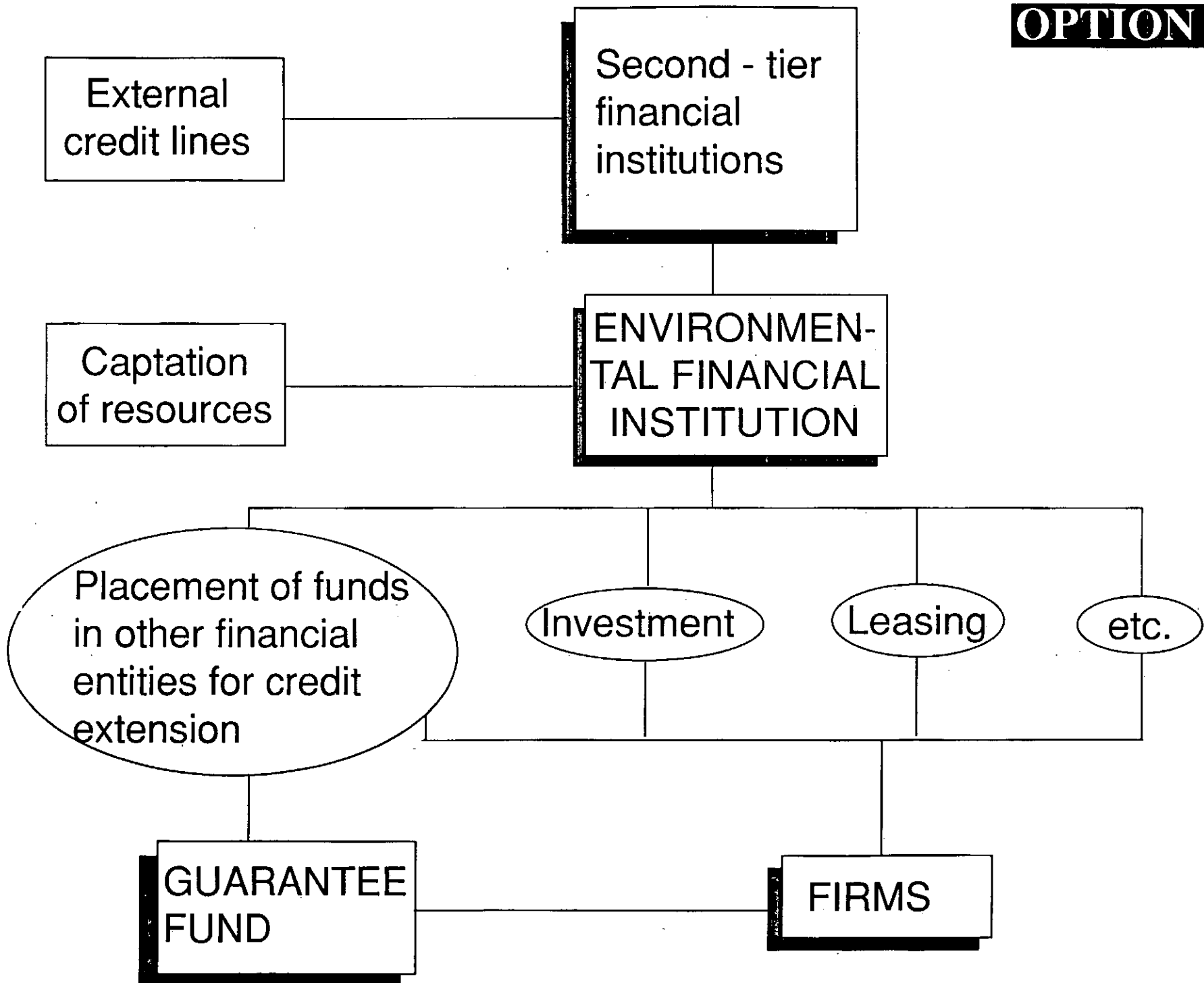
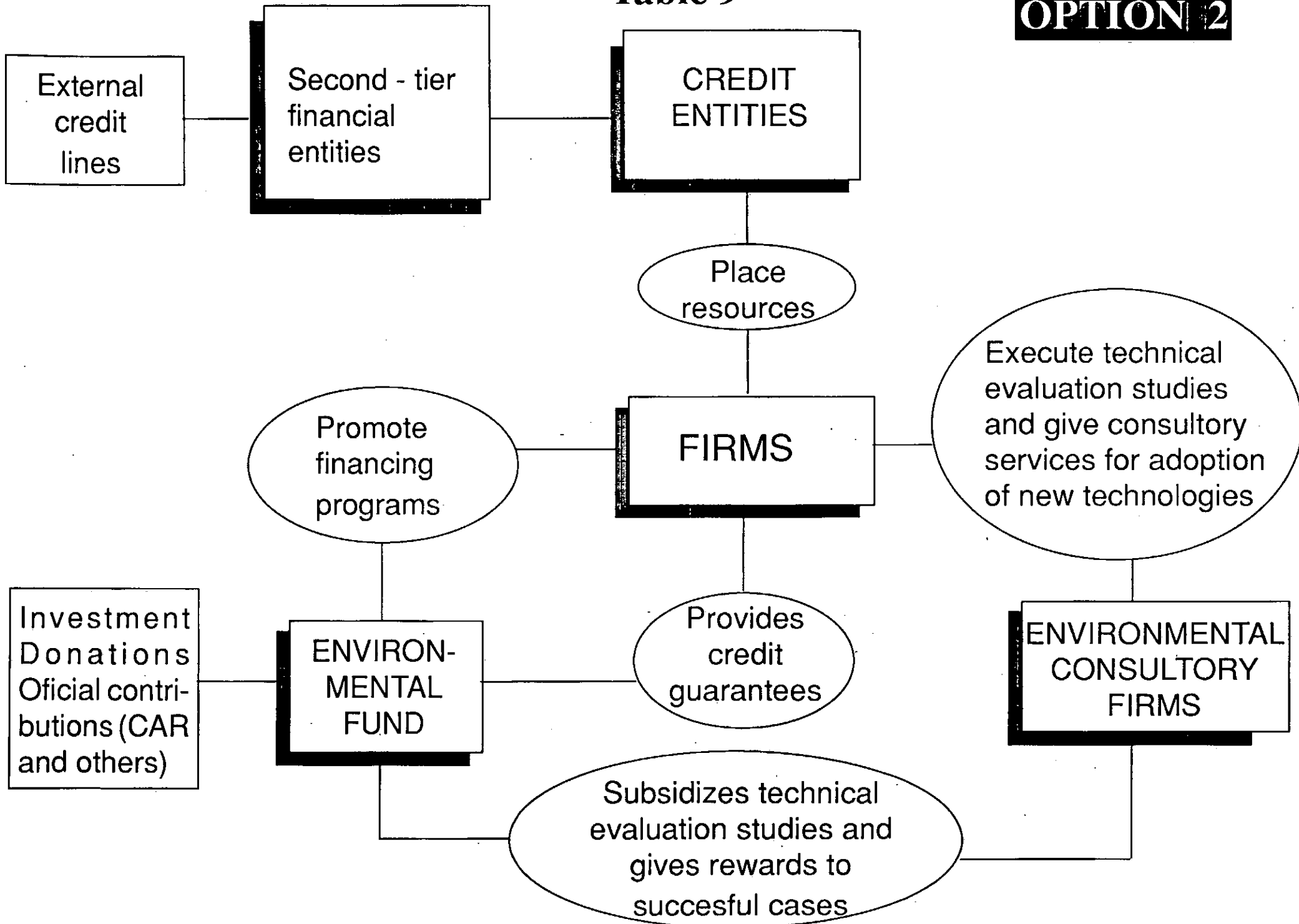


Table 9

OPTION 2



1. Viability Analysis of the ECOFIDUCIA

The main advantage of a fiducia as a legal structure of a financial entity is the large scope of services it can offer, while having to comply with less stringent restrictions than a bank or a CF. It can direct trusted resources to a guaranty fund, facilitate credit intermediation, invest in entities, offer consulting services, etc. (Table 8). As opposed to banks and CFs, it cannot, however, seek deposits and extend credits. Given the need for other forms of long-term involvement, particularly consulting, technical assistance and guarantees, this restriction is not a severe one. Due to the large scope of possible services, the fiducia can be considered to be the most adequate form of a financial entity to meet the objective of CAR, given the considerable legal advantages, like the small equity capital requirements, absence of reserve requirements etc, of a fiducia over other forms of financial entities. The founding of a fiducia is legally both easier and less costly and allows a better relation between operative liabilities and assets designed to support the decontamination of the Río Bogota. Second, the trustees who provide capital to an Eco-fiducia would know that the fiducia directs the entrusted resources towards the specified objective and coordinates all the activities relevant for a successful environmental program.

