



# THE PRACTICE OF COST BENEFIT ANALYSIS IN THE TRANSPORT SECTOR: A MEXICAN PERSPECTIVE

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# THE PRACTICE OF COST BENEFIT ANALYSIS IN THE TRANSPORT SECTOR A MEXICAN PERSPECTIVE

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*The views expressed in this paper are the author's and do not represent the opinions of the Secretaría de Hacienda y Crédito Público of Mexico, the Investment Unit, the ITF or the OECD.*



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## ABSTRACT

Mexico's public investment process is strengthened by an institutional framework that ensures that projects with a high social return are given preference. The *Federal Law of Budget and Financial Responsibility* establishes as prerequisite for federal investments the obligation to present a Cost-Benefit Analysis (CBA), and to get the Investment Unit approval. This paper describes the use of CBA for the social and economic evaluation of transport infrastructure in Mexico and is made from the point of view of the role of the Ministry of Finance's Investment Unit in the appraisal process.

## Introduction

Mexico has an institutional framework that seeks to strengthen the process of planning, selection and prioritization of investment projects. At the beginning of the process, many actors participate including the Ministry of Finance –SHCP-, the Ministry of Transport –SCT-, the Infrastructure National Fund -FNI-, the National Development Bank for Public Works and Services – BANOBRAS-, private actors, and the Congress (who has the final decision of approving the Federal Expenditure Budget –PEF-).

This process ensures that investment projects with a high social return are given preference. The Federal Law of Budget and Financial Responsibility (LFPRH) establishes as prerequisites for federal investments:

- i) to present to the SHCP a planning document where federal entities identify and prioritize their investment needs for the next 6 years,
- ii) to present to the SHCP a cost - benefit analysis (the SHCP may request that such analysis is judged by an independent expert),
- iii) to obtain the project approval in SHCP's Investment Portfolio System,
- iv) The Inter-ministerial Commission for Financing and Expenditure (CIGFD) will analyze and determine the projects prioritization for their inclusion in the draft budget of expenditure considering the following criteria: social profitability, regional development and synergies, among others.

A key element which has allowed organizing the process of project selection is the obligation, by law, to present a Cost Benefit Analysis (CBA) in order to demonstrate its profitability and to access public funding. If a project's Social Internal Rate of Return does not exceed the minimum required (12%) it will not have access to public funds and may not be executed. This instrument will allow financing projects socially worthwhile.

The Investment Unit (UI) of the Ministry of Finance plays a fundamental role in this process. It is responsible for integrating and managing the Investment Portfolio System and reviewing and approving the CBA. Each time a project proves to be socially worthwhile, the UI assigns a registration code which identifies the project and makes it possible to receive public funding either through the Federal Expenditure Budget or the National Fund of Infrastructure.

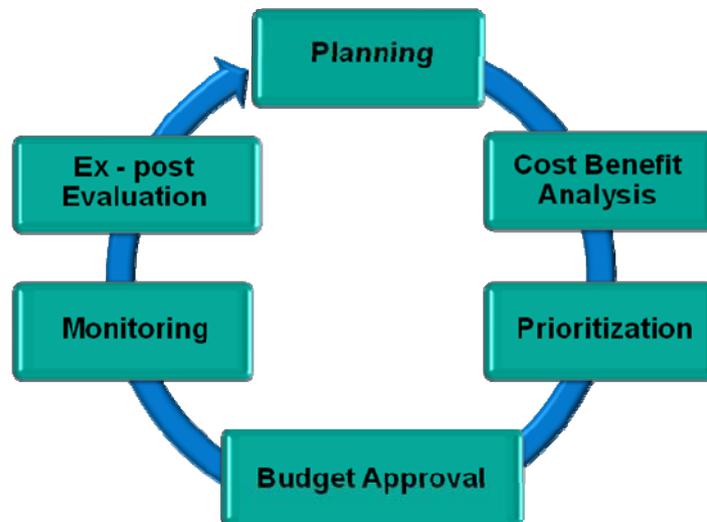
This document describes the use of cost - benefit analysis for the social and economic evaluation of transport infrastructure. The description is made from the point of view of the role of UI in the investment process, and does not consider internal evaluations in SCT and in other federal entities involved in the definition, selection, evaluation and financing of projects.

