# Methodology for socioeconomic impact assessment of phytosanitary measures and application Guide

COSAVE

STDF Standards and Trade Development Facility

IICA

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# INDEX

# ACRONYMS

| | |
|---|---|
| **COSAVE** | Southern Cone Plant Protection Committee (COSAVE by its acronym in Spanish) |
| **DAC** | Development Assistance Committee |
| **DGSA** | Dirección General de Servicios Agrícolas from Uruguay |
| **GATT** | General Agreement on Tariffs and Trade |
| **IBRD** | International Bank for Reconstruction and Development |
| **IICA** | Inter-American Institute for Cooperation on Agriculture |
| **IMF** | International Monetary Fund |
| **IPPC** | International Plant Protection Convention |
| **MAPA** | Ministério da Agricultura, Pecuária e Abastecimento from Brasil |
| **MEIS** | Socioeconomic Impact Assessment Methodology (MEIS by its acronym in Spanish) |
| **NPPO** | National Plant Protection Organization |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PRA** | Pest Risk Analysis |
| **RPPO** | Regional Plant Protection Organization |
| **SAG** | Servicio Agrícola y Ganadero from Chile |
| **SDF** | Secretaria de Defensa Agropecuaria from Brasil |
| **SENASA** | Servicio Nacional de Sanidad y Calidad Agroalimentaria from Argentina |
| **SENASA** | Servicio Nacional de Sanidad Agraria from Perú |
| **SENASAG** | Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria from Bolivia |
| **SENAVE** | Servicio Nacional de Calidad, Sanidad Vegetal y de Semillas from Paraguay |
| **SPS Agreement** | Agreement on the Application of Sanitary and Phytosanitary Measures |
| **STDF** | Standards and Trade Development Facility |
| **UN** | United Nations |
| **USAID** | United States Agency for Cooperation |
| **WTO** | World Trade Organization |

# I. INTRODUCTION

Several international studies, as we will present throughout this document, already provide evidence of the economic and social impacts of phytosanitary measures for the control of various pests. Therefore, it is important to emphasize that phytosanitary measures do not constitute an expense or merely a cost to the public sector. Quite the contrary, they represent an important investment to ensure the sustainable development of agricultural production, marketing and export of countries.

However, it is up to organizations to demonstrate socioeconomic returns to society. Measures that are not monitored and evidence-based in terms of their cost-efficacy and their economic and social returns can be questioned in the medium to long term. In this context, the standardization of practices of assessments of phytosanitary measures contributes to the demonstration of its returns and impacts and must be incorporated in the routines of implementation of these measures.

This is even more significant with the reduction of public budgets in several countries for activities that are even considered priorities, such as health and education. With the scarcity of resources, stakeholders seek evidence, increasingly significant, of the real need for public measures of phytosanitary control.

Impact assessment is a major challenge as it should measure its actual contribution to society. In addition, it is known that the indicators to be used depends on the type of intervention that is being developed to reduce the risks of dissemination of specific pests. However, best practices serve as tools for the construction of impact assessment cycles. That is, there is no way to standardize content, but rather to use the concepts and assessment tools already widely recognized in the international literature.

The Plant Protection Committee of the Southern Cone (COSAVE in spanish) is a Regional Plant Protection Organization (RPPO), which was created by an agreement among the governments of Argentina, Brazil, Chile, Paraguay and Uruguay with the subsequent inclusion of Peru and Bolivia. It operates as an intergovernmental coordination and harmonization of actions that seek to solve phytosanitary problems of common interest for its Member Countries and strengthen regional phytosanitary integration [1].

COSAVE promotes the adoption of impact assessment mechanisms. Therefore, Project STDF / PG / 502 "COSAVE: regional strengthening for the implementation of phytosanitary measures and market access", has as one of its outputs the generation of tools and strengthening of capacities to evaluate the impact of the phytosanitary regulation that the countries apply to maintain or improve the phytosanitary condition, consequently improving access to markets and commerce.

This manual proposes the use of the Socioeconomic Impact Assessment Methodology and the Application Guide as a tool by public managers in their countries for the implementation of impact assessment of phytosanitary measures. It is intended

1 Official site Recovered (17.10.2018): http://www.cosave.org/pagina/bienvenidos-al-comite-de-sanidad-vegetal-cosave

for all of those who coordinate the monitoring and evaluation procedures of the pest control systems.

This document aims to present the structure and the step-by-step process of implementation of socio-economic impact assessment cycles targeting phytosanitary measures.

A logical subdivision was used for this document, starting with a contextualization on impact assessments for phytosanitary measures and the definition of internationally established standards for impact assessments.

The second part presents the structure of the socioeconomic impact assessment methodology for phytosanitary measures, including the process towards the development of a complete cycle of an impact assessment. It also defines the main evaluation components to be adopted for the standardization of evaluative practices for specific phytosanitary measures.

In the third part, there is an Application Guide with the main steps to carry out the assessment defined in the methodology: construction of a logical framework, preparation of forms for data collection, definition of data collection strategies and formulas for analysis of cost-efficacy (management), cost-benefit (economic) and equity (social).

Throughout this third part, examples identified in the international literature, including some from the health sector, are presented so readers can have examples of the actual application of the impact assessment concepts included in this manual. The bibliography used is also presented at the end of the document for further references.

At the end of the guide, a glossary is presented with the main concepts, terminologies and references and the bibliography.

# II. CONTEXT AND IMPORTANCE OF IMPACT ASSESSMENT FOR PHYTOSANITARY MEASURES

The United Nations (UN) was created in 1945 after the end of World War II by countries that volunteered to work for world peace and development. One of the characteristics of the post-World War II period is economic liberalization and with this, it was necessary to create an institution with the objective of regularizing multilateral international trade. Therefore, during the creation of the UN, two other economic institutions were founded: the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IBRD). Furthermore, since 1947 and after several rounds of negotiations, the General Agreement on Tariffs and Trade (GATT) was used as the basis for the creation of the World Trade Organization (WTO) in 1995.

During that same year, the Agreement on Agriculture was reached, which sought to guide market policies and reform trade targeting agricultural products. Also, at that same time, the Agreement on the Application of Sanitary and Phytosanitary Measures began to define and established the criteria to guide governments in the adoption of sanitary and phytosanitary standards, to protect human health, animals and plants and reduce barriers to trade.

The mechanism responsible for standardizing plant health is the International Plant Protection Convention (IPPC), which is a multilateral treaty that includes the International Standards for Phytosanitary Measures[2] (ISPM). Based on these measures, country members cooperate to combat and prevent the spread of plant plagues and their products and agree to implement phytosanitary measures that are technically strong and should not be used as technical barriers to international trade.

Phytosanitary measures[3], by definition of the IPPC, are any official legislation, regulation or procedure intended to prevent the introduction and/or dissemination of quarantine pests, or to limit the economic impact of regulated non-quarantine pests. One of the principles of the SPS Agreement is harmonization of norms, in which its members agree to adopt phytosanitary measures that are based on international standards, guides and recommendations. This promotes a single standard, resulting in more transparency and comparability during commercial negotiations. Each SPS member has its National Plant Protection Organization (NPPO) which is responsible for national phytosanitary regulation and enforcement.

NPPOs from geographically neighboring countries can merge and create a Regional Plant Protection Organization (RPPO) with the main objective of harmonizing phytosanitary measures and procedures and promoting integrated activities to define and attempt to solve phytosanitary problems of common interest for all Member States. One example is the Plant Protection Committee of the Southern Cone, the Cosave[4], formed by the NPPOs of Argentina, Bolivia, Brazil, Chile, Paraguay, Peru and Uruguay.

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2 Available in: https://www.ippc.int/en/core-activities/standards-setting/ispms/

3 IPPC - ISPM nº5: Glossary of phytosanitary terms, Rome, FAO; 2009.

4 Official Site recovered (17.10.2018) COSAVE: http://www.cosave.org/pagina/bienvenidos-al-comite-de-sanidad-vegetal-cosave

Quarantine pests are classified as *absent* and *present. Absent* quarantine pests are those that are not yet present in the country or in a particular risk area, but if they are introduced to that country or area have the potential to cause significant economic damage. The *present* quarantine pests are those of economic importance that have been already introduced, but are not widely disseminated and can be controlled under official norms and regulations. There are also *regulated* non-quarantine pests, which result in significant damage to plans with significant economic impact.

For all pests, phytosanitary measures are then established. According to the concept suggested above, they are created for both pests that are present in the country and those that are absent, provided they have been regulated by the NPPO. Moreover, in order to establish these measures and to guarantee an adequate level of protection, it is necessary to take into account the potential damages caused by the presence of the pest. Some of these damages include a decrease of productivity and an increase of the cost of production, increase of the price of the products, closure of production sites, disruption of productive chains, raise of restrictions to international trade, reduction in exports, and market closure for local products.

Generally, for a pest to be regulated, a scientifically based biological and economic assessment study is carried out called Pest Risk Analysis (PRA) in which the potential risk of economic damage and the intensity of the phytosanitary measures are assessed. It is common for this risk assessment to be made qualitatively based on consultations with specialists and bibliographic material that report on findings about pest's risks. These risks are classified as *high, medium* or *low* and rarely have any real and empirical measurement of economic impacts.

In the framework of STDF project are four outputs to strengthen the capacity of phytosanitary measure implementation: 1) Strengthen phytosanitary surveillance (general and specific); 2) Strengthen the capacities of pest risk analysis; 3) Strengthen phytosanitary inspection and certification capabilities; 4) Evaluate the impact of the implementation of phytosanitary measures. These outputs condense the project aim that proposes to generate tools and develop capacities that allow the beneficiary countries to improve the implementation of their phytosanitary measures with a regional and novel approach[5].

Quantitative analyzes of the economic damage potential of pests can yield important information to assist NPPOs. This information may contribute to the decision-making process for the adoption or not of phytosanitary measures, to determine the intensity of these measures and allow a better strategic definition and budgetary planning. Also, it always relates to the objectives set by the IPPC: to prevent the spread of pests and to ensure that the adoption of measures has the least possible impact on international trade.