There are basically two types of fiducias: The Investment Fiducias that accept resources from the public through the "Fondos Comunes Ordinarios" and the "Fondos de Pensiones" and the Fiducias that basically administer resources (Fiducia de administración and Fiducia inmobiliaria). The profitability of a fiducia results from the commission the client pays for this service. Generally, the aim of the "fideicomitentes" is to invest the trusted money in the most profitable way, given certain risk restrictions and objectives imposed by the trustee.²⁶

Due to the increasing number of investment possibilities and financial services in the context of "apertura", these financial entities are gaining in importance. The market of "fiducias" has grown substantially in the last decade. In 1979 only three fiducias existed. In 1987²⁷ 14 such entities operated, and in 1992 the number²⁸ has increased to 31²⁹. This growth reflects itself in

²⁶ The "Directory and Guide of the Financial Sector in Colombia, 1991, describes the attractions of the fiducias in the following way : "...Frente a la gran variedad de alternativas de inversión en los mercados, los ahorradores buscan asesoría de personas, naturales o jurídicas con el fin de garantizar seguridad en el destino manejo de sus recursos monetarios o de otra índole..."

²⁷ Revista Superintendencia Bancaria, "Reflexiones en torno al "boom fiduciario", pp.28, Vol.1, No.1, octubre 1988.

²⁸ These are the fiducias that are submitting regular information on their balances to the "Asociación Bancaria"; see "Banca y Finanzas", several issues.

the total assets of that segment of the Colombian financial market: At the end of 1987, total assets were 101 million pesos (or approx. 227 millions in pesos of 1992). In September 1992, total assets of the fiducias amounted to 64.674 million Colombian pesos, only a small part of the total fideicomiso being managed by banks (8% in September 1992). Although the volume of fideicomiso is growing, it is channeled through the fiduciaries which grew rapidly over the last years, whereas bank and CF involvement decreased. It seems that the "fiducias" can offer an important financial service, despite the recent trend towards a multibank system.³⁰

a). The Funding of the "Eco-Fiducia"

As has been shown earlier in Table 2, a financial entity can fund itself basically by using the external credit lines, raising funds on the national capital market and seeking contributions from the promoter group. Government entities can make a relatively small financial contribution. Contrary to other financial institutions (banks or CF), a fiducia manages and administers portfolios of its clients.

²⁹ There are six more fiducias appearing in the statistics of the Colombian Banking Association but they have not submitted any balance data yet.

³⁰ For a detailed analysis of the Fiducias and the balance structure of the potential "Eco-Fiducia" see appendix III.

b). The Profitability of the "Eco-Fiducia"

The different services would yield incomes for the fiducia. Two main sources of incomes should be discussed in more detail. First, some regular and substantial income is expected from the "Eco-fiducias" function as a "second-tier" institution, and, second, the advisory aspect should be emphasized, due to the large need for such services.

The function as a second-tier bank entails investment of the trusted capital in other financial institutions at a given interest rate.³¹ As the fiducia cannot extend its own credits to the target group, it can do so through other financial institutions by imposing conditions on the use of these resources. This restriction for the first-tier bank will reflect itself, however, in a lower interest rate this entity is prepared to pay.

The financial entities will be confronted with all the cost aspects of extending credits, mentioned in the section on the feasibility of a "Eco-bank". Even if the financial entity would receive deposits from the "Eco-fiducia" at a substantially lower rate of

³¹ Probably most importantly in banks and/or financial corporations that have already some experience in dealing with small and medium sized enterprises (i.e. the Corporación Financiera de Desarrollo). Other banks and financial corporations may find it of little interest to participate in this business.

interest, it is doubtful whether this cost advantage covers the administrative and risk costs of placing credits in the market segment of SME's. Financial entities will only respond to the offer if at the same time the clients to which the credits should be addressed will be covered by a "Fondo de Garantía" and if some of the evaluation costs are carried by the client or by the fiducia. The fiducia, then, has either to found its own Fondo, or invest (or establish contracts) with an existing "Fondo de Garantía". Furthermore, it has to finance consulting services, particularly in technical and economic evaluation (the cost of which it can impose on the firm). However, "Fondos de Garantía" are not a profitable service, and, as has been discussed above, technical and economic evaluation imply large sunk costs. The prospects of overall gains from its function as "second-tier" bank are, therefore, not too bright.

Technical and economic assistance shall be considered as a second source of income, although these services as far as they are connected to the credit seeking SME's will not be very profitable. However, the "Eco-fiducia" does not have to limit this service towards this market segment, but could invest in general environmental consulting and technical assistance. Two forms shall be distinguished. First, technical assistance for the choice of the most adequate technology and, second, general management assistance that needs not only a sound comprehension of management practices,

but also some know-how on the relationship between efficient management and environment protection. Venture capital may be one form of technical assistance³². It requires an intensive relation between the fiducia's technical staff and the firms. As discussed in appendix I, this form of assistance is working well, but is extremely restricted to some small to middle sized firm which are open to outside participation. Many SME's resist the sharing of the control over their enterprise. It implies, moreover, substantial administrative costs.

All these services will be costly. A specialized environmental fiducia offering technical and economic evaluation needs a fairly large staff of specialized professionals or a considerable budget for external consultants. Unless the services can be successfully extended into the market of large and medium sized companies, the unit cost per service extended will be very large. Only if there are high economies of scale in putting together and selling a data bank on environment technologies, could one imagine a certain profitability of the "Eco-fiducia". It is not considered, however, that a technology data bank can increase income sufficiently to cover the costs of technical assistance.

³² The basic idea of this form of investment consists in buying part of the assets of firms with a good growth potential and with a lack of resources to extend, assist them over several years in all production and management processes and sell assets later on for a better price.

Administrative costs are expected to be important for another reason. As a specialized and isolated environmental financial entity it will have to establish a costly infrastructure with subsidiaries across different strategic points along the Río Bogotá in order to get in touch with the clients. Alternatively, promotional publicity activities can create similar effects and at lower costs.

There is a more general disadvantage to be mentioned. Although the legislation is very general with respect to the services a fiducia can offer, it is fairly restrictive with respect to the managing of the entity. This puts restrictions on the composition and the size of the services the fiducia can undertake. There is an additional disadvantage based on the stability of the current legislation. Control by the Superintendencia and rules applying to fiducias may change over the next years as fiducias become an ever more important part of the Colombian capital market. Costs may therefore arise from low institutional stability. Also, the greater the dependence on sponsor's contribution to the "Eco-Fiducia", the greater the potential instability of this entity due to uncertainty on the flows of these contributions.

c). Conclusions

Even though the "Eco-Fiducia" offers the services considered most adequate for solving the technology adoption problems of the SME sector, profitability of the "Eco-Fiducia" will at most be very low. Due to the costly services the "Eco-Fiducia" has to offer, it may even experience losses, if it wants to comply with the central objective of decontaminating the Río Bogotá. Legal restrictions may create difficulties for the management of the "Eco-Fiducia". Also the entity may find problems in attracting resources. Actually the design of the "Eco-Fiducia" does not accord well with the general aim and function of a trusteeship. A fiducia usually obtains resources because people want to extract returns from their resources and it sustains its activity by the commission the clients pay. On the other hand, the flexibility of the fiducia corresponds perfectly to the variety of functions any environmental financial institution would have to assume. This advantage however can be found in the institutional form of a foundation which does not show some of the disadvantages of the "Eco-Fiducia". An Industrial Environmental Fund would not be restricted by any legal regulations and would not compete significantly against any similar institutions while providing the same services that were designed for the "Eco-Fiducia". The advantage of combining services such as technical assistance, guarantee provision and promotion can be done in an even more general form in an Environmental Fund.

2. Viability of the IEF

The name "Industrial Environmental Fund" illustrates a principle characteristic of the fund that will be presented: The Fund will not only look for mechanisms to assist SME's in their effort of technology change, it also tries to respond to environmental concerns of the industrial and commercial sector.

This second option relies on a separation of the purely financial part (the chain on top of the scheme 9) and of the consulting and promotional part. It has several advantages: First, there are hardly any legal restrictions; the "Fondo" is probably the most open way of organization. The specialization is not by different financial services, but rather by financial and consulting aspects. The "Fondo" would complement the existing system in a segment in which the latter one is not prepared to enter. The three main activities of the "Fondo" are to offer credit guarantees, to support and promote consulting studies on environmental technologies (with an incentive scheme) and to promote the financing programs.

The IEF would not be the only Fondo of this type. At least two entities of this type are emerging in Colombia³³: The "Fondo Nacional Ambiental", an institution that will be created within the framework of the Ministry of Environment, and the "ECOFONDO", a semi-official fund addressed principally to NGO environmental projects and needs. The former is considered to be a financial instrument to assist the execution of environmental policy and management of natural resources. The main objective of this fund therefore, is not assistance to the private, industrial sector.³⁴ The terms of the law on the creation of the Ministry of the Environment, however, are sufficiently broad to include private entities.³⁵ The structure of the FNA draws attention to the problem of allocating resources in the absence of the profitability criteria and the price mechanism. As in all entities in which the

³³ There is a third fund which might be considered; In the Acuerdo No.9 of 1990 on DAMA, article 5, the constitution of a Fund for the realization of the plan of "Gestión Ambiental del Distrito Especial" is mentioned. Resources for this fund will basically be constituted by municipal taxes, fines and assignments.

