# Priority Setting for Research on Neglected and Underutilized Species

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**System-wide Genetic Resources Programme**

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# INTRODUCTION

Genetic diversity is the basis of improved production in natural and managed ecosystems; it is the starting point for biological innovation and adaptation to change and, therefore, the key to sustainability. Combating the loss of biodiversity requires a united global effort, as the erosion of genetic diversity threatens the future of production worldwide.

The System-wide Genetic Resources Programme (SGRP) of the Consultative Group on International Agricultural Research (CGIAR) unites the CGIAR's independent agricultural research centers in a common effort to sustain biodiversity for current and future generations. It is a mechanism for collective action that has an impact on the work of individual centers, the CGIAR as a whole, and even on activities/entities beyond this sphere.

The SGRP provides a forum for debate, strategic analysis and planning on topics of common concern to the CGIAR centers, national programs and other partners. An important issue for analysis and planning is the funding of conservation efforts and the efficient use of scarce resources. The present document focuses on priority setting for Neglected and Underutilized Species (NUS) as an initial convening point to help develop strategies for further conservation efforts.

Neglected and underutilized species are often considered "minor crops" because they are less important than staple crops and agricultural commodities, in terms of global production and market value. However, from the standpoint of the rural poor, who depend on many of these species for their food security, nutrition and income, they are hardly "minor" (IPGRI, 2002). In addition, these so-called "minor crops" can also make significant contributions to ecosystem stability and cultural diversity.

This is why both Bioversity International's strategy on neglected and underutilized crops, as well as the ICUC's strategic framework for underutilized plant species research and development, seek to strengthen the ability of stakeholders to maintain and enhance the biological assets of the rural poor by enhancing and developing a broader range of species adapted to diverse environments. These species can ultimately provide new opportunities for better nutrition and income generation. Yet, taking into account that resources are limited, it is important to compile, analyze and promote the development of priority–setting approaches at the local, national and international levels. This would greatly aid stakeholders in establishing priorities for research, development and conservation actions regarding neglected and underutilized species (NUS).

For such a broad spectrum of species, different stakeholders are involved at various points in production, processing, marketing and consumption; therefore, mechanisms for priority setting need to capture the diversity of interests, opportunities and potential, at different levels and with different objectives.

The first part of this document provides a brief overview of research priority-setting methods. It includes a collection of methods that range from an economic to social focus, giving particular weight to participatory methods, due to the nature of underutilized species and the potential contribution of these methods to the objectives of neglected and underutilized species.

The second part analyzes the different methods presented, regarding their contribution to setting priorities for neglected and underutilized species. These methods are used to develop a set of variables and indicators that need to be addressed when setting priorities and evaluating alternatives for research on NUS.

Finally, suggestions for future research are made with regard to the opportunities and challenges for NUS priority setting.

It is also important to mention that this work is based on priority-setting tools and variables analyzed at IPGRI's conference on NUS in the Mediterranean region held in Aleppo, Syria, in 1998 (Padulosi (a), 1999). It comprises the objectives and constraints identified during the International Symposium "Underutilized Plant Species for Food, Nutrition, Income and Development" held in Arusha, Tanzania in March 2008 (ICUS-GFU, 2008). Other contributions are gathered from work developed in both International Centers and National Research Institutions. Furthermore, it is important to mention the contribution of donor agencies and local NGO's that have developed a series of methods to set priorities at a local level.

# PART I
# METHODS FOR PRIORITY SETTING

## DEFINITION OF PRIORITY SETTING

In the context of research for Neglected and Underutilized Species (NUS), priority setting is the process of ranking different research alternatives to help define a research portfolio that responds to the mission of NUS promotion and conservation. Therefore, the criteria used for selecting the appropriate method must be determined based on the special features of NUS that are to be fully understood in advance.

Priority setting is a common part of planning and helps define a research portfolio in line with the mission, objectives or policy of the decision maker (Falconi, 1999). According to Benyon et al. (1998), priority setting is the most important element in improving the cost effectiveness and efficiency of research expenditures. Therefore, the most appropriate method or combination of methods must be identified in order to address the unique features determining the Neglected and Underutilized Species.

## CLASSIFICATION OF PRIORITY-SETTING METHODS

Over the last few decades, a number of priority-setting methods have been developed. These methods vary in their scope of analysis, degree of sophistication and applicability (Brithal et al., 2002). In practice, the process employs a range of approaches that can be broadly classified as being supply or demand oriented, although a combination of approaches is often used (Byerlee, 2000). Furthermore, there can be other classifications based on the objectives of the process (single or multiple criteria), measurement concepts (direct and indirect or qualitative and quantitative), and time dimension (*ex-ante* or *ex-post*) (Brithal et al., 2002).

For the purpose of this document, a simple classification was arranged based on the supply-demand approach and the objectives of the priority-setting process.

### 1. Supply-Oriented Priority-Setting Methods

In supply-oriented methods and approaches, priorities are largely set within the research system. A variety of methods might be used from informal methods based on previous allocations (i.e. precedence), informal discussions and consensus among research managers, taking the sector's strategies and priorities into account, in addition to formal quantitative methods (Byerlee, 2000).

### 1.1 Single-Criterion Methods

Single-criterion methods develop their analysis based on one particular criterion, which, in most cases, is economic. Under this classification we can find the Cost-Benefit Analysis and the Economic Surplus Model as a variant with a deeper economic analysis.

A. Cost-Benefit Analysis

The Cost-Benefit Analysis uses the economically efficient value of costs and benefits to determine which alternatives contribute more to the objective of economic growth. A variant of this analysis is the Cost-Social Benefit Analysis, which takes into account the benefits accumulated by the poor.

B. Economic Surplus Model

Efficiency is one of the most common decision-making criteria. Commodities are ranked according to the Net Present Value (NPV) of the benefit stream (net research costs) per unit of investment in research of the commodity in question (Alston et al., 1995). Economic surplus consists of the producer surplus and consumer surplus, each of which can be distributed between different income groups. This approach is relatively straightforward on the consumer side because of data availability, but on the producer side, the lack of data on income sources by commodity for different income strata is a major constraint (Byerlee, 2000).

## 1.2 Multiple-Criteria Methods

C. Geographic Research Problem Domains

Geographic information systems (GIS) provide a useful approach to evaluating a set of site-specific resources and their relationship to a given problem domain. GIS can be used to identify suitable regions for growing specific crops, based on the analysis of conditions given on specific geographic areas.

D. Scoring Model

The Scoring Model uses a multi-criteria approach often referred to as the congruence method. The model incorporates multiple objectives by modifying simple measures of research evaluation – such as changes in the value of production – to consider the concerns of equity, sustainability and trade. Given the relative importance of the various objectives, the scoring model makes tradeoffs between objectives explicit.

E. Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a multi-objective, multi-criteria decision-making tool that employs multiple paired comparisons to rank alternative solutions to a problem, formulated in hierarchic terms (Ramanujam and Saaty 1981).

F. Mathematical Programming Model

Mathematical programming is an optimization procedure for guiding the allocation of limited resources. Unlike scoring and cost-benefit methods, which only produce a ranking of alternatives, mathematical programming aims to select an "optimal" research portfolio. This optimal portfolio is achieved by

formulating an objective function that is maximized subject to certain constraints (Braunschweig, 2000).

## 1.3 Less Elaborated Methods

G. Rule of Thumb

This method is the starting point for the precedence and congruence methods. The precedence method uses the previous year's funding as the basis for the current year's allocations. Changes in budgets and other resources are shared proportionally by each research activity. In congruence analysis, the available resources are allocated across research areas in proportion to their relative value of production.

Annex I will provide a special overview of supply-oriented priority setting methods and their main characteristics.

## 2. Demand-Oriented Priority-Setting Methods

A major motivation for changes from formal supply-driven priority-setting to demand-driven approaches has been the widespread perception that supply-driven approaches were not effective in reaching resource-poor farmers, especially in marginal areas. The move toward farming systems research (FSR) in the 1970's and 80s reflects this realization (Byerlee, 1999).

In demand-oriented methods and approaches, priorities are set based on perspectives of major stakeholders from outside the research system, especially users. These might employ consultative and participatory methods, or the users themselves might be empowered to make decisions on research priorities (Byerlee, 2000).

Over time, many participatory methods have been developed in different regions and with different purposes. Gradually, original ideas have been improved by different authors and variations have been developed. This document presents a few of the most recent participatory methods developed, which can be used for the purpose of setting priorities in NUS. Nevertheless, it is important to mention that there may be other methods that can also be adapted to different contexts.

## 2.1 Participatory Methods

A. In-Depth Study of Demands

This method seeks to contribute to innovation adoption by promoting the identification of project ideas centered on the farmers' demands and inspired by their vision of development. The method incorporates the sequential use of a set of participatory tools such as: problem trees, priority-setting matrix, community mapping, valuation tools, etc.

B. Qualified Demand and Risk Management Approach

This method seeks to work with a target group to identify genuine demand and transform it into qualified[1] demand through management activities carried out by the group. The method includes a risk management component that enables planning in adverse situations.

C. Participatory Adjustment of Proposals

The Participatory Adjustment of Proposals methodology seeks to achieve improved implementation of big projects at a local level by adjusting expected outcomes, activities and indicators for that level. This way, both technology innovation and intervention systems may be adjusted to fit the particular needs of different target groups. The method incorporates the sequential use of a set of participatory tools[2] such as: problem trees, the priority-setting matrix, valuation tools, ranking rating and sorting, local stratification etc.

D. Participatory Market Chain Approach

The Participatory Market Chain Approach is a method that seeks to link small producers to the market. The method fosters interaction among market chain actors in order to identify, prioritize and generate technology, market and institutional innovations. It develops interest, trust and collaboration among actors of the market chain.

E. Outcome Mapping

Outcome Mapping is a method for planning and assessing the social effects and internal performance of projects, programs, and organizations. A holistic and multidimensional vision of reality is the guiding principle of the method, which, therefore, promotes the active participation and interaction of different players.

F. Participatory Impact Pathway Analysis

Participatory Impact Pathway Analysis is a project-planning, monitoring and evaluation approach. It draws from program theory evaluation, social network analysis and research to understand and foster innovation. It is designed to help actors involved in a project make explicit their theories on change.

G. Participatory Monitoring and Evaluation

PM&E is a method that seeks to identify demand at local level and strengthen local target organizations by making them responsible for the planning, monitoring and evaluation of any research and development initiative. The method uses a sequence of participatory tools to identify demand, structure local planning, monitor progress and evaluate results. It is a method adapted to work with groups of a particularly low level of schooling and a multi-cultural or ethnic background.

[1] The method defines "qualified" as legitimate and realistic or achievable.
[2] Details on the application of participatory tools can be found in: (King, 2000), (Geilfus, 1997)

Annex II will provide a special overview of demand-oriented priority-setting methods and their main characteristics.

# PART II
# BASIC STEPS FOR A PRIORITY-SETTING EXERCISE, ANALYSIS OF METHODS, VARIABLES AND INDICATORS FOR PRIORITY SETTING ON NEGLECTED AND UNDERUTILIZED SPECIES

Despite the currently more favorable climate for conducting research on underutilized species, there remains a disproportionate gap between research funding needs and successful resource mobilization (L. Withers, 2005). Recognizing this constraint opens a challenge, for there is a great need to clarify and make explicit a priority-setting process for the particular needs and features of NUS crops. According to Withers (2005), the method or combination of methods should indicate the criteria that lead to the choice of species and the constraints that the research is addressing in order to enable the potential of the species to be expressed.

The choice of method depends on the objectives of research, level of priority assessment (regional, national, institutional, local, etc.), and its simplicity in application, data requirements and capacity to allow the participation of stakeholders in priority-assessment exercises (Brithal et al., 2002). Based on this premise, we must fully understand NUS and their characteristics in order to identify the methods that will best contribute to achieving the outlined goals and objectives.

## UNDERSTANDING NEGLECTED AND UNDERUTILIZED SPECIES

SGRP is collaborating with Bioversity International and others to create a global Platform for Agrobiodiversity Research to support actions aimed at stemming the loss of biodiversity (SGRP, 2006). The concern is to broaden the species portfolio in agriculture and forestry for the sustainable management of ecosystems, and to deploy genetic resources in areas and ways so as to raise income, improve nutrition and increase food security. To broaden the species portfolio, it is necessary to better understand existing uses and conserve the genetic resources of neglected and underutilized species (Eyzaguirre et al., 1999).

Underutilized Species are defined as "*those non-commodity crops, which are part of a large biodiversity portfolio, once more popular and today neglected by users' groups for a variety of agronomic, genetic, economic, social and cultural factors*" (Padulosi and Hoeschle-Zeledon 2004). To achieve a better understanding of these crops, it is important to identify the features that these species have in common, as well as strategic factors that need to be taken into account (Padulosi and Hoeschle-Zeledon 2004). Another definition of underutilized species reads "*those species with under-exploited potential for contributing to food security, health (nutritional/medicinal), income generation and environmental services"* (Jaenicke and Höschle-Zeledon, 2006).