Mexico is currently carrying out an effort to improve the quality of public investment. In this process the UI will play a more active role starting from the conception of alternatives to solve a transport problem until the definition of the project and its evaluation; it will delve deeply into risk analysis and in the determination of the best financing scheme either through pure federal expenditure or Public - Private Partnerships.

### **Institutional Framework (Stages of the Public Investment Process)**

Cost - benefit analysis in Mexico is not an isolated practice but rather part of an integral process that seeks to influence the preparation, selection, evaluation, financing and monitoring of an investment project.

Currently, Mexico has an institutional framework that gives support to the National Public Investment System. This institutional framework can be explained by the different stages of the investment cycle which are described in the next paragraphs.



**Planning.** In order to guide the actions and efforts in the development of infrastructure, there are planning tools that allow to identify and to define what will be the priority projects to develop at any particular moment. This stage is considered crucial since it depends on the correct identification of the needs of public investment, the analysis of feasible alternatives and the deepness of necessary studies in order to reduce the uncertainty of a project. The expected outcome at this stage is a strong investment expenditure planning (multi annual investment planning). In the specific case of Transport projects, these tools are:

- National Development Plan (6 years). It establishes the general objectives that the government plans to achieve concerning the transport sector.
- National Infrastructure Program (6 years). Defines in a more precise way the strategies and lines of action to follow concerning the transport sector. It also defines in a quantitative matter the goals to achieve (kilometers, ports and airports to construct, among others) and what are the main projects to boost, as well as the source of their financing.
- Planning Document (updated every year) with the purpose of detecting the necessities of investment in medium term, the SCT must elaborate a plan which identify and prioritize their investment needs for the next 6 years.

**Cost-Benefit Analysis.** By Law, all federal projects have the obligation to present a cost - benefit analysis in order to demonstrate its social profitability and to access public funding. It is

important to note that the elements that help homogenize criteria and promote transparency and certainty in the process are:

- Clear guidelines and parameters for the evaluation of costs and benefits. In order to promote the same process for all projects there's a general methodology that helps in the evaluation and selection of projects with high social return. Also, there's specific methodologies for highways, rural roads, massive transport, etc.
- An independent expert opinion. The new projects which investment amount is greater than 500 million pesos<sup>1</sup> have the obligation to present an analysis examined by an independent expert, before initiating the construction. The opinion deal with the technical, economic and environmental feasibility. This only applies for the energy, water and transport sectors.
- Training Center for the Preparation and Evaluation of Projects (CEPEP). It is the think tank of the UI. The CEPEP helps in the development of new methodologies, assists in the analysis of complex projects and provides training in these methodologies to federal entities and local governments.
- Investment Portfolio System. It is a bank of projects that demonstrates, through a cost benefit analysis, high social return. If a project is socially worthwhile the UI assigns a registration code. **This code (equals to UI's approval) is a prerequisite for their inclusion in the draft budget and for accessing to public funding.**
- Transparency. With the purpose of giving greater transparency in the use of public funding for projects, the Investment Portfolio System is available in the SHCP web page and can be consulted in this link:  
[http://www.apartados.hacienda.gob.mx/sistema\\_cartera\\_inversion/index.html](http://www.apartados.hacienda.gob.mx/sistema_cartera_inversion/index.html)

**Prioritization.** Programs and projects registered on the Investment Portfolio System will be analyzed by the Inter-ministerial Commission for Financing and Expenditure (CIGFD), which will determine the priority for inclusion in the Federal Expenditure Budget Draft, as well as the order of its execution. This process intend to establish an order in all the programs and projects, and maximize the impact they may have to increase the social benefit, primarily observing the following criteria:

- a) Social-economic profitability;
- b) Extreme poverty reduction;
- c) Regional development, and
- d) Synergies with other programs and investment projects

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<sup>1</sup> Approximately 50 million dollars.