³⁴ Law Project for the creation of the ministry of environment, the national environmental system and other dispositions. Título XII, on the national environmental fund.

³⁵ See "Ponencia para primer debate, Creación del Ministerio del Ambiente", 22.12.92, p.50, which says : "Se amplía la órbita de entidades privadas que podrían ser beneficiarias del Fondo, toda vez que su señalamiento se hace en forma genérica, incluyendo, de esta manera, no sólo a entes privados sin ánimo de lucro, sino también a aquellos con finalidad diferente".

sponsors are at the same time potential beneficiaries and in which no clear criteria of allocation exists, there exists the problem of extending services according to personal preferences and not according to environmental and economic efficiency.

Beneficiaries of the "ECOFONDO" are NGO's dedicated to environmental protection.³⁶ Assistance to the SME sector is not mentioned. The contaminating industrial sector will, thus, have only limited access to resources of the FNA. The objectives of the FNA and the IEF will therefore not be in any conflict. As to the competition for resources, these are planned to come from the national budget, fines and fees, part of international resources from debt-for-nature swaps, and possibly from the "Fondo Nacional de Regalías". To rely on private donations is not foreseen, so little competition is expected from this side. Also, international resources - different from debt for nature swaps - do not seem to constitute a very important part of resources of the FNA.

As to competition for external resources, the situation may be somewhat stronger in the case of the "Eco-Fondo" than in the FNA: This semi-official organization (there are government members on the board of executives) that creates a financial network among all NGO's involved in environmental affairs may attract a substantial

³⁶ See "El Espectador", 14.3.93.

part of external resources for two reasons: International organizations and foreign governments are getting ever more interested in financing grass roots organizations especially those that are active in the environmental field. This statement gives rise to caution as to the availability of international resources for the decontamination of Río Bogota.

a). The Funding of the IEF

Main resources for funds of the IEF will initially be private and public contributions and donations. Later on the Fund may receive the following three additional sources of contributions: A percentage participation of the profits of the firms sponsoring the IEF, returns from promotional activities (seminars, books, conferences etc.) and eventually some returns from the (environmental-) credits placed through credit institutions.

The most important group of donors will be promoters which spend some money not because of a direct monetary advantage, but because of a "reputation premium" or a "green image". They expect from their participation a better image which can be a useful public relations argument. A second group of donors can be very important. The current Colombian legislation permits a 100% tax deduction of

donations for scientific and environmental purposes.³⁷ This legislation gives the IEF a clear advantage over other foundations in attracting national resources since non-profit foundations with other than scientific and environmental objectives benefit only from a 60% reduction. Third, much less important, but not to be excluded are international and national funds from environmentally oriented organizations. This source can be expected to increase in importance once the Fondo Ambiental has established a sound reputation. Fourth, as mentioned above, the income of CAR due to the fees and fines can be (partly) reinvested to the Fondo's capital. This would be an economically efficient solution, since the legislature has no incentive to maximize its income and not the environmental benefit in setting the optimal fees. Fifth, some of the activities of the Fondo Ambiental might generate an income which would be reinvested in the Fondo's capital.

b). The Profitability of the IEF's Activities

1) The Guarantee Fund

In line with the analysis that the fundamental problem of credit access for many of the small enterprises is the risk structure and the missing guarantees, a Fondo de Garantía could ease the entrance

³⁷

The promoter group certainly also includes fiscal considerations in its reasonings.

of firms into the formal credit market. At the moment there exist two significant Fondos de Garantía : FOMENTAR and the Fondo Nacional de Garantía (FNG)³⁸. As in the case of an Eco-credit institution and an Eco-Fiducia, the small size of a Fondo has cost disadvantages, because of relatively high unit costs of administering the Fondo (high administrative costs) and a limited possibility of diversifying the risk (high placement costs).

The potential revenues of the guaranty service are derived from the commissions the customers pay. This commission is usually established as additional percentage points on the interest to be paid for the credit. The existing guaranty funds that address guaranty needs of the SME sector are, to date, not profitable despite the experience these institutions have accumulated in their years of operation. Taking into account that a new Fund has to acquire the knowledge of the market and the character of the demand, it is very unlikely that such a Guaranty Fund would be profitable.

Given these cost disadvantages a participation in one of the existing Fondos is considered to be a more efficient and less costly solution than the founding of a new Guaranty Fund. According to this scheme the IEF would assign resources to an existing Fondo de Garantía under the condition that these resources be used to

³⁸ There is third, very small one called FUNDESCOL.

give guarantees to firms asking for credits to finance the necessary investment to decontaminate the Rio Bogota. The Fondo de Garantía manages the assigned resources and charges a commission to the IEF. It is to be expected that the commissions paid to existing funds are higher than the fees received from the beneficiaries.³⁹ This implies that this service of the Fondo Ambiental is not profitable and it puts a cost on the IEF. These costs of a participation in an existing Fondo are certainly lower than the expected losses from founding a new Fondo de Garantía.

2) Promotion

The second activity is the promoting of environmentally clean technologies and production processes. This is, at first sight, hardly a very profitable activity, either. It has been shown in several studies that one of the fundamental problems to technical changes are lacking or at least incomplete information about adequate technologies. As opposed to the difficult access of small and microenterprises to the formal credit market, the lack of information is a problem also for middle sized firms. The Fondo Ambiental could help to close the gap, in organizing expositions and seminars on environmental technologies (together with the

³⁹ In discussions with the FNG, it became clear that guaranty extension is not a profitable business due to the high risk of default of beneficiaries.

different chamber of commerce in Colombia, the national chamber of commerce and the associations etc.).

Other promotional efforts can be envisaged, given a slowly rising environmental consciousness of the consumers. The Fondo Ambiental can define standards of environmentally clean products and production processes, and offer an investigation on the compatibility of the product and/or the production process with these standards. Firms can, then, buy such an enquiry. In case the product and/or the production process complies with the standard, the firm receives a certificate or a stamp which can be used for public relations purposes.⁴⁰ In such a scheme there exists a clear conflict of interest: Donors will certainly try to get the certificate of producing in an environmentally sound manner independent of the Fondo's evaluation. In order not to risk its reputation, the Fondo might have to exclude the possibility to evaluate donor firm's products or production processes. The donor could, of course, use the participation itself for public relations purposes. This, however, gives rise to the risk that contaminating firms may use the Fondo Ambiental as cover.⁴¹

⁴⁰ The idea is close to a practice of some industrialised countries in which firms are obliged by law to have their production processes examined with respect to their environmental effects.

⁴¹ On the other hand it might be problematic for the IEF to include very contaminating industries on its board because public scrutiny may study the environmental

Needless to say the success of such a program depends heavily on the good reputation of the Fondo Ambiental. Consumers have to be convinced that the standards set are high, that such an examination is done thoroughly and that the standards are in fact met. If not, they do not consider as superior the products carrying the examination's result. Then, firms do not have any incentives to buy such an investigation.

It has to be stressed that these promotional efforts will have at least in the near future a relatively small market. However, given the tendency of the central government, the regional government and the municipal government to apply a more stringent environmental policy and given the increasing public pressure to resolve some of the most pressing problems, one should not discard these considerations completely.⁴² In any case, in the short run, such activities will not be very profitable, simply due to the limited demand. However, they can be organized such that they do not impose costs on the Fondo Ambiental.

record of Fund participants and thereby make damage to the credibility of the Fund.

⁴² There are some signs in the business community to take the environmental issue serious. The Swiss Chamber of Commerce has organised a seminar on Industry and Environment. One of the largest retail salers in Bogotá sells linen bags to substitute for the plastic bags. Such efforts are doubtedlessly done out of public relation reasons. However, they serve up to a certain point the purpose to decrease the contamination.

The importance of the "Green Market" with "Green Consumers" is well documented for some OECD countries (see Salzman, 1991). In 1985 only 0.5% of all products newly introduced in the US could be labeled green products, whereas in 1990, 9.5% carried such a label. In most OECD-countries some forms of publications promote the consumption of environmentally sound products; the "Green Consumer Guide" in the UK is one of the few specialized publications, whereas in other countries (particularly in Northern and Central Europe) the Consumer's organization put emphasis on the environment aspect. At last, product labels - first introduced in Germany - are now applied in the majority of the OECD-countries, although to a different extend. In Germany, 3500 products are labeled as environmentally sound; the label is attributed by an independent jury. The system is financed by government contributions.

3) Consulting

The third activity is probably the most promising one as to possible returns that can be expected. It has been stated that the consulting activities of financial entities to evaluate risks are very costly with respect to the credit sums and the margin which such credits permit. However, as in the case of promotional efforts the Fondo's consulting activities are not limited to the risk evaluation of small and microenterprises.