Although the advantages that economic and even social impact assessments may have in contributing to the improvement of the plant protection service and to the phytosanitary protection of the countries are widely recognized, it is also clear the difficulty of measuring these impacts broadly and accurately. Therefore, it is necessary the participation and collaboration of experienced professionals in the area of plant health and in the economic and social areas. It is also necessary the development of a database with reliable and constantly updated information to foster decision-making.

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5 Official site STDF recovered (17.10.2018) http://www.standardsfacility.org/PG-502

According to the OECD Development Assistance Committee (DAC), define evaluation as:

> [...] a systematic and objective process for assessing a project, program or policy, its design, its implementation and results. It is aimed at determining the relevance and degree of achievement of objectives as well as its efficiency, efficacy, impact and sustainability. An evaluation should provide credible and useful information and enable the lessons learned to be incorporated into the decision-making process of beneficiaries and donors [6].

The definitions on program evaluation are diverse. They may have a more general approach or be depended upon the evaluative purpose. Therefore, the objective of the evaluation must be linked to clear goals and indicators, so that the evaluative modeling can be detailed and performed. Evaluative studies have the potential to generate knowledge for a broad and contextualized understanding of the programs, as well as for the analysis of the decision process, generating conditions for its governance and sustainability (Bodstein et al, 2006).

The actual mechanisms for and evaluative process can include different approaches, such as:

- Review and re-examine, with critical judgment, the rationale of the programs for their objectives and strategies, in order to overcome identified limitations;
- Compare the achievement of actual goals with those pre-established, identifying the reasons for success and failure;
- To verify the cost, efficacy and efficiency of the procedures used in the execution of the program and the quality of the managerial performance;
- Verify the economic efficiency and reduction of social differences provided by the program;
- Check the impact that the achievement of goals has brought to society.

On the other hand, the objective of the evaluation must be linked to clear goals and indicators, so that the evaluative modeling can be detailed and implemented.

Initially, the objectives of the project must be defined, as well as defined stakeholders and responsible professionals for each goal, in addition to the time needed to reach them. Next, information and indicators are defined and selected, which should be prioritized in order to meet the evidence demands from the main stakeholders of the initiative. The necessary data collection is then performed to answer the questions related to the indicators to be evaluated and the data are then stored and processed in order to be used for different analyzes. Information is analyzed, clarified and organized in order to assess if the results were achieved, identifying the best practices and pointing out correlations and changes that have occurred over time at the level of individuals, families, communities, groups or institutions. Finally, these results of the analysis are communicated to the stakeholders of the project in the form of written reports, presentations, workshops, etc.

In this sense, the questions that should be verified in this evaluation find support in Owen (2006), when it makes clear that the evaluation of programs does not only

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6 Official site OECD recovered (17.10.2018) http://www.oecd.org/dac/evaluation/dcdndep/35882773.pdf

cover the offer or coverage of services provided by a program. For the author, the most common issues are:

**a_** Has the program been implemented as planned?

**b_** Were the planned objectives achieved by the program?

**c_** Are the needs of the public served fulfilled by the program?

**d_** What were the unintended results?

**e_** Which implementation strategies should be accountable for what impacts?

**f_** How can differences in implementation affect program outcomes?

**g_** What are the benefits of the program, given the costs?

In addition, some international standards have already been established with the aim of standardizing the quality of evaluations. The DAC-OECD Evaluation Network in its Quality Standards for Development Evaluation lists some key features of best practices[7].

**Meeting the expectations of stakeholders**

- The assessment meets the requirements of the contract and the expectations of the work plan;
- The evaluation incorporates a set of standards and indicators that meet management expectations.

**Build value added**

- The evaluation contributes with a greater focus to the programming and to the priority areas of action;
- The evaluation contributes to the development effort, informs the decision-making in a timely manner and promotes learning;
- The evaluation presents and articulates the results in order to facilitate the understanding by the partners/stakeholders;
- The evaluation presents useful results, pragmatic recommendations and lessons learned through a participatory process that actively involves all stakeholders.

**Quality of results**

- The evaluation produces credible results, using appropriate design and rigorous methods;
- The evaluation demonstrates impartiality and objectivity, always maintaining the principles of independence, neutrality and transparency.

7 See document recovered https://www.oecd.org/development/evaluation/qualitystandards.pdf

**Cost benefit**

- The evaluation shows added value for the Organization, for the communities and target groups;
- The evaluation reflects the fair use of human, financial and physical resources.

## EVALUATION IS NOT AUDIT

Prior to the presentation of the impact assessment methodology, an important caveat should be made about the existing confusion between evaluation and audit. It is always good to remember that evaluation is not audit. While the *audit* is established by verification procedures if an organization has implemented a project or action within the established norms, rules and regulations (often in the form of a law), for example, for the use of resources, *evaluation* is an instrument which provides key inputs for improving the implementation of public policies and demonstrating their results and impacts.

## ETHICS DURING THE ASSESSMENT PROCESS

Even taking into consideration that the evaluation is not based on pre-established organizational norms (as in the case of the audit), it is worth remembering that there are international norms and conventions of ethics in evaluative research. These standards and conventions are fundamentally based on procedures that reduce the potential for bias during the evaluative cycle. The evaluation bias can occur at any time, from the definition of objectives and indicators, during the data collection and finally in the final assessment of the impacts. The evaluation cycle should focus on improving management procedures to ensure greater cost-efficacy of standards and contribute to decision-making.

Therefore, any manipulation or misrepresentation of the evaluation procedures can directly affect the results of the evaluation and bring conclusions that do not reflect reality. The consequences can be devastating, such as imbalance in the use of resources to unnecessary areas, taking resources from other areas considered fundamental, overweighting the impacts, excessive mobilization of phytosanitary agents, unnecessary expenses, among others.

# III. SOCIOECONOMIC IMPACT ASSESSMENT METHODOLOGY
## (MEIS BY ITS ACRONYM IN SPANISH)

Based on scientific principles, MEIS is an impact assessment methodology, created by JS/Brasil and adapted to the needs of the COSAVE project, which makes a wide and innovative assessment of social programs and policies, analyzing three spheres of performance: financial, economic and social. The methodology incorporates different internationally recognized assessment techniques, such as the logical framework theory of the US Agency for Cooperation (USAID)[8] and the economic projection models of J. Price Gittinger[9] for projects in the agricultural area. In addition, it incorporates different elements of methods of economic valuation of development banks such as the World Bank. Measurement of impacts based on social indexes is also incorporated and uses equity analysis metrics (eg. Hoover index)[10].

**Target Audience:** any initiative that has public policy strengthening objectives and that meets at least one of the following prerequisites can be assessed by MEIS:

**a_** to foster knowledge, attitudes and practices

**b_** to increase the standardization and standards for the implementation of public policies

**c_** strengthen cognitive domains of target audience.

**Necessary investment:** 10% to 15% of the total implementation value of a new policy.

8 Pereira, M. S. A. (2015). A utilização da matriz lógica em projetos sociais Pesquisas e Práticas Psicossociais, 10(2), São João del-Rei, julho/dezembro 2015.

9 Gittinger, J. P. (1992) Economic analysis of agricultural projects. The Johns Hopkins University Press. Maryland, USA.

10 United Nations. Development Strategy and Policy Analysis Unit. Development Policy and Analysis Division Department of Economic and Social Affairs Inequality Measurement Development Issues No. 2. October, 2015.

MEIS measures and identifies the transformations promoted by a new policy into four macro-steps represented in the flowchart and described below:

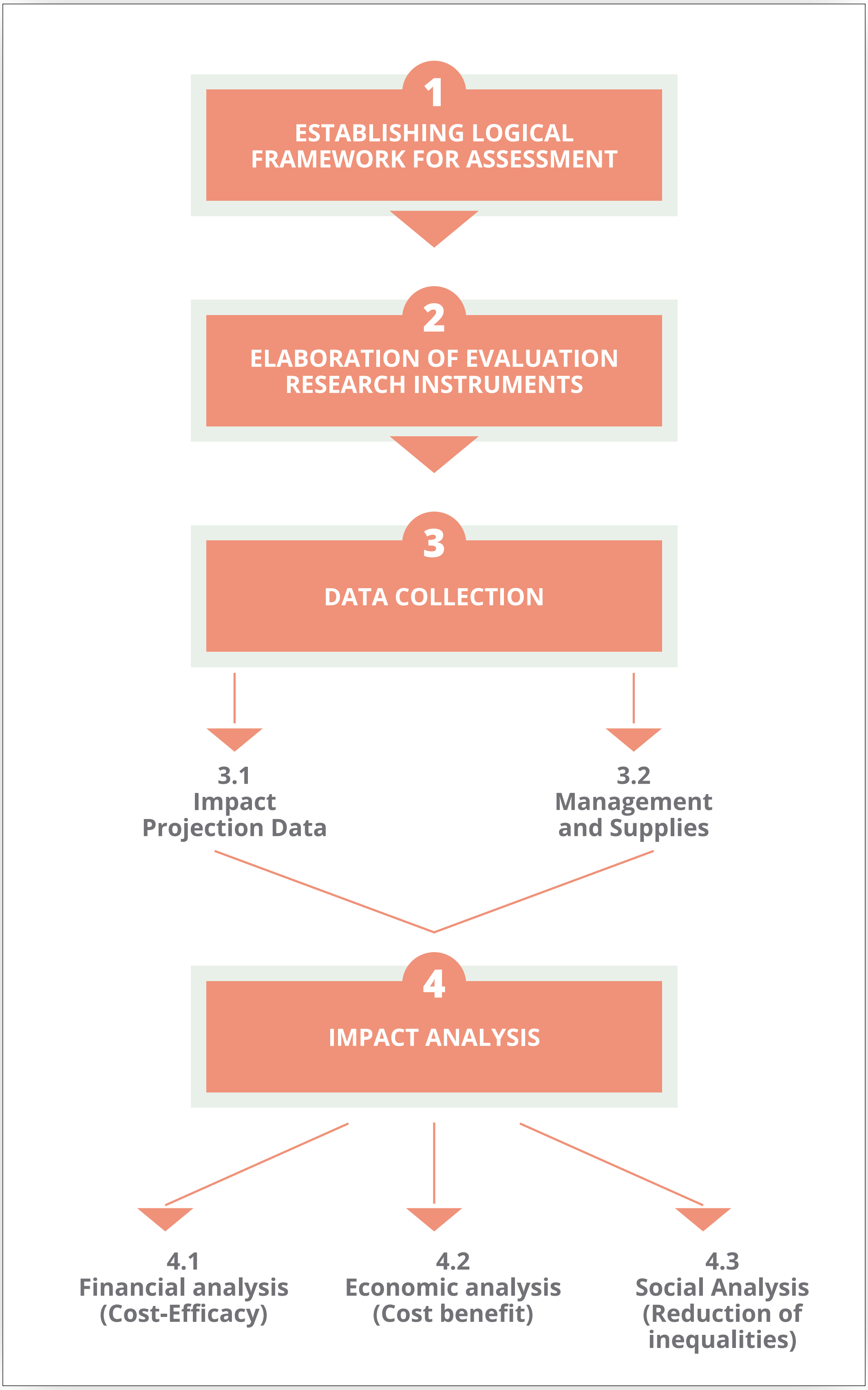



**Figure 1:** Diagram Socioeconomic Impact Assessment Methodology

## STAGE 1. CONSTRUCTION OF THE LOGICAL FRAMEWORK

The first step in the elaboration of an assessment process based on the MEIS is the definition of the logical framework, a tool that helps to follow the steps of the implementation of a public policy. In the logical framework, all the objectives, goals, indicators, means of verification and risks of implementing the policy, as well as its inputs, activities and products must be defined.

At this stage, a workshop is held to elaborate the logical evaluative framework of the phytosanitary norm to be evaluated. Collaboration with the team of a specific phytosanitary measure managers and other important partners should be carried out to elaborate the logical framework. In this logical framework, objectives, targets, indicators and means of verification will be defined that will foster the elaboration of the research/collection instruments that will be used in the assessment.

The logical framework is a management tool used to evaluate projects, programs and policies. It is a matrix in which objectives, goals, indicators, sources of verification, risks, inputs, products and activities are interrelated. It was developed in the 1970s by the USAID to respond to three common problems in public/social projects and policies (Adulis, 2002):

- Project plans were inaccurate and contained multiple objectives that were not related to project activities;
- Difficulty in determining the extent of managers' responsibility in the event of project failure; and
- Lack of clarity about the expected results of the project, making it difficult to compare and evaluate.

Currently, a number of international cooperation agencies use the logical framework, especially with the aim at having greater control over the efficacy of the programs they support, that is to make sure that the variations in financial, human and infrastructure costs planned and used are not significant.

**Table 1:** Matrix with the main elements of the logical framework

| Objectives | Strategies | Targets | Means of Verification | Risks and Assumptions |
|---|---|---|---|---|
| General or Impact Objective | | | | |
| Specific Objectives | | | | |

## STAGE 2. ELABORATION OF ASSESSMENT RESEARCH INSTRUMENTS

This stage consists of the elaboration of questionnaires, spreadsheets and instruments for the search of scientific evidence that will be answered by users, (policy managers, traders, exporters, transporters, warehouses) and literature reviews (eg. impact potential of pests).

The questions for users are based on the retrospective/prospective projection of pest impacts (with and without a given policy), which in turn are based on the goals and general objective outlined in the logical framework. The questions can assess the situation found in two moments: before the implementation of the new policy (ex-ante analysis) and after its implementation. The two surveys include the exact same questions. Thus, it is possible to measure the impacts projected by the new policy, that is, what changes were observed

The questionnaire for this analysis includes two parts: the first, of a socioeconomic nature, contains data such as production, productivity, areas worked, etc. The second one asks questions about the potential impacts of the problems that the new policy intends to remedy or avoid. The answers provided will help to set up the phytosanitary projection model of policy impact, that is, the changes promoted or situation preserved by that initiative in the life of the target populations and the production capacity of a given geographic area. It will clearly point out and measure the efficacy and efficiency of various activities.

In addition to the impact data collection, it is also necessary to collect data with policy managers. These data are important for management reviews and the assessment of economic impact. The questionnaires must be answered by all organizations involved in the implementation of phytosanitary measures. In different tables, managers need to indicate in detail all expenditures made with inputs, the scope of the measures they are responsible for, among others. Some input data will also be surveyed in the marketplace so that it is possible to make a comparison to check for price market distortions.

## STAGE 3. DATA COLLECTION

The collection of data on phytosanitary epidemiology is carried-out with information generated by the scientific literature and on the basis of the existing data systems of the countries. In many cases, this survey is performed by agents who collect field data in their daily routines. However, this information may come from the private sector and civil society. In addition, scientific data based on international literature reviews are essential to obtain projections on pest impact.

The data of the assessment instruments of management and inputs are collected in two distinct moments (planning and post-implementation of measures) at the cost centers responsible for carrying out the interventions. It is worth mentioning that it may be necessary to incorporate other instruments and data collection procedures, such as for measuring satisfaction of stakeholders. This will all depend on the elements defined in the logical framework.

## STAGE 4. IMPACT ANALYSIS

In line with the most modern international assessment best practices, MEIS identifies the impact of public policies in three different levels: financial, economic and social. A quick description of each level follows:

- **Financial Analysis (cost-efficacy):** identifies performance and possible bottlenecks in policy planning and management, taking into account the specific objectives, inputs, and goals set out in the Logical Framework.
- **Economic Analysis (cost-benefit)**: seeks to measure how much policies are generating economic gains to society and government and how users from the productive sector will recognize the importance of the norms established by a new policy. The guiding question is: how much each monetary unit invested generates in economic returns to the society, government and the productive system? Ultimately, the goal is to uncover the wealth generated by the program. The analysis is based on a first step that adjusts the financial costs to incorporate opportunity costs and adjusts financial costs to market price distortions vs. those practiced by the measure and applies different discounting factors. This should be carried-out for each of the cases studied individually. In the second step, projections of possible losses of productivity are made according to the level of risk of propagation of the pest and the calculation of the economic benefits of the measures. Finally, the assessment will define a benefit-cost ratio of the measure, including its internal rate of return and the net present economic value for society.
- **Social Analysis (equity)**: the third and final analysis of the methodology aims to demonstrate the impact of the policy on the social structure and quality of life of the most vulnerable groups. The study measures the situation of the beneficiary population before and after the new policy and compares the results obtained with indicators of social inequality. An equity index is created to see how the implementation of a new policy impacts the most vulnerable populations or regions, reducing socio-economic inequalities. These vulnerabilities have to do with the economic (eg., labor and unemployment) and social (eg., type of families that live in agricultural units most affected in the region) profiles.

## COMPLEMENTARY STAGE. STAKEHOLDER COMMUNICATIONS

With the information and data obtained in the assessment process, a communication strategy of the assessment to various stakeholders should be established. The impacts coming from the financial, economic and social analysis will allow coordinators of the assessment process to define the main priority communication hooks for each stakeholder audience. For example, for entrepreneurs and government, the data that are frequently the most interesting relate to economic returns; for managers and agricultural agents, it is important to focus on the efficacy gaps, and so on.

At this stage, the quality standards undertaken during the assessment process is translated for each stakeholder with information about the impacts of the measures and the performance of the institutions responsible for their implementation. Communication strategies will facilitate an integration between the scientific knowledge acquired during the assessment process and its effective use for the improvement of the program or policy.

# IV. MEIS APPLICATION GUIDE

Based on the concepts and steps described for the implementation of the MEIS of phytosanitary measures, the following diagram was developed:

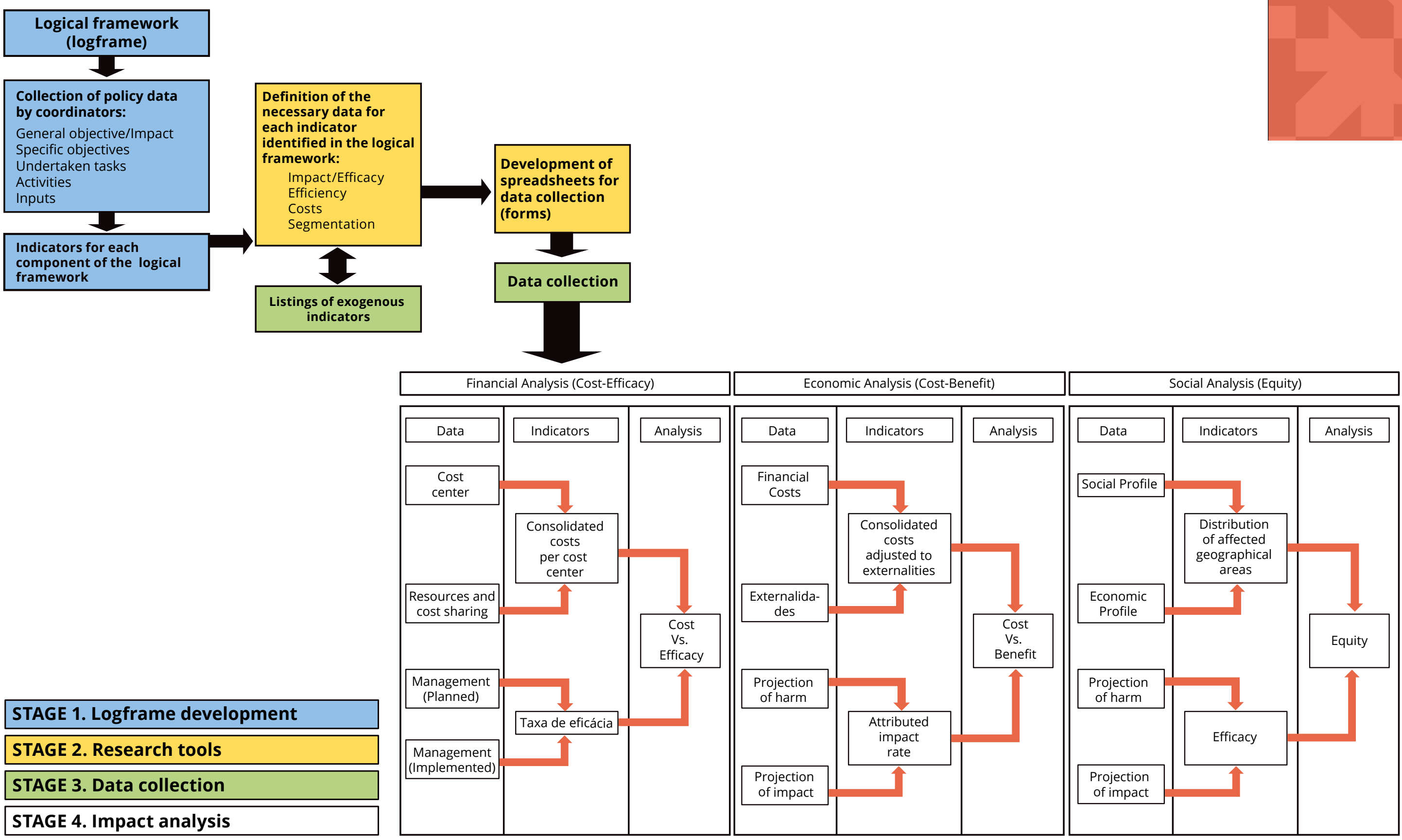
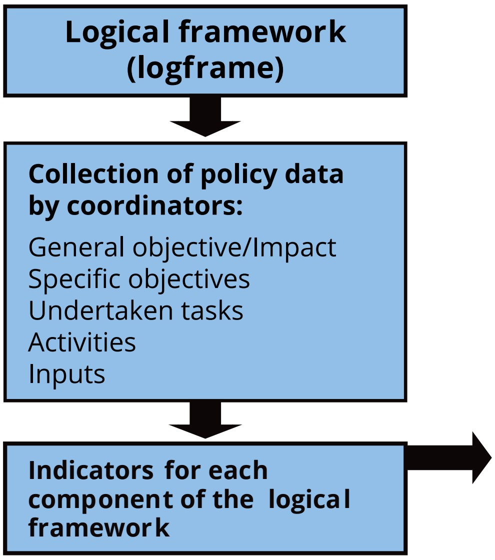



**Figura 2. Diagram of implementation of the Socioeconomic Impact Assessment Methodology**

In this diagram, the four fundamental stages of MEIS are disaggregated to indicate the most important steps of your application. For stage 1, defining the Logical Framework of the measure, an indication of the most important steps is in blue. For stage 2, creating the data collection forms, the steps are set are in yellow. For stage 3, collection of endogenous and exogenous data, the steps are in green. And finally, for stage 4, the financial, economic, and social analyzes, a specific box was created for the descriptions of three fundamental sub-steps: 1) the definition of the data needed for the analyzes; 2) the composition of the indicators needed for the analyzes; and 3) the calculation of financial, economic and social analysis.

## STAGE 1. PROCESS FOR THE DEVELOPMENT OF THE LOGICAL ASSESSMENT FRAMEWORK

The process for the development of the logical framework begins with the organization of a working group to discuss the main general and specific objectives of the measure to be evaluated. It is then recommended to hold a two-day workshop, with representatives of all stakeholders to define goals and indicators that should be correlated to those goals. The final output is a report including all contributions to the definition of objectives, targets and indicators and the final correlation matrix of the logical framework.




### 1) ORGANIZATION OF A WORKING GROUP

The coordinators of a new phytosanitary measure should organize a working group to define the general and specific objectives of a phytosanitary measure. This group can communicate by virtual means of communication (example: Trello[11]). However, the active participation of all members of the group is essential. In the virtual channel of communication, it should include reference documents on the measure, forums for discussion on guiding questions to define the objectives, and the definition of responsibilities for coordination and a schedule of activities.

### 2) ORGANIZATION OF A LOGICAL FRAMEWORK WORKSHOP

After the organization of the working group and preliminary definition of the general objective of the measure (impact) and its specific objectives (results), a workshop of 16 hours, with representatives of the main stakeholders (Secretariats of government, international body, private sector, civil society, etc.) should be organized. It should be clear that this workshop is not for specific discussions of the measures.

11 Trello is a web tool for project management. Recovered from https://trello.com/home

The focus should be given on the final overall definition of the impact objective and specific outcome objectives and, respectively, their goals, indicators and means of verification.

### 3) AGENDA AND DYNAMICS OF THE LOGICAL FRAMEWORK WORKSHOP

The workshop should take place in a space that enables accommodating a maximum of 20 representatives, two moderators and should include the following agenda items:

FIRST DAY

**1**_ Introduction about the objectives and purposes of the workshop.

**2**_ Presentation of all participants.

**3**_ Rationale on the matrix of the logical framework and indicators.

**4**_ Discussion about the difference between impact objectives and outcomes.

**5**_ Definition of the general impact objective. In this item, the moderators should request that each participant individually write their understanding of the impact objective of the phytosanitary measure on a sheet of paper.

**6**_ Include all contributions to a computer and project them to participants. Moderators should read all contributions.

**7**_ Group consensus discussions regarding the definition of a general impact objective.

**8**_ Following the definition and consensus on a single overall objective, the targets, indicators and means of verification should also be discussed for the overall objective.

SECOND DAY:

**1**_ Listing and projecting specific suggested outcome goals.

**2**_ Definition of the main specific objectives.

**3**_ Following the definition and consensus on the list of specific objectives, their respective targets, indicators and means of verification should also be defined.

### 4) ELABORATION OF THE LOGICAL FRAMEWORK REPORT

With the completion of the logical framework matrix by the group, the facilitators should prepare a final report and pass it on to the participants for future comments, adjustments and suggestions. The final report is the first product of the evaluative cycle, but will also be used as a reference of the phytosanitary measure for future consultations.

## WHAT IS A LOGICAL FRAMEWORK?

The Logical Framework can be compared to a guide that indicates the best approach and inputs needed to arrive safely at a successful implementation of a policy. In reality, it interrelates several key components of an assessment cycle, such as:

- **General objective:** indicates the desired impact, ie the long-term situation to be achieved
- **Specific objectives:** are linked to the responsibilities of the managers involved in the process and can be structured according to the components of the program
- **Goals:** they give the quantitative reach of each managerial aspect of the program. Goals are fully linked to the general and specific objectives
- **Indicators:** work as a quantitative indication of a clear metric that allows managers to follow best practices and approaches. Based on these indicators, managers will know if they are moving in the right direction and how efficiently they are. However, it should not be mixed with data or information (eg number of beneficiaries). An indicator is composed of three fundamental elements: numerator, denominator and time specification.
- **Means of verification:** are tools that let managers know if the policy is being efficient along the way
- **Risks:** indicate the obstacles for implementing the assessment cycle

**What's its role at this stage?**

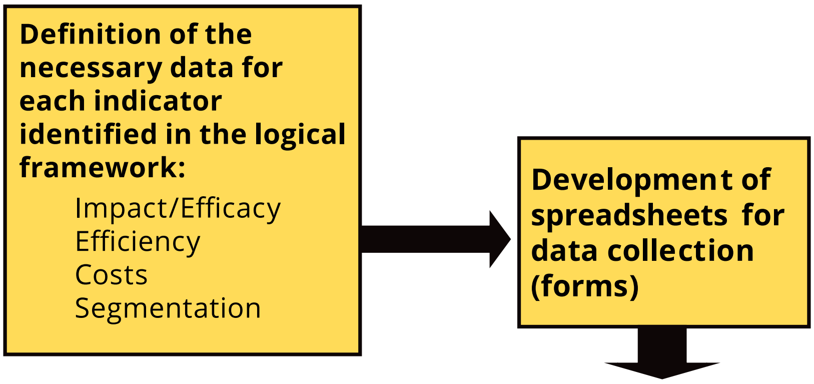
Creating the logical framework is one of the most important milestones in MEIS. Therefore, the participation of all managers and coordinators of the policy is essential. Considering only the experience of a director or coordinator can restrict and mislead indicators. This may create a significant bias in the subsequent stages of MEIS. Public managers are responsible for defining all the components of the logical framework. The evaluators facilitate the work of elaborating the logical framework and develop the final report with all the definitions.

**Duration:** On average, it takes one month to complete a logical framework. However, the greater the participation and interaction of the management team and other stakeholders, the faster the preparation of the final document.

**Team:** At least two facilitators should work in the workshop to assist and conduct the work. The participation of all the managers involved is crucial.

## STAGE 2. STEP-BY-STEP PREPARATION OF COLLECTION TOOLS (PHYTOSANITARY AND MANAGEMENT)

For the second step, based on the indicators established in the logical framework matrix, it is necessary to define the data that will be necessary for the composition of set indicators. That is, a breakdown of these indicators is necessary to define what data will be needed during the collection process. By defining all the necessary data, a form is generated for its effective collections according to the step-by-step procedures described below.




### 1) DEVELOPMENT OF PHYTOSANITARY DATA TOOLS

The instrument for the collection of phytosanitary measures must be subdivided into two parts:

**1_** Phytosanitary impact profile of the measure (control variables): It is necessary to define which crops and regions are being affected or will potentially be affected by the spread of a particular pest. The instrument should also include the search for socioeconomic information about the region and the affected agricultural culture and region. They should include questions about levels of production, marketing and export of potentially affected crops.