**Programming and budgeting.** Since it is a prerequisite to have a registration code in the Investment Portfolio System in order to receive public funds, Federal Expenditure Budget and Investment Portfolio System are linked at this stage.

- The Draft Federal Expenditure Budget that the President sends to the Deputies Chamber only incorporates investment programs and projects which have registration code, it means, that has a CBA and meets with the established profitability parameters.
- Once the Federal Expenditure Budget is approved, new projects that are incorporated must present a CBA and have the UI's approval.

**Monitoring and Ex-post Evaluation.** At this stage it seeks to monitor the development of the project, checking that *ex ante* estimated benefits are actually attained. The following instruments are used:

- Monitoring the physical and financial progress, provides information about investment's outlays and construction progress.
- Profitability monitoring, reviews the behavior of the profitability indicators at the operation stage.
- Ex – Post evaluation. Compares observed benefits of the project once it is on operation, against the planned benefits.

### **The role of Cost-Benefit Analysis in the decision-making process**

In Mexico, as in many other countries, there are multiple needs for transport and very few resources to attend them. In addition to this, transport projects face an important political debate, having a huge impact on the Federal Expenditure Budget.

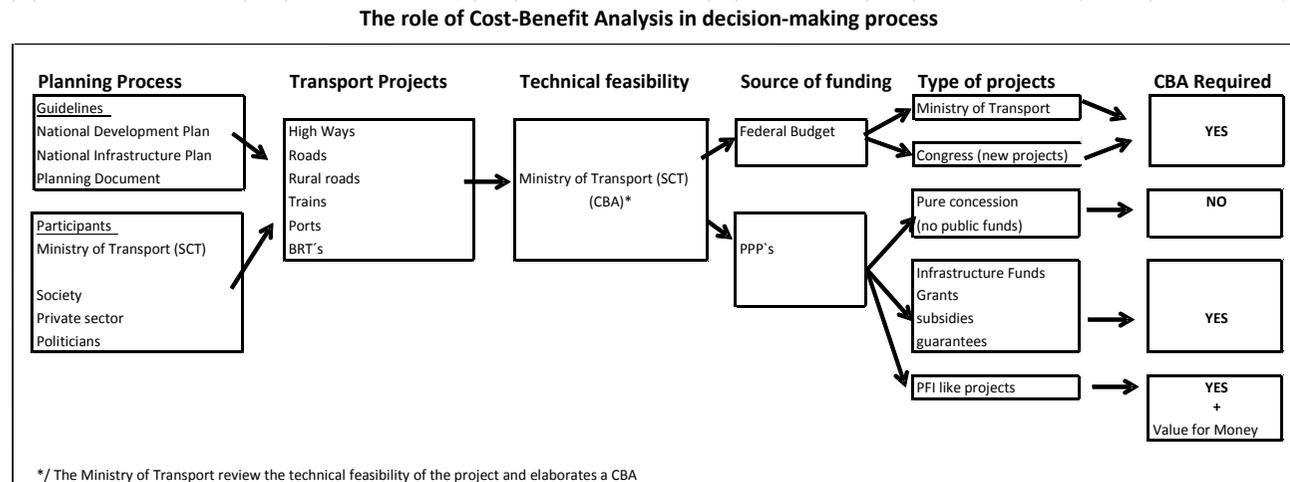
In this respect, the cost-benefit analysis is the most important instrument in the decision making process. The principle behind the CBA is the seeking of the best possible way to use the public resources available to finance any project.