In the first chapters of this study the need of an environmental auditing has been pointed out. Such a need is not confined to any sector or size class. The Fondo Ambiental can offer consulting services in environmental technologies and managing and accounting forms. Environmental accounting has been found to be an efficient instrument to evaluate the economic impact of a firm's production both with respect to the immediate cost position of the firm and with respect to the social impact of the firm (see Maurer, 1992). Social accountability is a newly introduced concept in Colombia which is slowly gaining popularity, particularly within the more modern firms. Including the environmental impact into social accounting would induce firms to reduce contamination in order to increase the net benefits of their production activities.

Smaller firms and microenterprises will not need a sophisticated environmental auditing, but a relatively simple consulting in both technical and managerial issues. The focus, here, should not be on more of the same type of courses which are offered by the foundations or of a once-for-all consulting, but of a system of consulting sessions over a certain period of time which, first, analyses the production process, second, suggests solutions and, third, helps to implement them. Each individual step can be relatively short (and, thus, does not have to be extremely expensive).

This kind of consulting can be profitable, although some small and microenterprises might be unable or unwilling to pay for such services. The Fondo Ambiental, however, has the possibility to cross-subsidize such services through income generated by large-scale environmental auditing.

As discussed above, there might exist some economies of scale in specializing activities in a specific sector. With respect to credit activities it was concluded that the costs of such a specialization in terms of a bad risk structure are too high compared to the gains of information gathering and processing. In the consulting business, this conclusion does not hold. First, there are economies of scale in information and specialization in consulting with enterprises about the best-practice technologies. Second, the consulting results may be sold to the Fondos de Garantía and/or the credit institutions which need the respective information. A technology data bank might be a service which has a commercial value in itself.

3. Conclusions

The discussion of the three basic institutional forms for an financial entity contributing to the decontamination of Rio Bogota has shown that the CAR objective cannot be met by a profitable private financial entity without incurring substantial social

costs. Further, the three options have very different advantages and disadvantages.

Table 10 shows a summary of the basic criteria that have been used along this study to evaluate the feasibility of each of the suggested entities. Problems of each of them are evaluated according their, source of funds, their funding, placement and administrative costs, their profitability, the legal restrictions imposed on them, their disadvantages in competition in relation with other similar institutions and finally their contribution to solving the industrial contamination problem.

On the whole the "Eco-credit institution" is the least recommended option as its profitability is low at most, their clients will be lacking sufficient guarantees to cover the high default risk, administrative costs are high, competition in the credit sector is increasing and, most important, the extension of credits is considered to contribute only very marginally to industrial decontamination.

The "Eco-Fiducia" suffers from most of these disadvantages with the difference that it complies much more with the goal of decontamination as it offers crucial additional services such as technical assistance and guarantee extension and as legal restrictions give it a broad scope for activities. Moreover, since

TABLE 10 : Comparative Analysis of eci, efi and ief

	ECI *)	EFI **)	IEF ***)
SOURCE OF FUNDING	<ul style="list-style-type: none"> * Sponsors * National Capital Market * Internat. Credit lines 	<ul style="list-style-type: none"> * Sponsors * (eventually capital market) 	<ul style="list-style-type: none"> *Sponsors *International Funds
COSTS :			
FUNDING	<ul style="list-style-type: none"> * Sponsor's Conditions * Market Rates 	<ul style="list-style-type: none"> * Sponsor's Conditions * (Market Rates) 	<ul style="list-style-type: none"> * Sponsor's Conditions
PLACEMENT	<ul style="list-style-type: none"> * Bad Risk Structure of Credits * Lack of Guarantees 	<ul style="list-style-type: none"> * Risk of : <ul style="list-style-type: none"> -Guarantees -Venture Capital -Technical Assistance 	<ul style="list-style-type: none"> * Risk of : <ul style="list-style-type: none"> -Guarantees -Technical Assistance
ADMINISTRATIVE	<ul style="list-style-type: none"> * High Evaluation Costs * Low Economies of Scale 	<ul style="list-style-type: none"> * High Human Capital Costs Per Customer 	<ul style="list-style-type: none"> * High Human Capital Costs Per Customer
PROFITABILITY	<ul style="list-style-type: none"> * Low/Negative 	<ul style="list-style-type: none"> * Low/Negative 	<ul style="list-style-type: none"> * Low/Negative
LEGAL RESTRICTIONS	<ul style="list-style-type: none"> * Important Regulation 	<ul style="list-style-type: none"> * Broad Scope of Activities but Many Specific Restrictions 	<p>-----</p>
ADVANTAGES IN COMPARISON WITH SIMILIAR ENTITIES	<ul style="list-style-type: none"> * Low Economies of Scale * Low Risk Diversification * Strong Competition and Tendancy towards Multibanking 	<ul style="list-style-type: none"> * Low Economies of Scale * Low Risk Diversification * Strong Competition and Tendancy towards Multibanking 	<p>-----</p>
CONTRIBUTION TO OBJECTIVE OF DESCONTAMINATION	<ul style="list-style-type: none"> * Marginal 	<ul style="list-style-type: none"> * Important 	<ul style="list-style-type: none"> * Important

*) Environmental Credit Institution ~ "Eco-Bank"

**) Environmental Fiducia ~ "Ecofiducia"

***) Industrial Enviromental Fund

it does not offer credits, the default risk would affect the entity only over the "Fondo de Garantía". Administrative costs may however even be higher than for the Eco-credit institution.

Even though such a solution will not be discussed in detail in this context, one could envisage the integration of the ECI or the EFI in an existing entity, or the funding of a new credit institution or a new fiducia, with a strong Eco-department. It might be useful to indicate some of its advantages and disadvantages. On the negative side an even stronger competition from similar institutions may be expected as this mixed (bank or fiducia) would no longer specialize exclusively in one market segment. On the other hand, profitability may increase as ordinary business may cover eventual losses of the environmental services. Also, the possibility of attracting resources from the national capital market would probably improve as customers could count on some risk diversification of the financial institution and as they receive thereby more security for their resources.

The "Industrial Environmental Fund" is still not a profitable institution. But while complying perfectly with the central goals, it is not submitted in its activities to any legal regulations. It does not have to compete significantly with other similar institutions. And as a non profit entity it offers important

fiscal incentives to whomever may want to participate in the funding of it.

Thus, while profitability of the IEF will probably not be substantial, it is considered that on balance, it constitutes the best of the three options designed. It could improve the profitability of the institution to be designed. If more funds are to be attracted and if the institution to be established is to be self-sustaining on the long run, it has to try to extend its range of environmental activities to other than water issues and it has to offer services that are attractive to different market segments.

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APPENDIX I: EXISTING EXPERIENCES

In this chapter different experiences of financial institutions are reviewed. In a first part, the experience of Eco-Credit institution in Switzerland and Germany are analyzed. In the following two parts, the relevant experiences of IFI and CD in managing international credit lines as second-tier institutions and their credit policy as first-tier institutions are described. The fourth experience refers to the IDA project of a global credit program for small and medium sized microenterprises in Costa Rica. This program is very akin to the World Bank's Industrial Restructuration Program for Colombia. In the fifth study the experience of SERFINDES, a small NGO, is reviewed to sustain the importance of financial services different from credit extension.

A. Eco-Credit-Institutions in Switzerland and Germany

In most of the industrialized countries public and private spending to restore the environmental damages, is increasing rapidly (albeit from a low initial level). According to a study of the Investment Bank UBS Phillips & Drew, the expenditures for environmental protection for 1991 were estimated to represent 2 to 3 percent of PIB (between US\$ 125 and 175 milliards) in the European Economic

Community⁴³. Demand for financing environmental decontamination is accordingly high, which in turn would suggest a considerable potential for specialized, environmentally oriented banks.

In the second half of the eighties several Eco-Credit-Institutions have opened their doors to the public in Europe, and even some established banks offer now environmental banking services⁴⁴, mainly out of public relation reasons.

Switzerland, as an example of an important banking center, has today three banks of this type : The "Alternativbank Schweiz", the "Oekobank"⁴⁵ and the "Freie Gemeinschaftsbank". Even though only the "Oekobank" is dealing exclusively with environmental issues, all of them assign great importance to environmental affairs and none of them has as its first priority the maximization of profits.

⁴³ Frankfurter Allgemeine Zeitung, "Kursgewinne mit einer sauberen Umwelt", 26.10.89. Estimations on public expenditure in OECD countries are between 1 and 2% of the PIB, see the evidence reprinted in Coyuntura Social, forthcoming.

⁴⁴ As an example, the Zuercher Kantonalbank (Switzerland) is offering environmental saving deposits with slightly lower interest rates. Eligible environmental investments enjoy therefore preferential conditions. Environmental deposits represent however less than 1/1000. Also only about 30% of the volume of total environmental saving deposits has been used to finance environmental investment projects. High evaluation costs are made responsible for this low proportion.

⁴⁵ According to the Swiss review "MONETA", the ECO-bank has run into trouble and was taken over by the Swiss Credit Bank, the third biggest Swiss bank, at the end of last year. See MONETA, Nr.4/23.12.93.