Furthermore, the former International Plant Genetic Resource Institute (IPGRI), now Bioversity International, along with the SM Swaminathan Research Foundation and the Global Facilitation Unit for Underutilized Species, have

examined the contribution which underutilized plants can make to meeting the Millennium Development Goals, pointing out the vital role of biodiversity in the efforts to rid the world of poverty and hunger (IPGRI, GFU and MSSRF; n.d.a).

According to Eyzaguirre et al., (1999), there is a growing interest in neglected and underutilized agricultural species at all levels, and this must be understood before choosing a particular method for priority setting.

- At the global policy level, the concern is for environmental change and food security reasons.
- At the national level, both public and private industrial research are concerned with identifying minor species that can be developed to serve new markets and uses.
- At the local level, resource-poor farming communities depend on underutilized and neglected crops for their survival.

Biodiversity International has worked on many neglected and underutilized species. As a result, it has drawn up a set of key strategic factors to consider when setting priorities for research and conservation of NUS (Eyzaguirre et al., 1999):

- primary focus on crops and agro-forestry species, secondary focus on non-domesticated species which form a regular and significant income source for rural households;
- assessment of local, regional or global importance of a species;
- assessment of relative importance of a species' contribution to food security, e.g. food or non-food uses and contribution to the diet;
- assessment of the species' contribution to household income and market value;
- assessment of the species' contribution to the sustainability of ecosystems;
- assessment of the threats to its continued use and genetic erosion [biological features and uses of the crop which affect conservation, annual vs. perennial crop, status of domestication, mode of propagation (vegetative, seed – orthodox or recalcitrant)];
- assessment of the applicability of complementary conservation strategies (*ex-situ*, *in-situ* and conservation through use).

## BASIC STEPS FOR PRIORITY SETTING

Work on underutilized species, whether in research or development, requires a collaborative, open-minded spirit that recognizes and respects the complexity and interaction of social, economic and environmental factors in the development of underutilized crop products (Jaenicke and Höschle-Zeledon, 2006). This premise is the main guiding principle that will lead an integrated holistic approach for priority setting, taking into consideration the multidimensional nature of these crops. Therefore, the analysis of priority-setting methods must take this premise into consideration

While there is no single best method for undertaking priority setting, a series of basic steps have been tested and found useful (Janssen 1994; Chan-Halbrendt et al. 1995; Falconi 1999).

## 1. Identification of NUS research and development objectives

There are four major objectives (IPGRI, 2002) or main themes (ICUC – GFU, 2008) developed around Neglected and Underutilized Species, which can make significant contributions to global sustainable agriculture.

- contributing to food security and better nutrition
- increasing income for the rural poor
- contributing to ecosystem stability
- fostering cultural diversity

The importance of every objective may vary according to the region and its characteristics. Furthermore, different species and the constraints they face will contribute differently to every objective.

## 2. Defining feasible technology alternatives

A conventional priority setting process is mainly carried out by the researchers, who define feasible technology alternatives (Falconi, 1999). In the particular case of NUS, there can be many technological alternatives (species or approaches) for every specific objective and crop category.

## 3. Deriving criteria and method

In this step, criteria are chosen or derived, along with a method to evaluate the technology or research alternatives. Evaluation criteria normally correspond with measurable indicators, such as net present value, cost-benefit ratio, market standards, and resource capacity. These indicators are related to the research objectives identified earlier (Falconi, 1999).

Annex III shows the potential contribution of every priority-setting method to the analysis of variables and indicators reflecting on every objective of NUS crops.

## 4. Assessment of priority-setting methods regarding NUS-determining factors

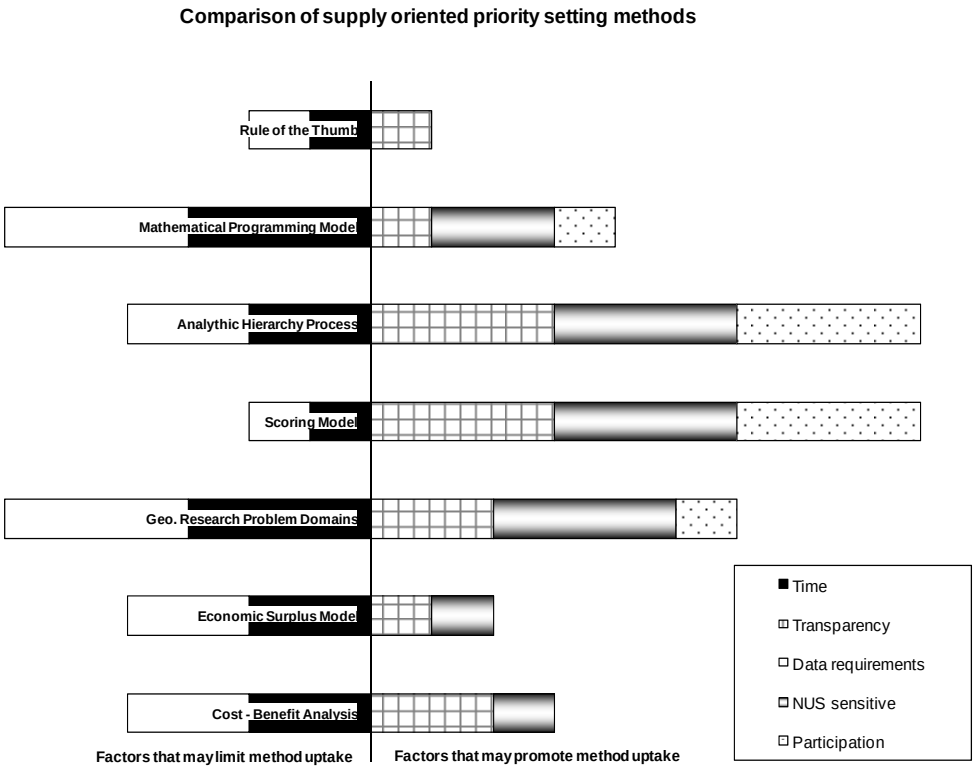
Some determining factors that may limit or promote the use of a certain ***supply or demand-oriented methods*** are: the **time** needed to apply the method; quantity of **data** collection and analysis required for the application of the method; possibility of incorporating the **participation** of stakeholders; **transparency,** understood as the clarity of the process for common viewers (Falcone, 1999); **simplicity** in the application; and **NUS sensitivity,** as the possibility of analyzing and including variables of interest for the four general objectives of NUS crops.

Figure 1 shows a comparison of supply-oriented priority-setting methods based on the above factors. To the right side of the axis are factors that contribute

positively to promoting the use of a method in the NUS context. To the left side of the axis are factors that limit the usage of the method. It is important to mention that these are not necessarily negative factors but constraints that need to be taken into consideration. For example, more time required to implement a method or more data requirements are likely to reduce the ease of its application.