Due to the fact that this process involves many actors, both within Government and outside it, the CBA allows establishing criteria in order to identify, quantify and value costs and benefits for the lifetime of the project in a uniform, clear and transparent way.

By law, investment projects which financing sources are public, must:

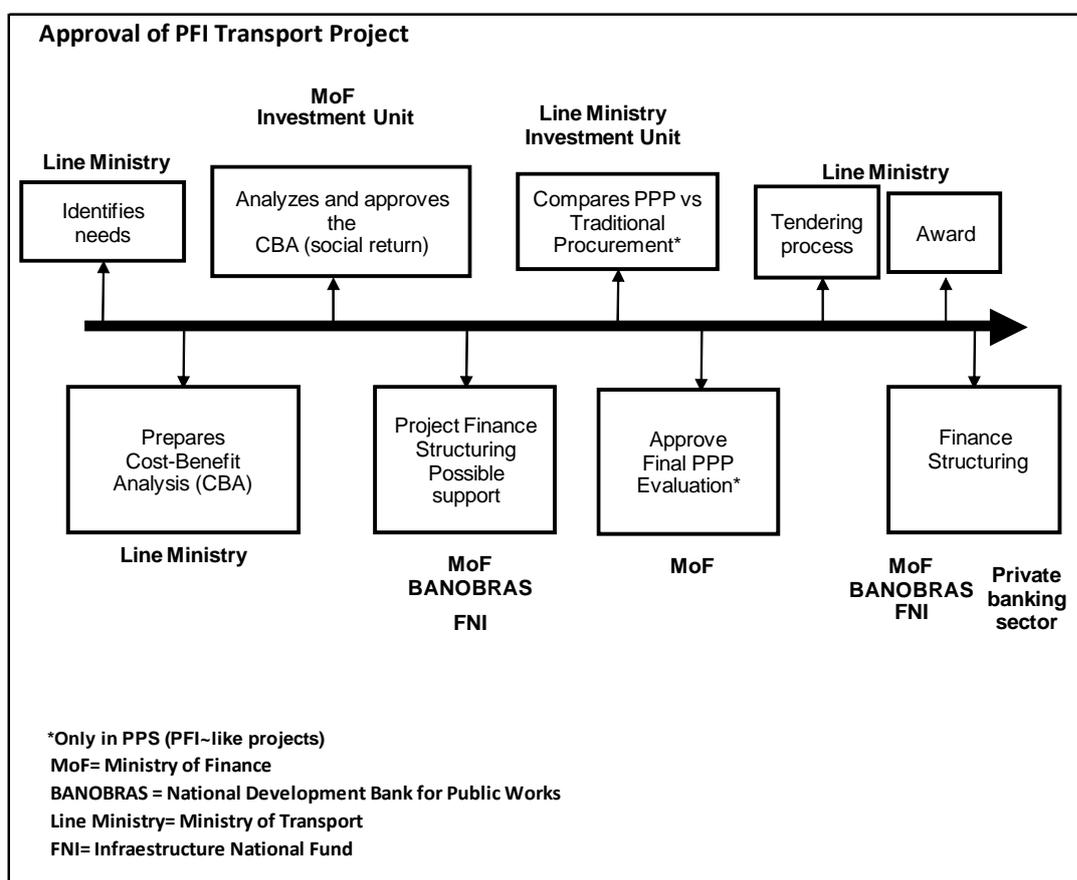
- i) present a Cost-Benefit Analysis,
- ii) have the Investment Unit approval (registration code) and
- iii) be part of the investment portfolio.

CBA is a prerequisite to acquiring UI's approval and for public funding.



In this way, to be able to execute a project it is necessary to demonstrate through a CBA that this project has high social return; otherwise the project cannot be undertaken. This is regulated on the Federal Law of Budget and Financial Responsibility (LFPRH). This institutional framework looks at both, the projects that do not belong to the National Infrastructure Plan at the beginning, and those that are included in it, must have to prove (through a CBA) its social profitability in order to accede to Infrastructure Funds.