Their declared aim is the promotion of environmentally (and socially) beneficial projects by means of subsidized credits (subsidies to interest rates). These subsidies are made possible by deposits which receive less than market rates.

A major problem for these banks is to establish clear criteria when a project can be considered as environmentally beneficial.⁴⁶ Good criteria, however, is crucial for the credibility of an Eco-Credit-Institution, especially as these institutions depend heavily on the goodwill of their clients (depositors) and on the increasing public environmental consciousness. Moreover, the philanthropic behavior will only hold as long as depositors agree fully with the credit activities of the Eco-Credit-Institution: this need for total transparency of credit activities creates considerable problems for the stability of the financial institution. But extensive and detailed criteria increases credit evaluation costs.

The "Alternativbank Schweiz" (ABS)

The most experienced financial institution in Switzerland that deals with environmental question is ABS. Its level of activity is steadily increasing: In 1992, two years after the bank has started

⁴⁶ Hans Neukomm, "Diskussionsbeitrag zum Seminar vom 8.12.89 ueber Oekobanken", Mimeo.

business, the balance had crossed the sfr 90 million (US \$ 60 million) line.⁴⁷

The bank funds itself by encouraging the depositors to accept below market rate returns. Equity capital comes mostly from NGO's, but also from private persons. The bank's main activity consists in the extension of credits. Two types of credits are distinguished: normal credits (for socially beneficial projects) and promotional credits for projects which are considered particularly valuable.⁴⁸ The former are extended on ordinary market conditions and the later are given at preferential conditions. Preferential conditions are made possible by two means: by selling certificates on which the depositor forgoes any interest payment, or through voluntary sacrifice by clients in the case of ordinary deposits.

The "Oekobank Frankfurt" (OEF)

The OEF offers saving and other deposits, extends credits to socially beneficial projects such as women affairs, and to environmentally beneficial projects, uses discount facilities, gives guaranty services and provides fiduciary services. Among the

⁴⁷ The other Swiss environmental bank, the "Oekobank Schweiz" increased its balance sum by 23.8% and total balance is now sfr 63,1 million.

⁴⁸ As to November 1992, 199 credits were extended 113 (34%) of which normal and 86 (76%) promotional credits.

credits, the same two types as in the case of the Swiss Alternativbank are distinguished: promotional credits and normal credits. Normal credits are extended to firms without any environmental or social objectives market conditions. Promotion credits are extended to firms with environmental methods or other socially beneficial aims and that are organized according to cooperative principles. Interest rates of these credits are subsidized. Normal credits are basically used to cover costs of the alternative promotion mechanisms. The higher the costs from these environmental credits the larger the share of normal credits has to be.⁴⁹ With this mechanism the bank's structure seems to approach the now standard practice of many banks in industrialized countries to offer some "Eco-" financial services (to improve their image), with the difference basically residing in the respective importance assigned to profit maximization.

In order to reduce risk, the bank has limited the total credit volume to maximum three times its equity capital, which is very low compared to the 18 times allowed for by law. As to the liability side of the OEF, 25% was equity capital and 75% deposits (current accounts 7%, saving accounts 30%, and time deposits 63%). Of these time deposits, about 50% are in a specific certificates, which allows the client to decide where his money will be invested.

⁴⁹ In 1988, normal credits represented 70% of the total credit volume. Annual Report 1988, Oekobank Frankfurt.

As to the active side the most interesting point is the relation between normal credits (70%) and credits extended on preferential conditions (30%). The high proportion of normal credits represents the means by which the OBF tries to assure itself against excessive risk and by which market based income from normal interest rates is assured.

What can be learnt from these examples of European Eco-Credit-Institutions? These examples point to a heavy dependence on the goodwill of the depositors. Environmental consciousness is increasing in Europe, life quality is high and some people combine these two aspects to sacrifice some of their income in form of low returns to their capital. They prefer to deposit their income in an institution that stands beyond any ethical suspicion (which means that many of them will not use the "Eco"-deposits of traditional banks as they are supposed to deal with "dirty money"). In countries where such environmental consciousness is high all these, as Germany and Switzerland, the volume handled by these Eco-Credit-Institutions is not very impressive, though. The main "lesson" then that can be learnt for our case under study is that under Colombian conditions, where environmental concern is not a first priority, Eco-Credit-Institutions of the type just described are certainly not feasible. The second lesson to be learnt is that even if Colombia was an industrialized country, the potential for green

banks functioning on the base of philanthropic reason, the offer of such funding would be far lower than the demand.

B. Instituto de Fomento Industrial (IFI)

In Colombia, more than 20 development banks, of which IFI is the most important, exist. From 1980 to 1990, IFI had given out credits for about 200'000 million pesos⁵⁰. Its operating area covers projects related with the reconversion and the reinforcement of the industrial sector, but includes credit lines for environmentally clean technologies.

IFI handles a considerable amount of resources from the "Banco de la República" (credito de fomento industrial and international credit lines). Contrary to commercial banks, most of its credits are medium and long term. Interest rates are set under market conditions. The interest rate for credit is determined by using the market rate and adding a fixed spread. As an institution with considerable resources and experience in the field of credit provision for the industrial sector, it could be of immediate interest for the financing of the industrial decontamination of Río Bogota.

⁵⁰ Directorio & Guía del Sector Financiero, Manual de Crédito y Financiamiento, Edición 1991. Bogotá 1991.

Moreover, in discussions with IFI authorities, several interesting points related to the feasibility of an environmental financing institution have been raised. High information costs and not excessive interest rates are considered the main barriers of access to the formal credit market. Particularly, information on the adequate technology represent costs and but not always gains for the firms. Technical assistance in the field of information gathering is, therefore, seen as crucial. In accordance with this view, IFI is starting a program, in cooperation with DAMA and FONADE, where resources for studies on decontamination are made available on favorable terms⁵¹: Credits are given for the realization of the study after DAMA (municipal environmental entity) has given its approval of the terms of reference of the study. Once financial conditions and technical aspects of these projects comply with technical and financial criteria, resources are made available by IFI for the realization of the projects.

⁵¹ The available sum for this credit discount line amounts to \$300 million colombian pesos. Interest rate is set at DTF + 2% T.A. The explicit aim of this line is financing of studies for environmental descontamination and includes : environmental impact studies, descontamination of solid and liquid residuals, atmospheric descontamination, acoustique descontamination, and most importantly in the context of the present study, industrial reconversion for descontamination. Unfortunately the required minimum sum of assets for applicants is \$800 million and excludes therefore smaller firms.

C. The Corporación Financiera de Desarrollo

The Corporación Financiera de Desarrollo (before Corporación Financiera Popular) extends long and medium term credits to medium sized-, small- and microenterprises, a sector that is almost completely ignored otherwise in the Colombian capital market. CFD covers thereby an important market segment.

Credits to the SME sector are oriented by market conditions. As IFI, the CFD does not consider the interest rate level as being a problem, but lack of ability to complete required documents and similar problems are seen to be the central obstacles for SME's credit access. To ease the know-how problem of how to apply for a credit, CFD provides basic courses in business management which are a compulsory condition to obtain a credit. Numerous foundations (i.e. Carvajal Foundation) organize these courses.

SME's access to credit facilities are also seen to be limited because of high administrative costs of credits for financial institutions. To forego these costs, CFD itself does not undertake risk evaluation, but has these evaluations done by the foundations. The evaluations will be submitted to the CFD for final approval. For every "successful client" the foundations obtain a bonus.

The CFD is currently undergoing a profound restructuring process and more changes seem to be ahead. 60% of its assets have been sold to parties interested in the SME and microenterprise sector. Major participants are the Interamerican Investment Corporation (BID), foundations, chambers of commerce and ACOPI (association for small firms). At the same time as privatization has taken place, institutions which have been providing major credit lines in the past (Banco de la Republica, IFI, Bancoldex) have established some standards to determine credit limits for eligible financial intermediaries (relation debt-equity capital, etc.).⁵² Under these terms CFD is no longer considered eligible for new credits. If these limits will not be reconsidered, CFD will have to increase substantially the participation of CDT's in total assets (today 30% of total resources) and credit conditions might become harsher. Today CFD's main financial resources (besides CDT's) come from the World Bank line (actually 5th line), various IDB lines (IDB-848, IDB 562/OC-CO Eximbank), and Bancoldex credit lines. For all of these credit lines the CFD acts as an intermediary financial institution and access to the credit lines functions via the Central Bank. This last aspect of the current problems of CFD shows some potential problems for whatever financial entity might want to benefit from the Central Bank's long term credit lines : These credit lines are scarce and its availability is conditioned on a

⁵²

As far as the Banco de la República is concerned, these standards will start functioning in April 1993.

series of indicators which describe the financial healthiness of the entity under concern.

As has been showed in the preceding paragraphs, CFD has a wide experience in dealing with SME's and the microenterpreneurial sector and shows limits to the availability of international credit lines.