According to the figure, the most useful method for priority-setting of NUS is the Scoring Model. Nevertheless, there can be a significant contribution from Geographic Research Problem Domains if work is developed on the basis of existing data sets, as this may reduce data collection and time required for its implementation.

**Figure 1.** Comparison of supply-oriented priority-setting methods

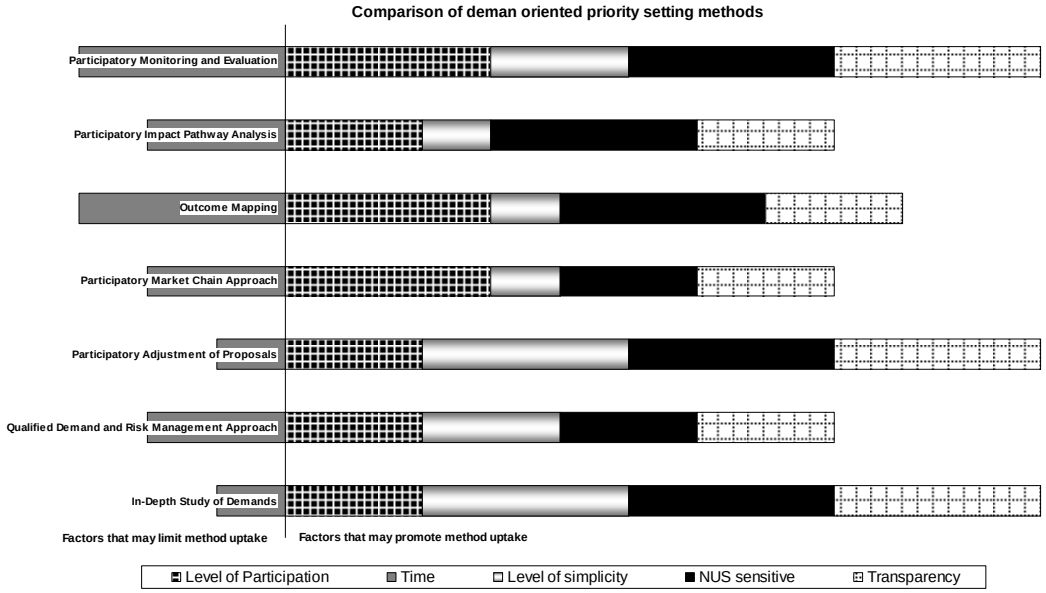



Source: own elaboration based on previous experiences developed by: Falcone, 1999.
[0 = none; 1 = low; 2 = medium; 3 = high]

Figure 2 shows a comparison of demand-oriented priority-setting methods based on the identified determinant factors. According to the figure, the most useful methods for priority setting of NUS are the In-Depth Study of Demands and the Participatory Adjustment of Proposals. In both case, there is an efficient use of time spent with stakeholders. The Participatory Monitoring and Evaluation is also among the most useful methods, even though more time is needed to establish the process.

Nevertheless, when selecting a participatory method, an important issue to take into consideration is the nature of the intervention to be developed. Some participatory methods work best in different types of situations and, therefore, should be analyzed according to the context.

**Figure 2.** Comparison of demand-oriented priority-setting methods




Source: own elaboration based on previous experience with supply oriented methods (Falcone, 1999)
[0 = none; 1 = low; 2 = medium; 3 = high]

## 4.1 Selection of method or combination of methods and procedures for priority setting

Understanding that NUS are numerous and globally distributed, and considering limitations in resources, the priority-setting method must aid in selecting a research agenda that will help build up a knowledge base in the promotion process and, thus, enhance future efforts on other underutilized crops (Padulosi et al. 2002). For this purpose, a sequential use of priority-setting methods is proposed. This sequence is arranged to manage differences in criteria according to the level of assessment (global, regional, and local).

A. Geographic Research Problem Domains

To apply the Geographic Research Problem Domains method, the following stages should be completed:

**Stage 1.** Definition of limits for regional intervention

The definition of limits for regional intervention is an important premise in developing the priority-setting strategy. Conditions in Sub-Saharan Africa are different from those in the Mediterranean region or Europe. One region cannot be compared with the other; doing so could cause unwanted bias in priority setting. The proposed strategy is to validate existing classification with researchers from different regions, in order to consolidate a classification that is fully agreed upon.

**Stage 2.** Definition of variables for analysis

Once the regions have been clearly identified, a geographic analysis should be carried out on each one. There are different sources of information available that can aid in performing a basic analysis of the variables contributing to the global objectives of NUS crops. Table 1 shows an aggregate of variables that can be analyzed globally. Additional variables of importance can be defined by experts in each region.

**Table 1.** Variables of analysis and potential sources of information

| NUS Objective | Variable | Potential sources of information |
|---|---|---|
| Contribute to ecosystem stability | Climatic variables (Temperature, rainfall, etc) | World Climate database<br>CRU TS 2.1 Climate Database<br>http://cru.csi.cgiar.org/ |
| | Elevation variables | USDA Elevation database<br>SRTM 90m Digital Elevation Data<br>http://srtm.csi.cgiar.org/ |
| | Climate change variables | Addressing Climate Change database<br>http://www.iea.org/textbase/pm/?mode=cc |
| | Identification of biodiversity hot-spots | Climate change adaptation database<br>http://adaptation.cbd.int/vulnerabilities.shtml |
| | Identification of vulnerable ecosystem | Climate change adaptation database<br>http://adaptation.cbd.int/vulnerabilities.shtml |
| Contribute to food security and better nutrition | Indicators of child growth and malnutrition, Vitamin and mineral deficiencies | World Health Organization – Database<br>http://www.who.int/research/en/<br>United Nations Standing Committee on Nutrition<br>http://www.unsystem.org/scn/Publications/RNIS/rniscountry_database.html |
| Increase incomes for the rural poor | Unsatisfied basic needs, Per capita income, Demographic information (children, women) | Poverty research institute database<br>http://ftp.unesco.org/poverty/form.shtml<br>Poverty mapping http://www.povertymap.net/ |
| Foster cultural diversity | Identification of biodiversity hot-spots | Climate change adaptation database<br>http://adaptation.cbd.int/vulnerabilities.shtml |

Source: own elaboration

An assessment of the importance of every objective and of variables within the objectives needs to be delivered in order to rank priorities accordingly. For example, in Sub-Saharan Africa, food security and better nutrition may have a higher value in comparison with fostering cultural diversity, while in the Mediterranean region, ecosystem stability may have a higher rank. Therefore, since specifying weights is the responsibility of policy makers and senior research managers (Braunschweig, 2000), a workshop or a survey can be delivered with researchers and other stakeholders working on every region, for the purpose of determining a ranking of importance among objectives and variables.