**2_** Diagnosis and phytosanitary epidemiology: Questions about the potential for pest spread and the current phytosanitary epidemiological conditions should also be included in the final instrument. Other questions related to the management indicators and targets established in the logical framework should also be included in the final instrument.

### 2) ELABORATION OF A MANAGEMENT TOOL

The management tool should include all indicators linked to the specific objectives of the logical framework. For example, if one of the indicators is rate of agents qualified for implementation of phytosanitary measures, specific cells should be included on the number of agents to be trained (denominator) and the number actually trained (numerator).

### 3) INSTRUMENT TESTING

Phytosanitary and management data instruments should be tested prior to data collection. The instruments should be socialized with the professionals involved in the implementation of the measure to check if questions are clear, simple and direct, avoiding a bias in the response. In addition, they should be shared with plant health managers and field workers to verify the validity and consistency of a baseline survey or a list of questions. With regard to validity, it must be verified whether the questions reflect the goals and indicators established in the Logical Framework. For consistency, it must be checked whether the information requested actually exists in the data systems of phytosanitary measures. If it does not exist, depending on the implementation of a new measure, the systems must be updated to include the new data fields necessary for the assessment.

#### SCIENTIFIC RIGOR

The phytosanitary data collection instruments are always pre-tested to verify the validity and consistency of the data. It is recommended that the pre-test be performed in at least one cost center. In addition to researching existing data systems, it is also necessary to collect data and inputs with policy managers. This information will be important for cost-efficacy analysis (management efficacy).

#### What's its role at this stage?

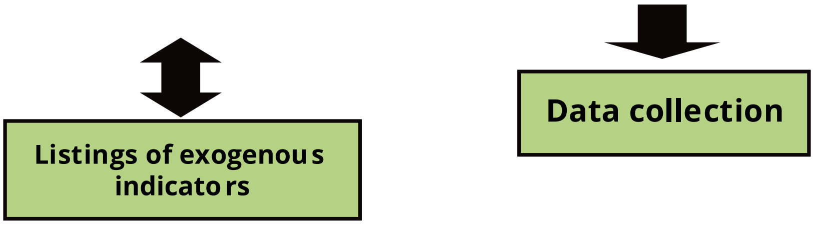
At least two coordination managers should attend face-to-face meetings with the evaluators to define these instruments. There is also a need for managers of all cost centers to review the instrument – those who will assist during data collection and can contribute to reviewing data collection tools.

**Duration:** On average, a month is required for this step. Participation of program managers is essential if deadlines are to be met.

**Team:** Two evaluators and two coordination managers should be mobilized for face-to-face work, during the data collection instruments elaboration state. Also, managers of the participating cost centers willing to contribute to the review of the instruments should also be mobilized.

## **STAGE 3.** STEP BY STEP DATA COLLECTION

As the indicators will always be related to impact and results, it is important to note that many exogenous data will also be needed. That is, data that are not in the control of the organizational body responsible for the implementation of phytosanitary measures. In many cases, exogenous data will be available in agricultural censuses,




sociodemographic studies of research institutes and other sources.

### 1) IDENTIFICATION OF EXOGENOUS DATA

These data are fundamental for economic and social analysis. Therefore, some of the data may be in epidemiological studies of a pest or in market price studies. Generally, exogenous data are multidisciplinary. The clear identification and separation of the data required in endogenous (controlled by implementing agency) and exogenous (controlled by other sources of information) is a fundamental step for data collection.

### 2) DATA COLLECTION

The process of data collection is based on the internal and external search of data that will lead to indicators being established in the logical framework based on the main sources of information. For endogenous data, financial and pest control departments should be contacted for information gathering. For exogenous data, research institutes and search engines for scientific studies should be the main sources of information.

### 3) DEVELOPMENT OF A DATABASE

At the end of the data search, a database with all the data collected must be generated. The database should include a clear classification of data that will be used for financial, economic and social analysis. They should also be correlated with the specific indicators set out in the logical framework.

### What's its role at this stage?

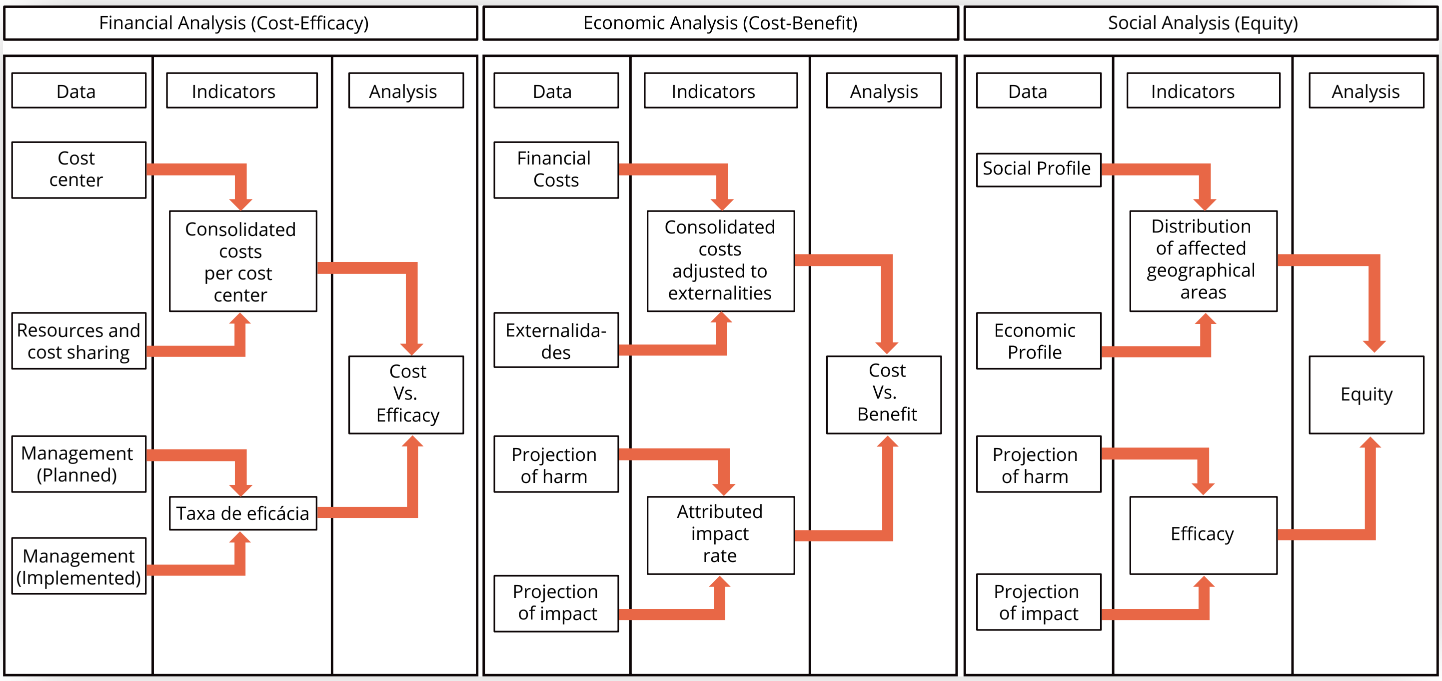
Again, manager involvement is key. First, this is important to ensure that two types of instruments are being filled out correctly: management and inputs data. Managers need to complete in detail all management items included in the instrument, based on the logical framework, and their actual expenditures during the implementation of the measure. Some data will be collected in the marketplace. This will help for comparisons in relation to the amounts paid by the management organization at each cost center of the program. Another important activity is the training of managers, who must be able to provide the information of the potential phytosanitary risk research data. Managers are also responsible for assisting in the analysis of the consistency of the database of the three surveys (impact, management and input data).

**Duration:** This is the most time consuming step of MEIS. The policy implementation period defines the interval between ex-ante and ex-post data collection. This period can vary from two months to one year on average. Of course, if the policy is already in action and the data is already available, its collection is immediate. In this same time interval, the data of the management research and inputs are collected. For this stage, as well as for all others, you can also work with time control tools and activities monitoring (eg GANTT diagram).

**Team:** The entire team of evaluators should be mobilized at this stage. Coordination/director also plays a relevant role. It is also necessary to have at least one responsible manager in each of the cost centers participating in the assessment.

## STAGE 4. FINANCIAL, ECONOMIC AND SOCIAL ANALYSIS

This stage is subdivided into two parts: one considering the type of analysis (financial, economic, and social) and another the level of analysis (data, indicator, and analysis). As shown in the diagram below, the analysis process should begin by defining the cost-efficacy of the measures, followed by the economic and social analysis. For each type of analysis, the flow should be based on the identification of the necessary data, the composition of the indicators and their correlations for a final analysis of the assessment results.



## Step-by-step for the elaboration of the cost-efficacy analysis (management linked to the specific objectives of the logical framework):

### 1. CALCULATION OF FINANCIAL COST

#### 1.a. Definition of cost centers:

The cost center must be clearly defined. In some countries, these cost centers are made up by representations of federal agencies that operate in specific provinces, municipalities or states; in other countries, by units of teams that are constituted for the implementation of a policy. For example, a school may constitute a cost center for an Education Department in a municipality. In another intervention, a community health team with a doctor, a social worker and a nurse can be a cost center for the implementation of a community health policy. In cases of phytosanitary measures for export and import, a cost center for cost-efficacy analysis may constitute phytosanitary units in ports and airports that will implement the measures.

#### 1.b. Verification of the financial values applied in the Cost Centers:

All values transferred to and used by these decentralized phytosanitary surveillance units should be identified If this is not the organizational structure of phytosanitary surveillance, other types of cost centers can be established, such as costs by teams of phytosanitary agents. It is very important to establish cost centers for a better comparison of the social and economic returns of the phytosanitary measure. The direct costs transferred to these cost centers must be identified.