D. The IDB project on a global credit program for small and microenterprises in Costa Rica

The IDB project examines major problems of credit provision to small enterprises in Costa Rica and concludes that they lie basically in the commercial bank's reluctance to lend to this sector. Administrative costs and risks associated with lending to SME'S are considered to be excessively high. This conclusion confirms the point made earlier that credits are rationed due to high administrative and monitoring cost. Not high interest rates, but credit availability on a timely basis is seen as the most important single obstacle to credit access. For this reason the IDB study is clearly opposed to the provision of subsidized interest rates and recommends to solve the credit access problem at its roots. IDB suggests the installation of information and monitoring facilities for both lenders and borrowers. Technical assistance

consists in the IDB project mainly of consulting functions for new credit technologies for the banking group.

The separation of technical and purely financial aspects applies perfectly to a situation where not only credit experience, but also environmental and technological consulting is needed by credit institutions for a proper credit evaluation.

In the IDB project existing commercial banks are seen as the central piece to establish a stable system of credit extension to the target group. No new financial institution for serving it is suggested. Advantages mentioned for choosing the existing commercial banks are: Their access to IDB funds through the rediscount facilities of the Central Bank⁵³, their supervision by a "superintendencia", and finally, they seem to be financially healthier than other financial institutions. The credit component of the program will thus be implemented by eligible existing commercial banks with access to IDB funds via a rediscount facility at the Central Bank. Loans will be made on market rates

⁵³ In Colombia any financial institution that fulfills certain conditions is eligible for the directed credit lines of the Banco de la República (IDB, BIRF, EXIMBANK, etc.).

and the foreign exchange risk will be assumed by the Central Bank.⁵⁴

According to the IDB study the main benefits for the target group can be seen in the small and microenterprises' access to financial resources at market rates and conditions. Moreover, the use of the commercial banks as financial intermediaries creates an independence from a continuing flow of external development loans and grants. Although development loans may be cheaper, small and microenterprises can never be sure when and for how long they will be available. Financial intermediaries benefit through the increase in the demand for banking services and through the exploration of new market segments. The program may also facilitate risk diversification for the banking sector.

The main problem in Colombia to serve the SME sector seem to be high administrative costs (and not mainly excessive interest rates). Also, there exists a wide network of financial institutions without primary interest in serving the small and microenterprise sector, but with a considerable experience in handling the external long term credit lines of the Banco de la República. Under these

⁵⁴ The total amount of resource implied in this project was estimated at US\$ 14.3 millions. Almost 70% of the resources will be provided for by the Interamerican Development Bank under market conditions. The local counterpart will come up for the remaining 30%.

circumstances, the "IDB scheme" with its strong technical assistance component and its market oriented framework, may be a good option for the decontamination issue of Río Bogota.

E. Serfindes

As will be shown later on, not only traditional financial corporations are possible candidates for the canalization of resources for the decontamination of Río Bogota, but also some new emerging forms of financial assistance will be considered. Venture Capital could represent an interesting, though very special, alternative or a useful complementary instrument for the decontamination of Río Bogota. SERFINDES is an example of a small "sociedad anónima" that uses venture capital to participate in small and medium sized enterprises with a strong growth and survival potential. Among its objectives figures the promotion of development and the assistance to the microenterpreneurial sector but it wants to achieve these goals not by offering grants but through the management of a profitable financial entity.

SERFINDES started operating more or less one year ago. Its declared aim is to use alternative, complementary financial instruments to assist small and micro enterprises with a growth potential and acceptable levels of profitability but with financial needs for their expansion. As it is considered that in order to achieve these

goals not only credits but also some technical assistance is needed, direct participation in firms is seen as a good option. Therefore the probably most important activity of SERFINDES is participation in healthy SME's through risk capital; SERFINDES buys up to 49% of the assets of selected SME's and assists during several years in the restructuring and expansion of these firms. When the restructuring has been successfully accomplished, assets are sold and profit can be made from difference between the value of the assets before and after financial, technical and managerial assistance has been given. Even though SERFINDES is only starting this business, preliminary results seem to be satisfactory. Another mechanism tested by SERFINDES are "apalancamiento de creditos" which constitute a complementary form to the participation through venture capital: As the extension of credit is very often tied to the existence of a saving account in the financial institution where the demand for credit is made, and as SME's saving will usually be too small to allow access to important credits, SERFINDES opens saving accounts in the name of the SME sector. Whenever the risk capital option shows the need for some additional financial resources, the SME can negotiate a credit with "apalancamiento".

Table 1 shows a synthesis of the main conclusions that can be drawn for the evaluation of an eco-financial institution from the study of the experiences.

Table 1: Lessons from Experience

WHAT ARE THE PRINCIPAL PROBLEMS OF CREDIT ACCESS FOR SME'S?

- Experiences shows that high interest rates are not the basic problems.
- The size of the firm determines its credit access possibilities. The smaller the firm the more important becomes credit rationing.
- High administrative costs (lack of economies of scale) and high risks associated with leading to the SME sector limit credit access.
- SME's perceive costs of information gathering on most appropriate technologies as being an important obstacle as no guarantee can be given that the credit application will actually result in the extension of a credit.

SUGGESTED SOLUTIONS TO THE CREDIT ACCESS PROBLEMS OF SME'S

- Nobody seems to suggest subsidies to interest rates.
- There exist already various institutions with considerable experience not only with respect to the SME sector but also with the extension of (mainly external) long term credit lines.
- Any assistance to SME's should include instrument aimed at decreasing high administrative cost and risk associated with leading to the SME sector. Among them the following are recommended.
 - * Technical assistance to financial institutions so that they can adapt to the special circumstances needs of SME's.
 - * Technical assistance to firms such as obligatory business courses or preferential terms for technical evaluation studies.
 - * Use of innovative financial instruments such as venture capital.

**APPENDIX II: THE STRUCTURE OF THE ECO-CREDIT-INSTITUTION (ECI)
AND SOME COMPARABLE CREDIT INSTITUTIONS**

To discuss the likely structure of the ECI, three existing "corporaciones financieras" (CF) are studied from which the structure of the ECI shall be deduced. The CF chosen are the Corporación Financiera de Desarrollo (CFD), "Coopdesarrollo" and finally "Corporación Financiera de los Andes". The first one serves as an example of a private-public financial entity whose liabilities are heavily dependent on the discount facilities of the Banco de la República, and whose credits are extended not exclusively to the best risks. Coopdesarrollo is an example of a private financial corporation (belonging to a foundation, Fundación Social) which depends on the private capital market to raise funds. Its objective includes borrowing to the smaller enterprises. As a third entity Corporación Financiera de los Andes (CFA) has been chosen as an example of a small, profit oriented, private corporation.

Table 2 shows the general balance structure of CFD, Coopdesarrollo, and CFA respectively. CFD's total actives amounted to roughly US \$ 70 million (June 1992), whereas Coopdesarrollo's actives sum to US \$ 90 million (december 1991) and CFA's amounted to approximately US \$ 40 millions.

Table 2: Balance structure

	CFD	Coop des.	CFA
Activos Productivos	80%	85%	85%
Activos Congelados	10%	5%	3%
- de mora, bienes en pago	5%	3%	3%
Otros	10%	10%	10%
Pasivos	80%	80%	80%
Patrimonio	20%	20%	20%
Capital Propio	10%	15%	2%
Reservas, Utilidades	10%	5%	18%

The general structure is very similar. The differences are to be found in the structure of the three main conglomerates. First, the composition of the productive assets, second the structure of the liabilities and third the property relation, expressed in the ownership of the equity capital.

The structure of the productive assets is rather different. Coopdesarrollo has 30% of its total actives in "Disponibles" and "Inversiones". Particularly the voluntary investments are high (10% of total actives). Voluntary investments are usually held to prevent liquidity problems in case of large withdrawals of deposits. Coopdesarrollo and CFA depend much more on private funds than CFD. The risk of illiquidity for the latter is much smaller; CFD holds therefore much lower voluntary investments (4%) whereas for Coopdesarrollo voluntary investments come up for 10% of total

actives.⁵⁵ Low investment volumes imply, of course, lower opportunity costs, since in general voluntary investments do not yield the same return as credits.

The advantage of CFD with respect to its low voluntary investment volume is at least partially offset by a higher ratio of "cartera vencida" to assets (5% for CFD, 3% for Coopdesarrollo and 0.6% for the Corporación Financiera de los Andes). CFD very likely extends credits to SME and microenterprises with low guarantees and a high risk factor. For the CFD, 75% of the credits are covered by a real (generally considered to be less valuable than personal guarantees) and 25% by a personal guarantee, whereas for Coopdesarrollo the ratio is 35% to 65% and for CFA it is 30% to 70%. Table 3 compares the risk structure for real and personal guarantees in three corporations.

⁵⁵ For CFA this relation is about 8% given that total investments come up for 10% of total actives.