Thus, infrastructure projects that claim for federal funding, or those that are realized by a PPP needing support and subsidies from the Government (through the National Infrastructure Fund) must submit a CBA and receive the authorization from the Investment Unit to initiate construction.



In the transport sector there are Services Provision Contracts (PFI like Projects). In this PPP scheme a CBA and UI's approval is a prerequisite before the Value for Money Analysis.

## Key Elements of Cost-Benefit Analysis

The Cost-Benefit Analysis aims to prove from the Net Present Value–NPV- and the Internal Rate of Return (IRR) assessment, that a project generates net benefits to society. Depending on the investment amount, the depth of analysis changes according to the size and type of the project, however, it is required that all the information is supported by reliable and precise data which allows adding a detailed monetary costs and benefits assessment.

### Types and level of studies for CBA

The depth in the analysis depends on the type and the amount of the project

| <b>Type of CBA</b>            |                                                               |                                       |                                   |
|-------------------------------|---------------------------------------------------------------|---------------------------------------|-----------------------------------|
| Millions of Dollars (MD)      |                                                               |                                       |                                   |
| Type                          | <b>Technical notes</b><br>(Idea and Project Definition level) | <b>CBA</b><br>(Pre-feasibility level) | <b>CBA</b><br>(Feasibility level) |
| <b>Infrastructure Project</b> | < 5 MD                                                        | < 50 MD                               | > 50 MD                           |
| <b>Maintenance Project</b>    | < 15 MD                                                       | < 50 MD                               | > 50 MD                           |

Below is described the process of a CBA:

- The first step is to identify the transport need to be solved. If the need or problem is not clearly defined, the CBA is sent back to SCT.
- It has to be reviewed whether is possible to “optimize” the current situation, looking for activities that would be carried out if the project is not undertake (i.e. upgrade the existing infrastructure, administrative measures to improve the current situation).
- There has to be an analysis of the alternatives proposed, examine each one and demonstrate why the one chosen is the best of all.
- The project costs and benefits have to be identified and quantified, and then calculate the profitability indicators (NPV, IRR).
- Finally, the project behavior is faced with stress scenarios.



There are key issues to be addressed in the structure of CBA

- What is the problem/need to be solved?
- Is the Project the best alternative? What others alternatives have been considered to solve the need?
- Is it technical, economical and environmentally viable? The rights of way are available?
- What are the components of the project? ¿Does It require complementary public works?
- Is the optimal time to start the project?
- Is the optimal size and scale?
- What are the main risks and how to control them?
- What is the impact in the transport network? ¿Is there a program to replace/ or reordering the transport operators routes?

#### a) What Costs and benefits are taken into account?

In some cases there's a lot of pressure to deliver results in projects that are not necessarily the best solution. In order to solve this issue the CBA tries to includes only those variables that are the most objectives, so the cost and benefits are well known and there's no controversy about them. The cost and benefits are as far as possible quantified and expressed in monetary terms. For example the comfort and safety conditions, accidents, service quality level are consider as no-monetary benefits so they are not taken into account. In the case of rural roads and other inter regional transport projects the impacts on local or regional economic development are consider as no-monetary benefits too. The CBA only consider social benefits, therefore it's not a financial evaluation

In general terms the costs and benefits are:

#### Costs

- Investment
- Maintenance
- Operation
- Re-investments
- Disruption cost

## Benefits

The main benefit is the reduction in transport costs (generalized cost of travelling). This applies for the direct users and in some cases to the indirect users whose benefit comes from a release of capacity in the transport network which helps to alleviate congestion and reduce the transport cost.