#### 1.c. Allocation of headquarters costs

The value used to establish and monitor the phytosanitary measures of a central entity (eg ministry) should also be determined and include the costs of personnel, equipment, travel, etc. used to implement an overall supervision of the implementation of a measure. After determining the total costs of the measure at headquarters, the value should be proportionally allocated to different cost centers. The table below presents a hypothetical example of allocation of headquarters financial costs:

**Table 2:** Example of financial values applied in cost centers

| Cost Center | Amounts transferred to local entities (Cost Centers) | Proportion of total transferred | Total headquarters costs | Allocation | Total Value |
|---|---|---|---|---|---|
| Unit 1 | $100.000,00 | 28,6% | NA | $142.857,14 | $242.857,14 |
| Unit 2 | $250.000,00 | 71,4% | NA* | $357.142,86 | $607.142,86 |
| Total | $350.000,00 | 100,0% | $500.000,00 | $500.000,00 | $850.000,00 |

***** Not applicable

According to the above example, even if the amounts transferred to the units of cost centers were R $ 350,000.00, the aggregate amount reaches R $ 850,000.00. This is because out of the total amount transferred, 28.6% of the total was transferred to the decentralized unit 1 and 71.4% to unit 2. These same proportions are used to allocate all costs of the measure used by headquarters. Headquarters in this case made an investment of R $ 500,000.00 for the central administration of the measure. These costs are then proportionally allocated between the two cost center units. Therefore, the proportional allocation of headquarters costs is fundamental so that the financial costs are not underestimated.

### 1.d. Definition of the beneficiary unit

For a financial analysis per beneficiary unit, it is important to establish which type of unit of analysis will be used. For example, the number of hectares in the geographical area covered by sanitary measures can be used. In this case, if the phytosanitary measures are covered by a million hectares, in Unit 1 the coverage is 400.000 hectares and the Unit 2 600.000 hectares and based on the values with the headquarters allocation suggested, the following formula should be used:

> **Cost per hectare = Total Value (including allocation of headquarters costs)/Coverage in hectares**
>
> In this case, he cost of the measure is set at $ 0.60 (Total Value Unit 1 / Coverage hectares) per hectare in Unit 1 and $ 1.01 (Total Value Unit 2 / Coverage hectares) per hectare in Unit 2.

## 2. EFFICACY ANALYSIS

### 2.a. Establishment of the level of efficacy for all management indicators set out in the logical framework.

In this item, the level of efficacy is assessed for all the indicators defined in the logical framework, especially in the specific objectives and inputs, according to the target ceilings, that is, the maximum targets established by the program managers for each goal. For example, if the goal set for the training component of agents was 90% and if a cost center presents evidence of only 80% of trained agents, their efficiency level will be 80% / 90 % = 0,89. That is, the cost center reached only 0.89 point of the pre-established target. If it has reached a value equal to or greater than 90%, it will have reached 1,00 point of the pre-established target.

That is, efficacy measures the efficacy of the services and inputs planned for the implementation of the policy. The level of efficacy for the indicators by cost center is measured from the calculation of the rate of efficacy indicator. Indicator data should be provided by cost centers and efficacy target ceilings (for each indicator) should be agreed and defined in the logical framework.

### 2.b. Definition of averages of the level of efficacy for all cost centers

After measuring the level of efficacy of each indicator, the averages of the level of efficacy for each cost center are calculated, from the level of efficacy obtained in each of the management indicators.

The average efficacy rate per cost center is calculated from the average efficacy indicators established. Efficiency is defined by the goal of reaching the input established by managers at the lowest cost possible. Any variation (positive or negative) outside the range of variation in achieving this goal proportionally reduces the final efficacy indicator. The purpose of the rate of efficacy is to measure the ability to implement the necessary measures according to preset goals established in the logical framework.

**Efficacy calculation formula:**

TE = (CE / CI) / M

**Where:**

CI = Installed Capacity

EC = Capacity Made

TE = Efficacy ratio

**TIP 1:**

It is important to note that, in some cases, the Capacity is greater than the Installed Capacity. Also, in other cases, the Installed Capacity or Capacity is Zero. That is, there was no adequate planning of the indicator or the level of efficacy of the indicator was zero. In such cases, the formula needs to be adjusted in the following ways:

| | | | |
|---|---|---|---|
| If CI <CE, | then make TE | = | (CI / CE) / TM |
| If CI = CE = 0 | then make TE | = | Zero |
| If CI = 0 and CE> 0 | then make TE | = | zero |
| If CI> 0 and CE = 0 | then make TE | = | zero |

**TIP 2:**

When TE> 100%, it is necessary to adjust the rate to 100%. You cannot have a TE greater than 100% for the final aggregate analysis of efficacy.

M = Reaching goal established by the program's logical framework

After the calculation of the efficacy rate, the average efficacy rate per cost center is defined as the simple arithmetic mean of all the indicators analyzed in each cost center. For example, if there are 21 indicators of efficacy in management objectives, the formula will be:

$$efficacy\ rate = \frac{\sum_{i=1}^{21} I_i}{21}$$

**Where:** $I_i$ = Eficacy indicator for each management input

### 3. COST EFFICACY ANALYSIS (EFFICIENCY)

#### 3.a. Establishing the efficacy of the cost per unit of analysis in each cost center

In this step, the cost is adjusted for the loss of efficacy, that is, the cost of the cost center is divided by the efficacy rate to arrive at the management efficiency of each cost center. In other words, the lower the efficiency level, the greater the distortion of the original financial cost.

Cost efficacy measures how much the cost invested in phytosanitary measures was effectively "integrated" in its overall goals. The calculation of cost efficacy is equal to the average cost of each cost center divided by the rate of efficacy.

Using the previous example of cost-per-unit in Table 1 and taking into account that the level of efficacy found (% efficiency of planned management targets for implementation of the measure) in Unit 1 was 0.31 and Unit 2 was of 0.95, we would have the following cost-efficacy values:

**Table 3:** **Example of cost effectiveness per unit of analysis in each cost center**

| Cost Center | Total Value | Average Efficacy Index | Cost-Efficacy |
|---|---|---|---|
| Unit 1 | $242.857,14 | 0,31 | $783.396,77 |
| Unit 2 | $607.142,86 | 0,95 | $639.097,75 |
| Total<br>(joint analysis with the average efficacy index) | $850.000,00 | 0,63 | $1.349.206,35 |

It is interesting to note that in the example above, even Unit 1 having significantly lower costs than Unit 2, its low efficacy was so significant that it resulted in a Cost-efficacy level greater than Unit 2. That is, at the end of the cost-efficacy analysis, Unit 1 is significantly less efficient compared to Unit 2.

This analysis should also be carried out by using a unit of analysis. For example, the measure by area covered by phytosanitary measures. The formula to be used in this step is as follows:

**Cost-Efficacy per hectare = Value Total cost efficacy / Coverage in hectare**

In this case, Unit 1 has an efficiency level of $ 1,96 per hectare (cost efficacy Unit 1/ total coverage unit 1), while in Unit 2 the efficiency (cost-efficacy) level reached $ 1,06 (cost efficacy Unit 2/total coverage unit 2. That is, even with high-level of financial costs, Unit 2 is more cost-effective than Unit 1. The main advantage of using a unit of analysis (as hectare) is that the analysis can be adjusted to incorporate aspects that may influence higher or lower costs, eg distance for phytosanitary inspections. In this case, units that need to do inspections in larger territories can adjust their cost- efficacy according to their territorial coverage.

## Step-by-Step for elaborate the economic analysis (cost-benefit related to projected impacts set by the general objective of the logical framework):

### 1. ECONOMIC COST ANALYSIS

The economic cost is an adjusted value of the total financial cost of the program by an "opportunity cost" factor and other market "price distortions".

#### 1.a. Opportunity cost factor

> "The true cost of something is what you give up to get it. This includes not only the money spent in buying (or doing) the something"[12]

The opportunity cost is the associated value granted to a specific resource allocation decision. When a decision is made, the comparative advantages are taken into account, but all other allocation decisions are discarded. In other words, the selected option represents the most significant benefit and lowest cost compared to all others.

For the analysis of phytosanitary measures, the opportunity cost is the non-financial resource used during the implementation of the measures that adds values to the financial costs of the intervention. If a cost center, for example, spends a financial value of $ 100.000 for the execution of phytosanitary measures and uses 60% of counterparts resources provided by international partners, the economic cost must include the $ 100.000 plus the counterpart contributions. This is true since the cost center values only met 40% of the implementation requirements and an extra funding was required for a full implementation of the measure.

The cost opportunity is frequently obtained from economic counterparts of cost center partners. The procedure must be carried out region by region, considering all the economic counterparts identified and engaged with the cost centers in a given region. Example: if the sum of all the expected economic counterparts of the

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12 Bishop, M. (2004). Economics A-Z adapted from "Essential Economics" in The Economist. Recovered (29.10.2018) en https://www.economist.com/economics-a-to-z/o#node-21529616

phytosanitary measures were X and the sum of the counterparts effected were Y, the cost-opportunity factor would be calculated by the result of the ratio X: Y, included in the cost-opportunity formula from MAPA. In addition, in the case of specific phytosanitary measures, it is possible to define parameters of opportunity cost base by country or type of measure. For example, in Brazil, the MAPA established a 15% counterpart of the centers of the agreed cost in contracts negotiated with state departments of agriculture.

FACTOR COST OPPORTUNITY = 1 + (ECONOMIC COUNTERPARTS REFERRED TO PARTNER'S / PARTNERS ECONOMIC CONTRACTS)

### 1.b. Other adjustments for economic distortions

Other economic adjustments include the differentiation between the market prices and the price used by the cost centers when acquiring the necessary inputs for the implementation of the program. The adjustment is obtained with the average of the differences of the prices paid by the cost centers and the values obtained at the marketplace for specific inputs.

Economic price represents the average market value of a product or service, within a specific market. In summary, the calculation of the distortion factor should take into account discount factors (such as inflation), but focuses on verifying the average of the differences between the "intervention price" (values of items purchased by cost centers) and the "price without distortion" of each item purchased (average market values). It should also apply the exchange rates between countries (in the case of inputs purchased or traded externally) to correct possible distortions of a currency value (shadow pricing).