Table 3: Risk structure

Real Guarantee:	CFD	CFA	Coopdesarrollo
Vigente	82%	98%	99%
Vencida < 6 meses	13%		
Vencida 6 - 12 meses	2%		0%
Vencida > 12 meses	4%	2%	1%
Personal Guarantee:			
Vigente	90%	100%	99%
Vencida < 6 meses	8%		
Vencida 6 - 12 meses	1%		1%
Vencida > 12 meses	2%		

CFD has the worst standing in the risk segment with real guarantees. In the personal guarantee segment, the risk structure is the same for both banks, which implies that Coopdesarrollo and CFA with a strong foot in this segment are less exposed to a high overall loss on credits.

There is a first, important conclusion to be drawn from this comparison. A profit oriented bank which is exposed to the risk of illiquidity due to fluctuations in their liabilities needs higher voluntary investments and finances itself on the capital market. It, therefore, extends less credits - whereas credits come up for 84% of total actives in CFD, for COOPDESARROLLO and CFA they amount to 55% and 75% respectively - but has higher voluntary investments and tries to allocate its resources in a safer segment of the market. A private ECI will, thus, not borrow extensively to SME

with real guarantees. A bank will try to find an optimal mix between "bad" and "good" risks. If "good risks" do not demand credits, the number and/or the volume of "bad risks" which will be served, declines accordingly. Or, in concrete terms, if the large and sound firms along Río Bogota do not need credits, look for credits at other banks or pay the fee, the financial entity will have to reduce its engagement in the high risk sector accordingly⁵⁶. These firms will not be able to readjust their technology as no financial entity will have any interest in borrowing only to bad risks (SME's).

A closer look at the liability side of the balance reveals another important aspect. Coopdesarrollo and CFA finance themselves not only more heavily on the capital market, but the funds are short- and medium- rather than long-run. Coopdesarrollo and CFA have 20% and 68%, respectively, of their liabilities in CDT's, as opposed to 2 % of CFD. For the CFA, 56% is provided by "depositos de ahorro" and 11% by credits from the Central Bank. CFD is not funded by savings, but primarily by credits through the Central Bank (51%; 10% short-run and 41% long-run), the Banco de Comercio Exterior (11%; 7,5%, 3,5%) and IFI (5%; 2%, 3%).

⁵⁶ This idea is based on the assumption that clients with safe risks are mostly big firms that have already their net of credit facilities and that will probably not want to engage relation with a new specialized entity unless -and this is very questionable - special credit conditions are offered to them.

Besides the balance one has to consider the gains and losses (Table 4).

Table 4: Comparison of Gains and Losses

	CFD	Coopdesarrollo	CFA
Ingresos operativos / Cartera de Creditos			
- Intereses	15%	32%	22%
- Total	16%	32%	31%
Ingresos operativos / Cartera+Inversiones+Disponibles			
- Intereses	14%	20%	20%
Gastos operativos/ Pasivos			
- Intereses	12%	12%	18%
Margen financiero ⁵⁷ /	1.33%	6.72%	4.55%
Gastos pers./Activos	2%	4%	2%

The funding structure does not exhibit a difference, although the sources of funds are different. CFD pays market rates for its funding through international credit lines, which seem to amount to a similar ratio between operative costs and liabilities as have institutions which seek funds on the private capital market. There are, of course, opportunity costs implicit in the funding structure of the three banks. The risk and the term structure of the two are different; the CFD having access to long-term funds and a low risk of withdrawal. In so far, CFD's funding can be regarded as cheaper.

⁵⁷ The financial margin was defined as $m = (\text{operating income} - \text{operating costs})/\text{portfolio}$.

The more private character of Coopdesarrollo reflects itself strongest in the relation between income and assets. Interest incomes as percent of the whole outstanding credit volume is twice as high as for CFD, and even if one includes investments and liquid assets a considerably better relation remains. The reasons are difficult to assess: A higher mark-up - CFD is constraint to a maximum mark-up, if it uses money from international credit lines - a different credit policy towards SME and higher costs (personnel, subsidiaries etc.) might explain part of the difference. Assuming that the credits needed to implement the technological change at Rio Bogota are middle- to long-term credits, the share of CDT will be much lower in the ECI than in Coopdesarrollo.⁵⁸

The third difference to be observed are the ownership structure and the services offered. Share holders of CFD are CII, chambers of commerce, ACOPI, IFI, the Colombian Government, Bancoldex, Banco Popular and private persons. Coopdesarrollo is a cooperative which extends its services to its members. CFD has a large scope of services - credits to different sized enterprises in different sectors in the whole country - extension of working capital, leasing, etc. Coopdesarrollo is equally distributed over the whole

⁵⁸ There are however some restrictions on the amount of credit obtainable from the Banco de la República. The Central Bank determines a maximum level of exposure with the financial intermediaries based principally on the strength of the "equity capital" of each entity. (See Revista del Banco de la República, nov.1991).

country, but has a much smaller scope of services and a more similar structure of clients.

To calculate the structure of the ECI's balance, an anual credit volume of US \$ 20 million and 100 million is *ad hoc* assumed. Moreover, given the evaluation of the balances of the three institution, the following assumptions are made:

- The structure of Coopdesarrollo (or CFA) is more relevant than CFD for the ECI, since funds have to be sought in the private market (including the credit lines managed by the Central Bank).
- The ECI might have, given the objective, easier access to the certain international credit lines managed by the Central Bank. The experience of the CFD shows, however, that these credits are not unlimited (abstracting from the World Bank's Industrial Restructuring Program). One can, therefore, assume that 30 - 50% of the funds can be covered by credit lines; the remaining 50 - 30% has to be raised on the financial market (depending, of course, also on the size of the entity and the possibility to put in a higher share of equity capital).
- CDT's can initially not play an important part in financing the credit volume.

The ECI can then fund its activities in different ways. First, as Coopdesarrollo, the entity can raise savings which are relatively expensive funds. Moreover, the public response is highly uncertain. Another expensive way of financing are credits obtained from other financial corporations. Apart from being a costly way of financing, it has strict limits, since the market for long-run credits in Colombia is very small, as can be seen from Table 5 and 6.

Table 5: LONG TERM CREDITS BY BANKS AND CF 1984 - 1988*

Préstamos y descuentos vigentes, según plazo de los bancos comerciales

(in millions of pesos and in %)

Año	Total	Corto Plazo		Mediano Plazo		Largo Plazo	
1984	414.753	291.839	70	71.704	17	52.210	13
1985	521.713	378.315	73	79.112	15	64.286	12
1986	676.332	472.893	70	112.235	18	81.204	12
1987	907.949	627.700	69	180.887	20	99.362	11
1988	1.140.914	779.160	68	232.141	20	129.609	11

Préstamos y descuentos vigentes según plazo de la corporaciones financieras

(in millions of pesos and in %)

Año	Total	Corto Plazo		Mediano Plazo		Largo Plazo	
1984	99208	70368	71	22920	23	5920	6
1985	106633	71602	67	27457	26	7574	7
1986	145423	90523	62	45871	32	9029	6
1987	208626	46513	22	88518	42	73595	35
1988	282782	49665	18	143488	51	89629	32

*) Data available only until 1988

TABLE 6: Créditos a largo plazo de los bancos, corporaciones y totales en porciento de los créditos de bancos y corporaciones financieras y en porciento de inversiones en maquinas y equipos

Años	CF	Bancos	Total	en % maq./equ.1/
1984	1.1	10.1	11.3	22.0
1985	1.2	10.2	11.4	23.9
1986	1.1	9.9	11.0	19.8
1987	6.6	8.9	15.5	24.0
1988	6.3	9.1	15.4	21.4

Source: Revista del Banco de la República, Diciembre 1991

1/ Figures on total investments taken from Lora, Zuluaga, 1992

Also the situation has been changing a bit in the last years of the 80's the volume of long term credits extended particularly the CF is very small. Long-term investments, especially for credits to firms which are not first-class debtors, has to rely, then, on other sources of finance.

As has been discussed, an interesting way of raising funds would be the emitting of a "green bond" or a "green bond, convertible in shares".⁵⁹ The funding through bonds, though, will be an interesting possibility only once the entity has been working successfully.

The private funding puts restrictions on the structure of the asset side, and particularly on the level of credits which can be granted. It determines the keeping of a higher percentage of liquid assets, if large fluctuation in the entity's funds are to be expected. Assuming a higher percentage of Central Bank long-term credit than in Coopdesarrollo, the liquidity requirement will be somewhere between that one observed in that entity and CFD.

⁵⁹ This has been confirmed by one investor. However, he drew the attention to a recently emitted municipal bond which had been placed only with big difficulties.

In one respect, the ECI will be closer to the CFD. The risk structure of its credit will very likely be similar to that one of CFD, since the majority of its clients will be SME's or microempresas.

Very tentatively one could construct the following balance sheet for a small entity (US \$ 20 million) and a large entity (US \$ 100 million)

The structure of the smaller entity would be:

Disponible/Inversiones	10%	50%	Credits Central Bank, IFI etc.
Cartera de Creditos	70%	20%	Market funding
- de mora	5%		
otros	20%	30%	Equity Capital

This implies the following absolute values (in million) for a US \$ 20 million bank.