- Travel Time Savings<sup>2</sup>
- Vehicle Operating Cost Savings<sup>3</sup>
- Operation and Maintenance Savings
- Emission Cost Savings
- Salvage Value

## b) Structure of the Cost-Benefit Analysis

The general structure of a CBA is as follows

1. **Executive Summary.** Gives a global vision of the Project and describes the main components and characteristics.
2. **The “No Project scenario” and alternatives analysis.** Define the problem that needs to be solved, evaluates the proposed alternatives. Analyze what happens to transport costs if the project is not undertaken. It must consider measures to optimize the without project situation. This scenario must be properly defined before using it as the base case from which to measure incremental cost and benefits.
3. **Project Description.** Project is defined broadly to include what is the project’s purpose, what are the components, scale and scope of the project.
4. **Project Scenario.** Compare the optimized “no project” situation with the “project situation” to calculate the incremental benefits and costs.
5. **Project Evaluation.** Identifies the cost and benefits that are only associated with the project (and exclude those that would exist without the Project being undertaken). Measures the impact of costs and benefits streams on an incremental basis. Calculates

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<sup>2</sup> To calculate time travel savings there are different values of time depending on what is the travel purpose (business, leisure, freight, etc).

<sup>3</sup> World Bank’s Vehicle Operating Cost Model is used to calculate these savings.

the Social Net Present Value (NPV) and the Social Internal Rate of Return (IRR), using 12% as social discount rate.

6. **Sensitivity and Risk Analysis.** Measures the impact of changes in the main variables on NPV and IRR. It answers the question, what are the main risks and how can they be managed?

7. **Recommendations.**

### c) Specific Methodologies

There are specific methodologies to facilitate and promote transparency and uniform criteria to evaluate the costs and benefits of each type of transport mode.

#### Highways

- Construction
- Modernization
- Road bypasses
- Road junctions

#### Rural Roads

- Productive roads
- Connectivity roads

#### Railway projects

- Rail bypasses
- Rail terminals' reallocation

#### Massive Transport Projects

- BRT's Bus Rapid Transit
- Light rail train
- Interurban train

## **Methodology for Massive Transport Systems (BRT's, Light rail train, interurban railroad)**

The main elements analyzed in this type of evaluation are:

### Supply (Characteristics of the current Transport System)

- Operating hours
- Number and total capacity of all transport modes
- Age of vehicle fleet, and its costs of operation and maintenance
- Existing routes that provide the service (distance, number of lanes, etc.)
- Travel time by route, and traffic light system's description
- Route section
- Number of stops, their location and the distance between them (preferably present a diagram)
- Frequency of transport by congestion Schedule (high, medium and low)

### Demand

- Origin and destination of passengers
- Classification of passengers by travel's motivation
- Amount of user's time
- Estimated average number of passengers up and down daily and the distance traveled by the time of congestion (high, medium and low)
- Average occupancy rate of each transport mode by congestion schedule.

### Supply and Demand Interaction (What is the Problem?)

- Higher transport costs because of low speed of transport that mean more hours for transportation
- High operation and maintenance costs of public transportation by passenger
- Inefficient transport system's operation (stopping in prohibited places, not allowed use of lanes, per road signs), which causes an increase in transport cost of private vehicles

### Benefit Identification

- Benefits for a shorter travel time spent by passengers carried by
- Benefits for the reduction of pollutant emissions to the environment (intangible)
- Reduced operating and maintenance costs by using more efficient technologies with higher capacities

- Benefits for shorter travel time, operating and maintenance costs get by the vehicles that move on a path that was decongested by the project.
- Earnings per release of resources, by recovering the value of the units that have finished their useful life, even that is realized when the Project goes into operation
- Salvage value at the end of project evaluation horizon.

### **Potential Development of Project Assessment Procedures**

Mexico is currently carrying out an effort to improve the quality of public investment. In this process the UI will play a more active role starting from the conception of alternatives to solve a transport problem until the definition of the project and its evaluation; it will delve deeply into risk analysis and in the determination of the best financing scheme either through pure federal expenditure or Public - Private Partnerships.