**Stage 3.** Analysis of information and preliminary priority setting

The analysis of digitalized information will provide regional maps reflecting high poverty areas, areas with highest nutritional deficiencies as well as vulnerable regions and biodiversity hot spots. With support from the ranking of objectives

and variables, the GIS program will provide the identification of potential areas of work with specific topics to address. The agro-ecological mapping will also present results on crop categories in the potential areas of work. It is important to understand GIS as a tool that will support and aid the process. However, it is essential that the objectives and variables, as well as their importance and value, be defined by the different stakeholders.

An important element to consider is that a digitalized GIS database will not only provide information for this initial part of the priority-setting process, but it can also be referred to later on, with specific crop requirements, in order to determine potential areas of expansion for the research initiative (recommendation of domains).

B. Scoring Model

According to Braunschweig (2000), in order to guide research decision-making, research evaluations should address the most important objectives and assess their achievement. Therefore, once an area has been roughly defined, a Scoring Model can be applied to identify specific neglected species. For this purpose, we can rank a sequence of variables defined as important for the objectives. Species present in the area will be scored in reference to these variables and to the ranking of importance given to them.

According to Franzel et al. (1996), two issues further complicate the definition of research objectives: a) target groups are not normally the ones who conduct the research; however, it is necessary to bring their perspective into the process, and b) research is usually conducted in collaboration with partner institutions and programs; consequently, the objectives of the partners should also be considered in planning and prioritizing research.

Table 2 shows a proposed set of variables of analysis but, to be consistent with the above statement, these need to be appropriately validated with stakeholders in every region. Additionally, every variable has to be ranked according to the importance it has for the achievement of the proposed objectives.

**Table 2.** Variables of analysis that can be considered for the application of a scoring model.

| NUS Objective | Variables of Analysis |
|---|---|
| Contribute to ecosystem stability | Low requirements |
| | Adaptation to marginal lands/harsh environment |
| | Low environmental impact or contribution to improvement |
| | Source of genetic traits |
| | Contribution to conservation (endangered sp) |
| | Potential contribution to intra- and inter-specific genetic diversity with a focus on climate change related factors |
| Contribute to food security and better nutrition | Alternative source of food |
| | Contribution to nutrition (protein/energy) |
| | Contribution to hidden hunger (specific to area) |
| Increase incomes for the rural poor | Alternative source of income |
| | Potential new product |
| | Potential for industrial use |
| | Multiple use products/multipurpose crop |
| Foster cultural diversity | Historic value |
| | Landscape value |
| | Contribution to health |
| | Level of importance of species (local, regional, global) |

Source: own elaboration with variables cited by different authors. (Barone, E.; Caruso, T.; 1999), (Tazi, M.; 1999), (ICUC-GFU, 2008)

Throughout the scoring model process, the contribution of every crop or combination of crops will be aggregated in order to attain a final score for each alternative. This will provide a score or reference regarding the importance for every crop or combination of crops.

Moreover, to start a particular planning process on a selected crop or combination of crops, the constraints faced by them need to be taken into consideration. This would allow priorities to be set on the different types of research to be conducted (conservation, commercial applications, documentation, etc.), and aid in defining how funds can be assigned among these types of research.

A baseline for this type of analysis is provided by the constraints identified for different crop categories, where variations that reflect the nature of the crops can be clearly observed. A categorization of species was developed during the IPGRI Conference on Priority Setting (9-11 February 1998, ICARDA, Aleppo, Syria). NUS species were divided according to the type of crop, and nine categories were identified on the basis of use and biological classification (e.g., legumes and cereals). Once crop categories were identified, major constraints faced during the promotion of these species were identified, and values were given to each constraint, reflecting the degree of impact in limiting the use or increasing the state of neglect of species in each category (Padulosi (b), 1999).

**Table 3.** List of constraints per type of crop, with highest numbers indicating highest weight on correspondent constraints.

| SPECIFIC CONSTRAINTS IN NUS RESEARCH AND DEVELOPMENT | MAP | Forest Trees | Fruit Trees and nuts | Vegetables | Forages/ Browses | Industrial | Ornamental | Legumes | Cereals |
|---|---|---|---|---|---|---|---|---|---|
| Low competitiveness | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Lack of knowledge on uses | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Lack of research on genetic diversity assessment and use | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Policy and legislation | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 |
| Loss of traditional knowledge | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 |
| Lack of market/poor commercialization | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 1 | 1 |
| Low income | 2 | 3 | 2 | 2 | 3 | 3 | 1 | 2 | 2 |
| Lack of propagation techniques | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 1 | 1 |
| Scarce knowledge on cultural practices | 3 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 1 |
| Lack of attractive traits | 1 | 2 | 3 | 3 | 1 | 2 | 1 | 1 | 1 |

Source: List of Constraints per type of crop" (Padulosi, (b) 1999)

The information presented in table 3 can be used as reference but should not be generalized. The best way to address this issue is to deliver participatory consultations with researchers and stakeholders working in a specific region and with the crop or group of crops in question. An example of such consultation processes are those carried out by ICUC in Africa (Jaenicke et al. (a), 2006), (Haq and Atkinson, 1999); and Asia (Jaenicke et al. (b), 2006), (Haq and Hughes, 2003). Such consultation events are the best place to validate a list of constraints, as well as assign importance to each constraint. This simple scoring process can be arranged by type of stakeholder, to allow the subsequent combination of data, and can also provide information to help determine what areas of research and development need to be emphasized.

C. Participatory Methods (Demand-Oriented)

Traditional priority-setting approaches tend to have a bias towards applied research because its benefits are more tangible and, thus, more amenable to financial evaluation (Braunschweig, 2000). Nonetheless, new knowledge generated by research processes, even if not directly applicable in the productive sector, may still have substantial value in terms of conservation, poverty alleviation and the achievement of the millennium development goals. Therefore, it is important to include a participatory perspective that shows the interests, needs and demands of target groups, as well as of other stakeholders.

The Scoring Model previously proposed includes the use of participatory tools to identify weights of importance for objectives, variables and constraints. Nonetheless, it is important to incorporate a participatory method that enables the appropriate adjustment and targeting of the intervention at a local level. The method should take into account local demands in order to set priorities for specific objectives and activities.

As was mentioned earlier, the selection of a method should be based on the particular situation in which the project is being implemented. Table 4 shows a summary of suggested methods for certain situations, and takes into consideration the analysis shown in Figure 2.