For example, if a cost center purchased a computer for a specific price $ 5.000; however, the market price is, on average, 25% lower, an adjustment in the value of the computer is required. In this case, the market value of the economic investment is $ 4.000. That is, if the price paid for inputs is computed in the cost-benefit analysis, the value closest to its true market value should be used.

### 1.c. Total economic cost or per unit of analysis (eg hectare) adjusted to other discount factors

The economic cost of phytosanitary measures is the adjusted cost of the financial value practiced for price distortions, opportunity costs and discounting factors (Gittinger, 1992). In this case, it is also essential make adjustments in financial values taking into account discount factors. The discount factor is a depreciation rate based on the time of the intervention. For example, inflation or the cost of money (eg interest rate) for the implementation of a multi-annual phytosanitary measure should be used in the final calculations of the economic costs.

DISCOUNT FACTOR (FD)

$$FD= \frac{1}{(1+i)^n}$$

**Where:**

FD = Discount factor
i = applied discount rate
n = discount time (in years)

### 1.d. Final calculation of the economic cost

Based on the factors indicated above, the formula for calculating economic costs is as follows:

$$CEP= \frac{CF\ x\ FPS\ x\ FCO\ x\ FD}{N_{PESS}}$$

**Where:**

CEP = Policy economic cost
CF = Total financial cost
FPS = Shadow price factor
FCO = Opportunity cost factor
FD = Discount factor
$N_{PESS}$ = Analysis unit number

## 2. ANALYSIS OF THE NET BENEFIT (BLP)

The net benefit is obtained by calculating the impact of avoiding economic losses or improving productivity based on impact projection models of a given pest (see impact projection models below). For example, let´s assume, in a given country, that pest prevention, according to epidemiological studies, leads to a 5% reduction in productivity in a region. In this case, it can be estimated that the value of the benefit represents 5% of the total value of the production values of that region.

To calculate the benefits generated, the following formula is used:

$$BLP= \frac{GPP\ x\ GMP\ x\ TS\ x\ FD}{N\_PESS}$$

**Where:**

BLP = Net benefit from the policy
GPP = Gain in productivity per point of epidemiological prevention
GMP = Average gain in production
TS = Health prevalence rate
FD = Discount factor
N_PESS = Number of units of analysis

The economic benefits generated by phytosanitary measures can also be calculated, considering the productive life cycle of the affected areas. This should include all the discounting factors already mentioned above, except the net cost of the program, which should be deducted from the net benefit, generating the net present value (NPV) of the program.

## IMPACT PROJECTION MODELS

It is worth mentioning that the basis of economic and social analysis and of the socioeconomic assessment methodology itself is the development of retrospective or prospective models of impact (with and without the implementation of the new policy) of pests. In this case, scientific data already available in the scientific and/or technical literature should be available for the demonstration of possible impacts with and without the implementation of the new policy, such as cases averted. Only then, social and economic valuations can be measured.

These models have already been used extensively in the sanitary (health) and phytosanitary impact assessment. Here are two interesting and initial references (one in the health area and the other in the agricultural area) of already published assessment studies:

K. G. Castro, S. M. Marks, M. P. Chen†, Et al. Estimating tuberculosis cases and their economic costs averted in the United States over the past two decades. Int J Tuberc Lung Dis. 2016 July ; 20(7): 926–933. doi:10.5588/ijtld.15.1001.

Graham Love and Damien Riwoe. Economic costs and benefits of locust control in eastern

## 3. ANALYSIS OF THE NET COST-BENEFIT RATIO (BCL)

Net benefit-cost measures the relationship between net benefit and cost.

$$BCL = \frac{BLP}{CEP}$$

The benefit / cost ratio (gross) gives an idea of how much each dollar invested in the phytosanitary measure generates wealth for the whole society

**Some examples of benefit-cost analysis in the literature:**

EXAMPLE 1

Miranda et al. (2010), used benefit-cost analysis to present an approximation of two benefits of the Control and Eradication Program of Carambola Fly, established by the MAPA. The benefits of the Program are calculated by differentiating between the (maximum) periods of the census of the pest and those of the alternative program, in the program or program being maintained for a long time. It was considered the cultures of mango, goyaba and orange and computed losses of productivity, of post-work, and in exports in Brazil, tracing scenarios with and without the synergic effects of treatment for other fruit flies. The values obtained will allowed the author to calculate the ratio of, for each $ 1 invested by the federal government, the return reached $ 26,4 (with the Selic discount rate) and $ 35,7 with TJLP.

**Table 4. Present annual value of the cost-benefit ratio of the eradication of the carambola fly program for mango, guava and orange. Projection: 10 years (discounting rate - TJLP). R $ of 2008.**

| Benefits (losses averted) and Costs (R$) Cases: mango, guava and orange | | Scenarios | |
|---|---|---|---|
| | | A (without the program) | B (keeping the program) |
| Without control for Fruit Flies | Losses | 2.714.872.311 | - |
| | Cost of the program | - | 29.367.527 |
| | Benefits (losses averted A – losses B) | | 2.714.872.311 |
| | Cost (cost A – cost B) | | 29.367.527 |
| | Net total (benefit-cost) | 2.685.504.783 | |
| | Ratio benefit/cost | 92.4 | |
| With control for other Flies | Losses | 1.047.979.848 | - |
| | Cost of the program | - | 29.367.527 |
| | Benefits (losses averted A – losses B) | | 1.047.979.848 |
| | Cost (cost A – cost B) | | 29.367.527 |
| | Net total (benefit-cost) | 1.018.612.321 | |
| | Ratio benefit/cost | 35.7 | |

Source: Miranda *et al*[13], 2015

EXAMPLE 2

The Cost-Benefit Analysis was used in citriculture by Sanches et al. (2014) to estimate the benefit-cost relationship of various citrus canker control strategies (*Xanthomonas axonopodis pv. Citri*) - prevention, management and eradication - in São Paulo. The paper also discussed the increased contamination of citrus plants with disease,

13 MIRANDA, S. H. G. de; NASCIMENTO, A. M.; XIMENES, V. Aplicação da análise benefício-custo para políticas de defesa sanitária no Brasil: alguns estudos de caso. In: CONFERÊNCIA NACIONAL SOBRE DEFESA AGROPECUÁRIA, 2., 2010, Belo Horizonte. Trabalhos apresentados. Belo Horizonte: UFV; Instituto Mineiro de Agropecuária; Secretaria de Defesa Agropecuária, 2010.

after the change in São Paulo legislation for disease control in 2009. The increase in the contamination index was 893% between that year and 2012. The authors also used cost-benefit analyis for a period of 20 years and the results pointed to economic advantages of keeping citrus canker under control in the state, that is, under low incidence rates. The management with expansion of the disease in the medium and long term analyzed had a significantly lower benefit-cost ratio than the relation obtained when there is prevention and control of the disease, with strict eradication of diseased plants.

**Table 5. Benefit-cost ratio calculated by the difference between the present value of production and the total cost of production with different price levels paid by the orange box. Scenario 1 = Prevention, Scenario 2 = Control and Scenario 3 = Eradication and the 3A, 3B, 3C, 3D, 3E, and 3F scenarios refer to the eradication simulation of 0%, 20%, 40 %, 60%, 90% and 95% of contaminated sites.**

| Accumulated (years) | Price for box of 40,8 Kg (R$) | scenario. 1 | scenario. 2 | scenario. 3A | scenario. 3B | scenario. 3C | scenario. 3D | scenario. 3E | scenario. 3F |
|---|---|---|---|---|---|---|---|---|---|
| 5 years | 3.3 | 0.48 | 0.25 | 1.18 | 0 | -0.07 | -0.09 | -0.11 | -0.11 |
| | 10 years | 1.54 | 0.8 | 3.36 | 0 | -0.21 | -0.27 | -0.36 | -0.34 |
| | 15 years | 3.09 | 1.62 | 7.56 | 0.01 | -0.42 | -0.55 | -0.71 | -0.68 |
| 20 years | 3.3 | 1.54 | 1.22 | 1.16 | -0.09 | -0.19 | -0.08 | 0.35 | 0.45 |
| | 10.5 | 4.9 | 3.89 | 3.68 | -0.28 | -0.59 | -0.24 | 1.13 | 1.45 |
| | 21.1 | 9.84 | 7.81 | 7.4 | -0.55 | -1.19 | -0.49 | 2.26 | 2.91 |
| 15 anos | 3.3 | 2.81 | 2.43 | 1.18 | -0.18 | -0.26 | 0.03 | 1.18 | 1.36 |
| | 10.5 | 8.94 | 7.74 | 3.76 | -0.56 | -0.84 | 0.09 | 3.74 | 4.34 |
| | 21.1 | 17.96 | 15.55 | 7.56 | -1.12 | -1.69 | 0.19 | 7.51 | 8.72 |
| 20 anos | 3.3 | 3.84 | 3.34 | 1.19 | -0.21 | -0.24 | 0.16 | 1.78 | 2.02 |
| | 10.5 | 12.23 | 10.63 | 3.79 | -0.66 | -0.78 | 0.5 | 5.66 | 6.43 |
| | 21.1 | 24.58 | 21.37 | 7.62 | -1.33 | -1.56 | 1.01 | 11.38 | 12.92 |

Source: Sanches et al., 2014[14]

## Step-by-Step for the elaboration of Social Analysis (Equity linked to projected impacts in relation to the General Objective of the logical framework):

### 1. DEFINITION OF THE SOCIAL ANALYSIS UNIT

Socioeconomic segments for an equity impact analysis must first be defined. This equity segmentation may be due to the size of the productive units that may be affected by phytosanitary measures, the socioeconomic profile of regions or even

14 SANCHES,A.; MIRANDA, S.H.G.; BELASQUE JUNIOR, J.; BASSANEZI, R.B. Análise econômica da prevenção e controle do cancro cítrico no Estado de São Paulo. *Revista de Economia e Sociologia Rural*, v.52, n.3, p.549-566, 2014.

the type of crop that will be most affected in relation to others. In particular, its short and medium-term effects on the most relevant variables influencing people's well-being will be considered and how this influences the structure of preexisting inequality, with special emphasis on gender, generational and territorial inequalities. Based on the estimation of the impacts (positive and negative) of the implementation of the policy, different scenarios with their corresponding consequences on the well-being of the people is estimated, considering an integral vision about the quality of life, as well as its impact on the structure of inequality (equity index).