This effort seeks to strengthen the role of UI:

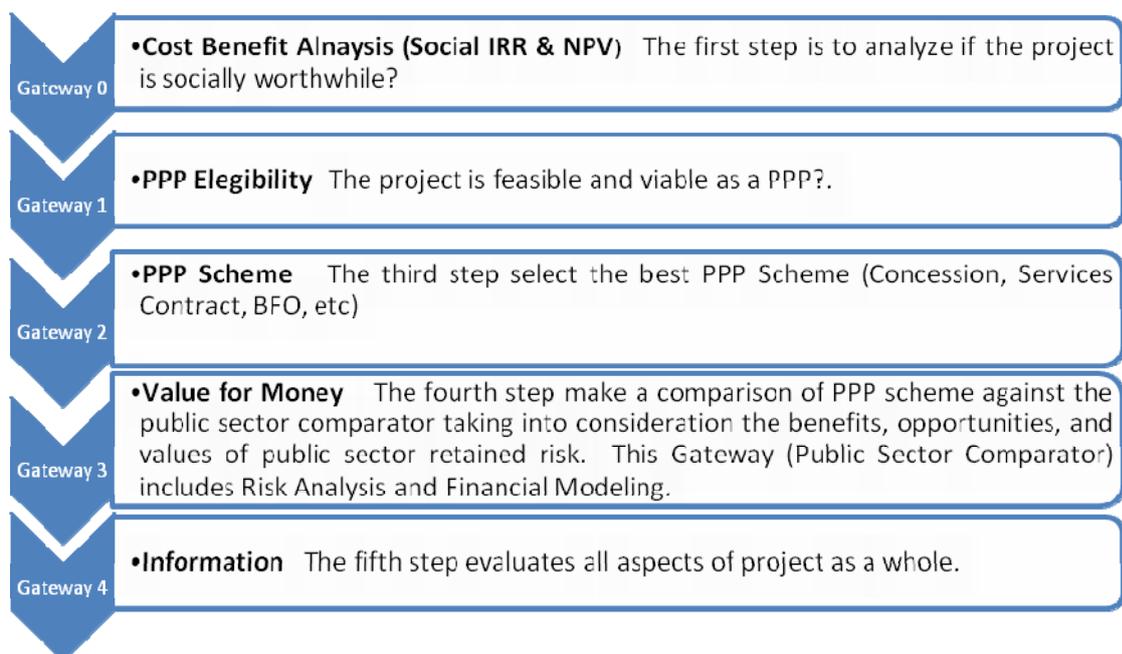
- To form specialized teams
- To follow the project's evolution
- To help in defining the scope and size of major projects in earlier stages
- To focus the attention in major projects
- Deeper risk analysis

To consolidate these efforts the UI is formulating and working on three new approaches to evaluate a PPP project:

- a) Gateway process review
- b) Eligibility index for PPP's
- c) A new methodology for the whole investment cycle (not shown here)