**Table 4.** Ranking of suggested methods according to type of project

| Type of project according to the emphasis on a particular objective | Suggested Methods | | | |
|---|---|---|---|---|
| | Small scale (few communities – can work with every individual community) | | Large scale (many communities, districts or other geographic units) | |
| | Step 1 | Step 2 | Step 1 | Step 2 |
| Contribute to ecosystem stability | • Participatory Adjustment of proposals | • Participatory Monitoring and Evaluation | • Participatory Adjustment of proposals | • Outcome Mapping<br>• Participatory Impact Pathway Analysis * |
| Contribute to food security and better nutrition | • In-depth study of demands | • Participatory Monitoring and Evaluation | • Participatory Adjustment of proposals | • Outcome Mapping<br>• Participatory Impact Pathway Analysis * |
| Increase incomes for the rural poor | • Participatory Monitoring and Evaluation<br>• In-depth study of demands | • Participatory Market Chain Approach | • Outcome Mapping<br>• Participatory Impact Pathway Analysis<br>• Qualified Demand and Risk Management Approach | |
| Foster cultural diversity | • Participatory Monitoring and Evaluation | | • Participatory Adjustment of proposals | • Outcome Mapping<br>• Participatory Impact Pathway Analysis * |

Source: own elaboration

* If more than one method appears per cell, one should be chosen according to intervention. See Annex I for details on every method.

When selecting a method, it is important to consider that not necessarily all methods on the list should be applied. Only one or two should be selected according to the needs. For example, both Outcome Mapping and Participatory Impact Pathway Analysis have elements in common, therefore, it is only necessary to apply one of them. The selection would also depend on the preferences of the facilitating team.

## 5. Performance assessment and comparison of alternatives

Once criteria and methods are selected, the expected performance of technologies is assessed through the application of the method, or combination of methods, and best alternatives are identified.

In the particular case of the proposed combination of methods for neglected and underutilized species, sequential assessments need to be performed by level of priority setting.

## 6. Approval and implementation

The final step is the approval and implementation of selected alternatives.

## HOW TO DEAL WITH THE CHALLENGE OF IMPLEMENTING THE PROCESS

Byerlee (2000) mentions that a big challenge in priority setting is developing institutional mechanisms that blend bottom-up and top-down approaches to priority setting. The proposed combination of methods is an attempt to blend both of these approaches. The implementation would require work to be organized in three steps, with specific issues relating to every step.

**Table 5.** Organization of work to deliver the priority-setting process

| Steps | Issues to be addressed |
|---|---|
| Global analysis | • Consolidating the spatial definition of regions<br>• Facilitating the definition of variables of importance on every region<br>• Processing information for the application of the "Geographic Research Problem Domains" Method<br>• Identifying potential areas for intervention regionally |
| Meso analysis | • Facilitating in every region the ranking of importance of global objectives<br>• Validating variables of analysis for crops or groups of crops<br>• Providing a ranking of importance of crops selected for determined areas<br>• Facilitating the analysis of constraints and their relative importance for the selected crops<br>• Outlining a suggested orientation of research areas for every crop or group of crops, according to the constraints and their importance |
| Micro analysis | • Delivering participatory methods at the local level to identify problems, demands and constraints<br>• Facilitating a planning process to adjust macro and meso priorities to fit with local priorities |

Source: own elaboration

# PART III

# IDENTIFICATION OF ISSUES NOT ADDRESSED BY PRIORITY-SETTING METHODS CURRENTLY IN USE

Historically, the Technical Advisory Committee of the CGIAR played a powerful role in the CGIAR's governance and organizational structure by setting system-level priorities, recommending allocation of resources among Centers, programs, and activities; monitoring budgets; conducting Center-level and System-level reviews; and, more recently, assessing impacts (Lele, U., 2004).

However, Lele states that the TAC's influence declined during the 1990's. In support of a CGIAR meta-evaluation, the Operations Evaluation Department (OED) of the World Bank conducted a survey to solicit input from 235 CGIAR stakeholders and outside observers in December 2001. Among the responses to this questionnaire, the two that focused specifically on priority setting were as follows (Lele, U., 2004):

1) 67% believed that the Technical Advisory Committee of the CGIAR's role in priority setting had declined in the past decade
2) 54% said that the Science Council should have the lead in System-level priority setting; 30% disagreed; and 16% did not know.

These and other findings led the OED to formulate a recommendation regarding the specific issue of priority setting within the CGIAR: "The governance of the CGIAR should be reconfigured to promote greater efficiency, tougher priority setting, and scientific excellence without sacrificing legitimacy and ownership" (Lele, 2004).

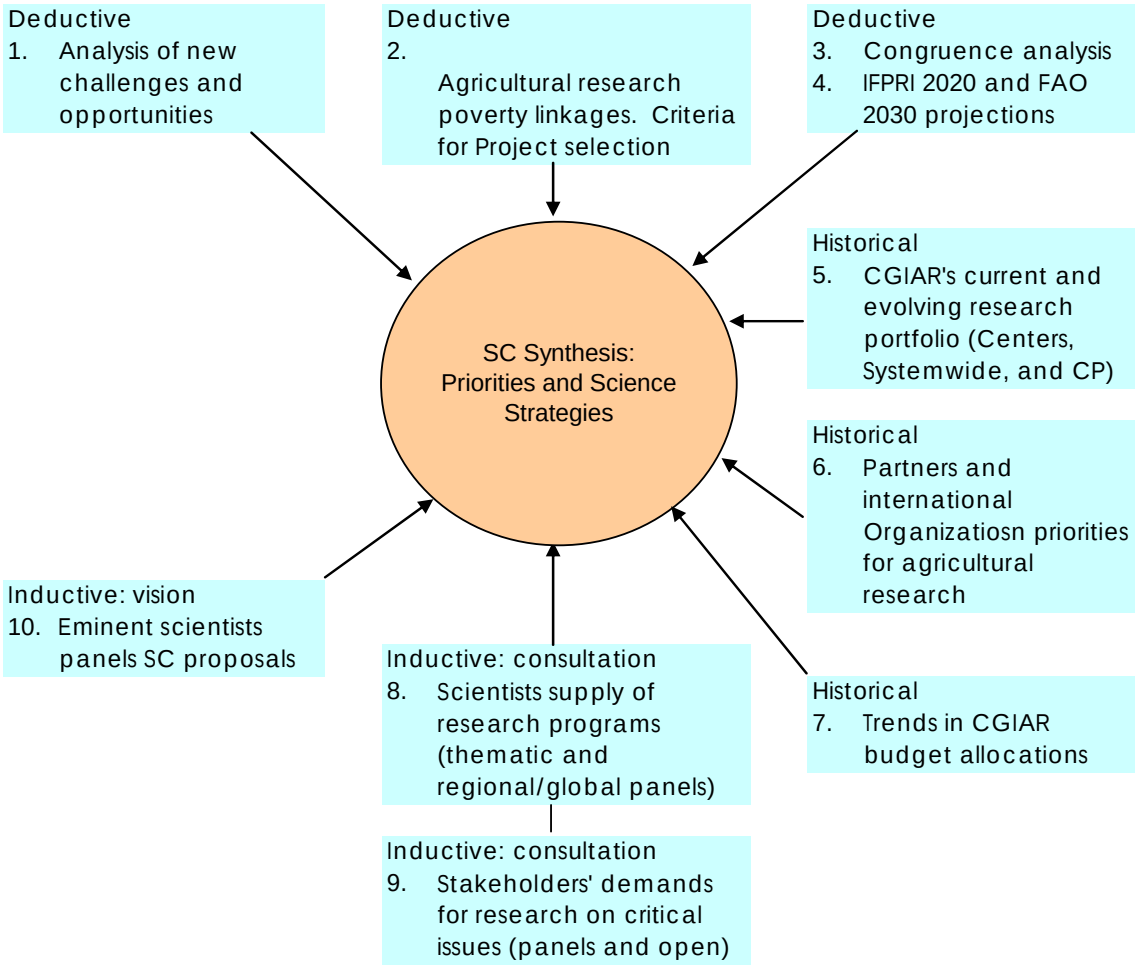
By 2004, these observations and recommendations were internalized by the CGIAR. The Standing Panel on Priorities and Strategies (SPPS) of the CGIAR Science Council developed a consultative process on priority setting that provided background information for the 2005 – 2010 CGIAR Report on Priorities and Strategies, and the subsequent steps taken by the Science Council on System Priorities.