## 2. EQUITY INDEX CALCULATION

The equity index represents a measure of social and economic resources inequality, where the share of a population's total resources must be redistributed so that there is perfect equality. In the social analysis of phytosanitary measures, the equity index can be adapted for crop types and economically most vulnerable areas or groups.

After defining the unit of analysis, the equity index should be used as the measurement of the effect generated by the phytosanitary measures. This is true for the ones that benefited from the intervention and those that did not (treatment group and control group), in relation to the reduction of their inequality status.

**Table 6.** **Hoover indicator for the measure of inequality "without" phytosanitary measures**

| Group | No. of Units | Prevalence | Prevalence | Relative | Hoover |
|---|---|---|---|---|---|
| 1 | $A_1$ | $E_1$ | $E_1=E_1/A_1$ | $D_1=E_1/=\sum E - A_1/\sum A$ | $H_1=abs(D_1)$ |
| 2 | $A_2$ | $E_2$ | $E_2=E_2/A_2$ | $D_2=E_2/=\sum E - A_2/\sum A$ | $H_2=abs(D_2)$ |
| Totals | $\sum A$ | $\sum E$ | $\sum=\sum E/\sum A$ | | $\sum H$ |
| Inequality | | | | | Hoover=$\sum H/2$ |

**Where:**

A1 = number of productive units estimated in the region x Proportion of size of productive units TYPE A (eg small size)

A2 = number of productive units estimated in the region x Proportion of size of productive units TYPE B (eg large size)

E1 = Prevalence without measures among production units TYPE A x number of production units estimated in the region

E2 = Prevalence without measures among productive units TYPE B x n° of productive units estimated in the region

## 3. COMPARISON BETWEEN THE EQUITY INDICES "WITH" AND "WITHOUT" THE PHYTOSANITARY MEASURES

From the calculation of the equity index according to the socioeconomic characteristics that one wishes to evaluate with and without the phytosanitary measures, a final analysis of the impact on equity can be carried out. It should demonstrate the reduction of differences in the epidemiological impact of phytosanitary measures in these regions, crops and production units most vulnerable to the spread of pests.

**What's its role at this stage?**

At this stage, policy coordination should validate the results of the analyzes, ie participate in the presentation of the data analysis, make possible questions and, finally, "approve" these analyzes. It is also the policy coordination who should define the types of publications and outputs that will be developed to disseminate the results.

**Duration:** the three analyzes are finalized in one month, from the completion of the databases with management and exogenous data. Analyzes are described in technical reports and in specific presentations. Communication and training products can also be made, but there is no set period for the completion of these activities, which will depend upon the characteristics of each communication strategy.

**Team:** All evaluators should participate in this phase. Policy coordination plays a key role in validating the final analyzes.

## COMPLEMENTARY STAGE

The results of the impact assessment should generate different and specific materials that will empower the evaluated measures, policies and programs. Therefore, after the technical reports are finalized, it is essential to define a communication strategy based on the following steps:

**1_** Review the information and data available in the reports on the three dimensions of analysis.

**2_** Discuss with the team of managers and technicians involved in the assessment process, the main data of each analysis and specific applicability to the stakeholders and groups of influence for the assessment. For example, cost-efficacy data are internal data and thus relevant to those directly involved in the implementation and management of the policy or program. While equity data may be interesting to promote the policies for given communities, inviting them to participate or commit the measures, data on economic impact may be decisive for government decision makers to keep, strengthen or even reduce investments for the assessed policy.

**3_** Once the main data have been identified, it is necessary to study the best channels and printed and electronic communication materials so that they are adapted to each audience involved in the assessment process.

**4_** Subsequently, the elaboration of communication materials should be prioritized, such as publications, executive summaries, scientific articles, materials for periodicals and magazines, publications in social media, among others.

# GLOSSARY

### IMPACT ASSESSMENT

It is the investigation of changes in the social and market places (social, economic and/or environmental). It should not be limited to the assessment of the implementation of the measure. It focuses on the investigation of change or preservation of the status quo and realities with and without the program/policy. It is subdivided into 03 analyzes: financial, economic and social, as shown below.

### ANALYSIS OF COST-EFFICACY (FINANCIAL)

This analysis is one of three dimensions of the Impact Assessment and are directly related to the quality standard of the policy, its management best practices and other items that must be under the control of the managers and agricultural agents who plan and carry out the intervention. In other words, this is the analysis of the management or implementation of phytosanitary measures. The purpose of this analysis is to identify how the different interventions can achieve greater efficacy at lower cost, based on their strengths and bottlenecks. In order to investigate the possible pattern of management of phytosanitary measures, the objectives, targets, indicators, means of verification, risks, inputs and outputs expressed in the Program's Logical Framework are used. The financial analysis is composed of three elements:

- Financial cost: The cost of phytosanitary measures is measured by the sum of the amounts invested in their execution, that is, the financial resources made available by headquarters, where applicable, funds from the units responsible for the execution and allocation of headquarters costs (including travel, administrative costs, among others).
- Efficacy: Efficacy is measured by the relation between what is set out in planning and what is effectively achieved by the measure. The average rate of efficacy of each executing unit (cost center) is a result of the sum of all efficacy indicators of the same unit over the total number of indicators.
- Efficiency: Also called Cost Efficacy, Efficiency expresses the relationship between results and resources. The efficiency assessment focuses on the delivery process (measured between planned and executed) and the resources used to achieve the results.

### Cost center

The cost center represents a clear and delimited orientation of the production of costs, grouping them into units of control and responsibility[15]. For example, for a phytosanitary measure, a cost center may be a local pest control department of a country's Ministry of Agriculture.

15 Riquelme, M. (2017) ¿Qué es un Centro de Costos? Web y empresas. Recovered (29.10.2018) de https://www.webyempresas.com/centro-de-costos/

**ANALYSIS OF COST BENEFIT (ECONOMIC)**

It is an economic analysis, where the benefits and costs are projected on the basis of market values for a given time cycle in relation to the areas affected by phytosanitary measures, using specific discounting factors. It is obtained from an econometric and epidemiological projection model, which must be thought and created specifically for each type of phytosanitary measure. It points to productivity impacts or reduction of future losses like most investments. In order to be carried out, the following elements must be considered:

**Economic Cost**

It is the total financial cost of the program adjusted by the "opportunity cost" factors - all the non-financial resource used in the implementation of the phytosanitary measures capable of adding values to the costs of the services - and price distortions corrections: differences between the market price and the price practiced by the organizations involved in the program. The economic cost adjusted to the opportunity cost is always greater than the financial cost.

**Price distortion**

It is the value practiced by the market in comparison with the values of the inputs that are acquired by the initiative. That is, it is the price with the least possible marketplace distortion. This is because, usually, when an organization acquires any input, it is common to try to find the lowest price possible from suppliers, mainly wholesale. As the organization acquires the lowest price possible, it may differ from the real marketplace price for the good. The shadow price represents the average market value of a product or service. This is especially true for corrections in exchange rates used by different countries.

**Opportunity Cost**

Cost-opportunity is the value that is associated with a given choice for resource allocations. When deciding on an option for allocation of resources, the advantages of this option are accepted, but these same resources could be used for other purposes. That is, the option selected represents an opportunity cost that could be used in another intervention. Therefore, resources that have not been disbursed, but represent fundamental inputs for the development of the program (eg voluntary work and counterpart) should also be considered.

**Benefit-Cost Ratio**

It is the division of net economic benefit by net economic cost, by area served or other type of analysis. It should present, as the main result, the return in money value of a cost-benefit ratio of a given phytosanitary measures. That is, for each unit invested of a given currency, for example, real (R $), what wat the return obtained.

**Discounting Factor**

Assuming that any benefit begins to depreciate from the first day of its use, the discount rates to be included in the cost-benefit analyzes should be clearly established. It may be a short or long term measure, a health treatment, or exposure to a social program, everything should be adjusted to a discounting factor. The main suggestion, in an economic analysis, is to use discount rates. This is a converging point cited by all the authors included in this manual. The rates and factors, when defined, will be part of the econometric equation for calculation of costs and benefits.

### Internal Rate of Return (TIR)

Represents the limit on which a loan could be taken from the Market to carry out the assessed Program. That is, what is the interest rate limit for negotiating a loan with credit entities.

### Net Present Value (NPV)

It is the economic wealth generated in present value, that is, monetary value at the moment of the assessment, considering all future cost and benefit values of the measure. For example, if an intervention is evaluated economically in relation to its implementation benefits only by 2023, the benefit results obtained for the next years will be adjusted to present values.

## EQUITY ANALYSIS (SOCIAL)

It is possible to evaluate the impact of the program of phytosanitary measures, based on the transformations generated by the intervention in areas of socioeconomic vulnerability. It demonstrates how the transformations produced by the intervention relate to specific levels of income, ethnicity, gender, schooling, sexual orientation, among others. An equity index, such as the Hoover index, should be used.

## PHYTOSANITARY EPIDEMIOLOGICAL PROJECTION MODEL

The projection models refer to calculations of future pest prevalence in certain geographic areas with or without the application of phytosanitary measures. From these projection models, the changes obtained or not by the assessed policies are analyzed in terms of avoided cases and prevention of dissemination.

## LOGICAL FRAMEWORK

It is an instrument that helps the monitoring and assessment of programs. It is composed of a matrix that correlates objectives, goals, indicators, sources of verification, risks, inputs, products and activities.

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