#### Gateway Process Review

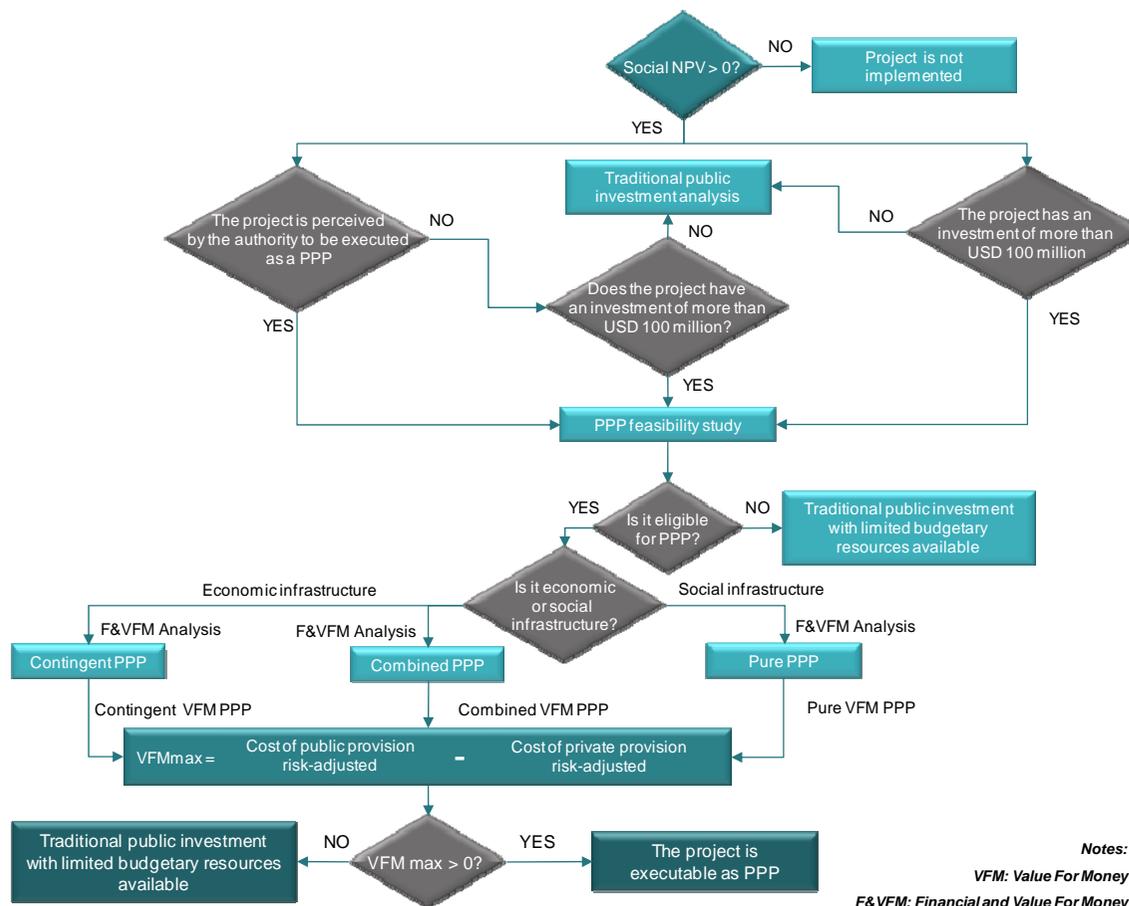
There's plenty of room to improve the PPP analysis through a gateway process reviews. Through all these gateways the UI will seek to get the best VFM for PPP projects.



**\*/ this is a preliminary version (still work in progress)**

#### PPP's Eligibility index

The UI is working on a new methodology to strengthen the identification and selection process of PPP's projects. The first requisite is preparing a CBA and identify if the project is socially worthwhile.



\*/ this is a preliminary version (still work in progress)

## Conclusion

In recent years Mexico has strengthened the institutional framework and the proceedings of the different stages of the investment cycle through changes in law:

- The obligation in the Federal Law of Budget and Financial Responsibility (LFPRH) to present and get the UI's approval of Cost Benefit Analysis as prerequisite to access public funding.
- The proceedings for project prioritization for their inclusion in the Budget of Expenditure Draft considering social profitability, regional development and synergies, among other criteria by the Inter-ministerial Commission for Financing and Expenditure (CIGFD).
- The constitution was amended to include the possibility of multiannual investment outlays for bigger infrastructure projects.
- The implementation of the Investment Portfolio System (every request for CBA approval it has to be made by internet, no paperwork is necessary).
- Clear guidelines and parameters for the evaluation of costs and benefits in specific methodologies for different transport sectors.
- A PPP Law.

There is room to make improvements in the use and role of CBA in the decision making on transport infrastructure, mainly to foster its use in the earlier phase (planning stages). The big challenge is to involve more key actors in the use of CBA in this process.