Disp./ Inversiones	2	10	Credits Central Bank, IFI
Cartera de Cred.	14	4	Market Funding
- de mora	1		
Otros	4	6	Equity Capital

For a large bank (US \$ 100 mill.) one would expect the following structure:

Disponible/Inversiones	20%	30%	Credits Central Bank, IFI etc.
Cartera de Creditos	60%	50%	Market funding
- de mora	5%		
otros	20%	20%	Equity Capital

This implies the following absolute values (in million):

Disp./ Inversiones	20	30	Credits Central Bank, IFI	
Cartera de Cred.	60	50	Market Funding	
- de mora	5			
Otros	20	20	Equity Capital	

The large bank has a equity capital which is about a quarter of that one of CFD. This is very large, given the fact that CFD has a long tradition, is active in all regions of Colombia and is generally concerned for development projects and specialized as a ECI would be.

Very likely the small entity comes closer to what is to be expected. US \$ 6 million equity would be required following our exercise. It has to be stressed that this is not the essential minimum, but required to allow a funding structure which does not have to rely too heavily on savings and long-term credits from other financial entities.⁶⁰ It would allow a credit volume of US \$ 14 millions (the larger entity would imply a volume of US \$ 60 millions). There is a need for funds of US \$ 10 (30) million from credit lines and US \$ 4 (50) million from the local financial market for the small (large) entity.

Even if the US \$ 20 million equity capital could be raised, the US \$ 50 million which has to be raised on the market is definitively

⁶⁰ The legal minimum would be a relation of 1:10 for paid in capital, legal reserves and valorisation in relation with the passives, see Ortiz, 1992, p. 382

too large. The smaller credit institution, however, is not only feasible, but very likely more in line with the demand for credits to be expected.

**APPENDIX III: COMPETITION FROM ADMINISTRATIVE TRUSTEES - AN
ANALYSIS OF THEIR BALANCE STRUCTURE**

In order to analyze the possible structure of an "Eco-Fiducia", the balance sheets of existing fiducias are analyzed. The analysis will be limited to fiducias that assign an important part of their business to "fiducia de administración". These fiducias concentrate 33.5% of total fideicomiso and ten out of 31 trusteeships assign a substantial part of their activities to fideicomiso de administración.

Balance Structure of the "Eco-fiducia"

Two scenarios will be presented in the following paragraphs :

- 1) Twenty environmental investors will contribute 10 million pesos each as equity capital.
- 2) Fifty environmental investors can be found to contribute each 10 million pesos.

This implies a total equity capital of 200 and 500 million pesos, respectively. Such an equity capital of the "Eco-Fiducia" corresponds to the smallest fiducias such as Alianza, Cálidas, Colmena, Fiducomercio, or Fiducoop. Looking at the total amount of

"fideicomiso de administración", it is noted that the first three fiducias have a substantial capacity of attracting capital from the market (see Banca & Finanzas, December 1992). As discussed in section three, however, the "Eco-Fiducia" will hardly make any benefits which lowers its capability to size resources. The structure of the "Eco-Fiducia" is, therefore, considered to resemble much more to an entity such as Fiducomercio or Fiducoop which have a higher ratio of equity capital to fideicomiso. Using indicators of these two fiducias a tentative balance of a hypothetical "Eco-fiducia" can be constructed. It has to be noted, however, that there is no clear relation between size of existing fiducias and the value of the different indicators. It is not possible, for example to rely on a relation that a large equity capital induces a large balance sum. Similarly, no clear relation between amount of trusted capital and size of equity capital can be established. Using these indicators to calculate a tentative balance of an "Eco-fiducia" is, therefore, to a large extent arbitrary. Comparing the structure of the assets and liabilities, the trusted capital and the income-expenditure flows, one notes the big difference of these two fiducias. In addition to the structure of the balances, some further indicators are used to establish the structure of the "Eco-fiducia". The ratio of Equity Capital to total Assets is fairly similar, 0.86 for the Fiducomercio and 0.88 for the Fiducoop. The average fiducia has a value of 0.57. A large difference is noted for the relation between trusted capital and

equity capital (0.47 for the fiducomercio, 7.21 for the Fiducop, and 40.3 for the average fiducia). The large difference between the average ratio and the ratios of the two fiducias suggests that these fiducias invest basically their own capital; be it because of the age of the fiducia, be it for other reasons.

Table 7: Balance Structure of Fiducop, Fiducop and of the sector's average

	Fiducop		Fiducop		Average	
Fideicomiso de Administración	238.6		4866.0		51164.0	
- Disponible	11.6	2%	72.5	10%	83.7	4%
- Inversiones	479.8	81%	142.5	19%	1318.7	57%
- Cuentas por Cobrar	10.2	2%	195.3	26%	361.4	16%
Activos Total	593.6		763.6		2323.9	
Pasivos Operativos	17.5	3%	46.0	7%	405.2	17%
- Capital Pagado	512.6	86%	674.5	88%	1270.4	55%
- Utilidad y Reservas	112.9	19%	0.0		376.0	16%
Patrimonio Total*	576.1	97%	717.6	94%	1918.7	83%
Ingresos Operacionales	171.3		83.9		1539.4	
- Servicios	36.3		52.0		1280.4	
- Financieros	97.2		31.9		225.9	
Gastos Operacionales	108.7		47.3		724.5	
- Financieros	9.1		6.2		210.4	
- Laborales	66.6		22.2		282.5	
- Otros	33.0		18.9		231.7	

* Where the Patrimonio is less than the sum of capital, reserves and profits, the difference is equivalent to "Resultados del ejercicio".

Source : Banca y Finanzza, No. 26 Oct-Dic de 1992, Bogota

The margin as a percentage of the Assets are quite different: 34% for Fiducomercio and 0.05 for Fiducoop (the average margin is 20%), and the profit rate 22% and 6%, respectively, with a percentage of 19% on average.

Based on these calculations, the structure of the "Eco-fiducia" is established. As mentioned above, two sizes are distinguished, first a small fiducia with a equity capital of 200, and second a larger one of 500 million pesos. Where Fiducomercio and Fiducoop have similar ratios, the average of these two are taken. Whenever the ratio are widely dispersed, the value of the average fiducia will be used, indicating that no firm relation between size of fiducia and value of ratio can be safely established.

Using the average values to calculate "disponibles", "inversiones" and "cuentas a cobrar", and the ratio of asset to equity capital of the Fiducomercio and Fiducoop, the following balance structure for a small and a larger "Eco-Fiducia" are established.

In table 8 the balance structures of a small and a larger hypothetical "Eco-fiducias" are calculated. It is assumed that investors contribute with 200 and 500 million pesos as funding capital. Given a relation of 0.87 as an average of the relation of

asset to paid in capital for Fiducomercio and Fiduccop, the total balance would be 230 and 575 million pesos, respectively.

Table 8: Hypothetical balance structures of a small and a larger "Eco-Fiducia"

Inversiones	109	271
Disponibles	8	21
Cuentas a cobrar y otros	113	283
Activos	230	575
Pasivos Operativos	12	29
Capital Pagado	200	500
Reservas y Utilidades	18	46
Fideicomiso I	108	270
Fideicomiso II	1658	4146

Using the balance structure of the active side of the average Colombian fiducia, the "inversiones" and "disponibles" are calculated. The residuals are cuentas a cobrar and other positions. Similarly, using a ratio of 5% of Pasivos Operativos to total balance sum (the average of the two Fiducias) a level of 12 and 29

million pesos of operating liabilities are calculated. Reserves and profits - amounting to about 10% of the paid in capital - is deduced as a residual. Lastly, the amount of entrusted capital is calculated, once using the Fiducomercio's low level of 0.47 of entrusted capital to assets, the second time using the level of Fiducoop (7.21).

Probably more interesting for the purpose of this study are the income-expenditure flows (table 9).

Table 9: Income and expenditures of the two "Eco-fiducias"

Income	22.8	56.8
- por servicios	14.9	37.1
- financieros	7.9	19.7
Costs	28.0	70.0
- financieros	4.6	11.5
- laborales	13.3	33.3
- otros	10.1	25.2
Ganancias	(5.2)	(13.2)
Margen	(2%)	(2.3%)
Tasa de redimimiento	(2.6%)	(2.6%)

The results show losses for the hypothetical "Eco-fiducia"; the positive financial situation in the balance sheet can be attributed to non-operative incomes and to the reserves. Obviously, the calculations cannot be taken at face value; the application of different ratios to the "Eco-fiducia" is up to a certain point an

arbitrary exercise. Two aspects, however, indicate a certain relevance of the calculations. First, the results obtained on basis of other fiducias' experiences reflect the tight competitive situation; there is not much room in the market for a large mark-up. Second, the discussion has shown that the income-cost flows for an "Eco-fiducia" will be less favorable than for the existing ones. If anything, the situation for the entity to be created will be even worse.



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