Until the 1990's, CGIAR research was largely driven by the goal of increasing productivity in the production of major food crops, according to CGIAR Science Council 2004. Until 1997, research priorities and resource allocation among commodities was facilitated by precedence and congruence methods based on the value of production (See Annex I for details on the method).

Over the years, this approach has become insufficient because the current goals and mission of the CGIAR have significantly broadened the objectives it pursues. Furthermore, the CGIAR needs to address increasingly complex, unresolved problems and deal with the multidimensionality of poverty, the multiplicity of constraints, the heterogeneity of local situations, and global problems of extraordinary scope and complexity (Science Council, 2004). As a

consequence, a new approach was developed to identify CGIAR Priorities and Strategies.

**Figure 3.** Science Council's approach to identifying CGIAR Priorities and Strategies.




Source: Science Council, 2005.

This new priority-setting process includes deductive approaches that seek to screen new challenges and future opportunities through a set of criteria that can update congruence analysis. It uses historical approaches to update a precedence analysis, and uses deductive approaches to identify demand and identify new opportunities for research.

The priority-setting process proposed by the Science Council is well-suited for determining new challenges and opportunities for research from the scientific point of view. It seeks to support its structure through an outlining process of historical research agendas and a consultation process that reaches out to compile information from stakeholders and scientists.

The challenge now is to blend this approach with a bottom–up strategy that integrates the potential of research with the demands of everyday technology users on specific areas and topics.

Scoones and Thompson (1994), said that much of the problem with conventional agricultural research and extension has been the process of generating and transferring technology, and that much of the solution lies in farmers' own capacities and priorities. The Science Council approach attempts to tackle the issue through a broad consultation process, yet it is up to every individual center and initiative to balance this approach with tools that will allow a compilation of priorities at the grassroots level. The process should start from a local level, using participatory approaches and tools for community level analysis and planning, in order to determine major problems and priority themes for research.

## ANALYZING CGIAR'S SYSTEM PRIORITY AREAS, THE MILLENNIUM DEVELOPMENT GOALS AND THE CONTRIBUTION OF NUS

From the priority-setting efforts led by the CGIAR Science Council, the following five System Priority Areas for CGIAR research were identified (CGIAR Science Council, 2005):

A. sustaining biodiversity for current and future generations;
B. producing more and better food at a lower cost through genetic improvements;
C. reducing rural poverty through agricultural diversification and emerging opportunities for high-value commodities and products;
D. poverty alleviation and sustainable management of water, land and forest resources;
E. improving policies and facilitating institutional innovations to support sustainable reduction of poverty and hunger.

As shown in table 6, all of the system priority areas identified contribute directly or indirectly to all of the Millennium Development Goals (MDGs).

**Table 6.** Direct and indirect impacts of CGIAR priority research on MDGs

| Millennium Development Goals | *System Priority areas for CGIAR research | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| **MDG 1:** Reduce extreme poverty and hunger | + | ++ | ++ | ++ | ++ |
| **MDG 2:** Ensure universal primary education | | + | + | | |
| **MDG 3:** Reduce gender disparity | | ++ | ++ | ++ | ++ |
| **MDG 4:** Reduce child mortality | + | + | + | + | + |
| **MDG 5:** Improve maternal health | + | + | + | + | + |
| **MDG 6:** Combat HIV/AIDS, malaria and other diseases | | ++ | | | ++ |
| **MDG 7:** Ensure environmental sustainability | ++ | ++ | + | ++ | ++ |
| **MDG 8:** Develop global partnerships for development | ++ | + | | ++ | ++ |

Source: Direct and indirect impacts of CGIAR priority research on MDGs (CGIAR Science Council , 2005)
*The five areas are listed in the above paragraph
++ denotes direct impact
+ denotes indirect impact

Drawing back to the objectives of NUS (see Table 2), we can see that all of them contribute directly to the CGIAR system priorities and, in turn, to the MDGs.

When we take a closer look at areas where NUS interventions are in progress or have high potential for this purpose, we see that extreme poverty is a main issue. People die of hunger, malnutrition, childbirth, and endemic diseases. It is difficult to work towards solutions through research when there are so many causes of poverty.

The CGIAR system is specialized in research, yet can it afford to overlook the entrenched development issues in areas where research is taking place? This and other problems may be partially addressed by the implementation of a priority-setting exercise at the local level. This exercise should reflect a holistic view of local needs, including topics for either research or development agendas.

With this broader horizon we need not only strengthen and develop networks of cooperation with research institutions, but more importantly, we must find ways to increase links with development institutions at all levels. We must seek to integrate agricultural development with education, health and human rights issues. How can farm workers produce food if they are too sick to work? How can children learn on empty stomachs or with no drinking water? How can gender inequality and violence against women be overcome, if they remain sick, hungry and economically dependent? Because all issues are deeply interlinked, there can be no intervention that focuses on a specific theme. This is a challenge that donors, research institutions and development agencies must face. The CGIAR system is no exception and it needs to open up its

horizon to consolidate partnerships with institutions and organizations beyond the research arena and the agricultural sector.

During an interview with Society Guardian in September 2008, Gordon Brown, UK prime minister commented on the need for faster progress on the MDGs: "I think if we could coordinate as a global summit, that could make a huge difference" (Tickle, 2008). This shows an awareness of the need for global integration, not only amongst researchers or development practitioners, but also among politicians and donors.

So far, some progress has been made towards the achievement of the MDGs. Nevertheless, there is a still long way to go. The contribution of NUS crops to the MDGs agenda as well as to the CGIAR goals and objectives is significant. Therefore setting priorities with NUS crops can be the starting point for the development of a new paradigm, one that defines research agendas with and for the end-users.

Furthermore, understanding the need for a holistic and multidimensional approach, the Strategic Framework for Underutilized Plant Species attempts to highlight specific fields of activities and, by doing so, to promote coordinated efforts to simultaneously tackle as many aspects of the problem as possible (Jaenicke and Höschle-Zeledon, 2006). Achieving this vision requires bringing together the different CGIAR centers, programs and initiatives, so that they will work more closely together on a common goal.

# PART IV
# RECOMMENDATIONS TO ENHANCE RELEVANCE OF NUS RESEARCH FOR COMMUNITIES

The ICUC, GFU and their partners have agreed that instead of simply ticking off a list of top-down priorities, it is crucial that the activities be part of a bigger picture, where numerous partners participate in diverse activities (Jaenicke and Höschle-Zeledon, 2006). To achieve this vision, efforts must be made to promote participatory approaches not only in the priority-setting stage, but also during capacity development of stakeholders and local groups, in order to facilitate innovation processes on a sustainable basis. Therefore, other approaches must be considered in order to consolidate the continuous expression of demands for research and development, as a sustainable process.

Furthermore, if the mandate of the CGIAR remains the provision of support to National Agricultural Systems, then one key area of priority research must be the development of participatory methodologies for agricultural research (Scoones and Thompson, 1994). Yet this research should not only focus on methods for research and development, but also on priority setting as a management tool.

Despite the currently more favorable climate for conducting research on underutilized species, there remains a disproportionate gap between research funding needs and successful resource mobilization (Withers, L., 2005). Nevertheless, if the vision is set on integrated research for development, alliances with different organizations and institutions outside the specific area of biodiversity, agriculture and research should be fostered. This will enable different actors to contribute to the solution of different problems of target groups and, in turn, will represent more efficient results in terms of the livelihoods of producers, communities and target organizations.

To enhance the relevance of NUS research for communities, three basic steps should be taken:

**Strengthen and promote local organizations or groups** to be committed with research initiatives. Communities must feel like they own the initiative and this will only happen when they are part of the whole process, from the formation of the main idea to the planning and execution of the process itself.

**Develop flexible projects and proposals** that can be adjusted progressively according to their evolution. Many times, projects are developed with specific objectives, outputs and deliverables over a period of time and this will in some ways restrict changes. A certain level of flexibility will allow communities and organizations to have a say and adjust proposals, ensuring that the results achieved are not only of scientific relevance but, more importantly, are relevant for end users.

**Foster interaction with diverse institutions and organizations** at local, regional and national levels. Many times, when communities are setting

priorities for research and development, we will see that the constraints usually go beyond our specific lines of work. There are times when constraints in infrastructure, services, health and other issues can be so strong that they will limit the contribution that can be made by research in agriculture. This is why fostering interactions with other institutions of diverse nature and scope becomes vital. Integrating the agricultural research agenda on NUS with other agendas such as education, health, services and others will not only increase the relevance of research, but it will also increase chances of achieving deeper impact in improving the livelihoods of the poor.

Often, proposals and projects are developed based on results from a global process of priority-setting that follows different priorities. Yet these projects need to be flexible enough to be adjusted and molded to the specific context in the field. They must allow a local planning process that outlines constraints and needs of a different nature and scope. It should respond to research priorities set at the local level, while integrating this with the proposed research agenda.

Moreover, the priority-setting exercise at a local level will be the starting point to strengthen local organizations and enhance ownership regarding the project or initiative. The priority-setting exercise will also be the guideline that determines the need for interaction with other institutions.

Finally, it is important to consider that research and extension in general must keep in mind two levels: a more abstract level that considers policies and institutional or global agendas, and a more tangible level that addresses people's needs and priorities.

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# ANNEX I
# SUPPLY-ORIENTED PRIORITY-SETTING METHODS

## A. COST - BENEFIT ANALYSIS

### MAIN CHARACTERISTICS

The aim is to gauge the efficiency of the intervention relative to the status quo. The costs and benefits of the impacts of an intervention are evaluated in terms of the public's willingness to pay for them (benefits) or willingness to pay to avoid them (costs). Inputs are typically measured in terms of opportunity costs - the value in their best alternative use. The guiding principle is to list all of the parties affected by an intervention, and place a monetary value of the effect it has on their welfare as it would be valued by them.

Cost-benefit analysis attempts to put all relevant costs and benefits on a common temporal footing. A discount rate is chosen, which is then used to compute all relevant future costs and benefits in present-value terms.

This model uses efficiency as the main criterion for ranking alternative research themes.

### PROCESS

Knowing the benefits and costs of the research over a period of time, it is possible to carry out profitability analyses to show the economic viability of the research. The three most recognized ways to carry out profitability analyses are the Net Present Value (NPV), the Internal Rate of Return (IRR) and the Benefit-Cost Ratio (BCR). NPV in the year "t" is equal to a flow of benefits generated by an investment minus a flow of costs of this investment, discounted by an appropriate rate. If NPV is positive, then the investment is considered as profitable.

$$NPV_t = PV(B)_t - PV(C)_t = \sum_{j=0} \frac{(B_{t+j} - C_{t+j})}{(1+i)^j}$$

IRR is the rate that turns the NPV to zero or turns the present value of benefits equal to the present value of costs. The IRR should be higher than the rates available on the market for alternative capital use, in order to consider the investment as profitable.

$$0 = \sum_{j=0} \frac{(B_{t+j} - C_{t+j})}{(1+IRR)^j}$$

BCR represents the relationship between the present value of the benefits and the present value of the costs. The investment is considered profitable if the benefit-cost ratio is higher than 1.

$$BCR_t = \frac{PV(B)_t}{PV(C)_t}$$

## ADVANTAGES

Cost-benefit analysis is mainly, but not exclusively, used to assess the value for money of very large private and public sector projects. This is because such projects tend to include costs and benefits that are less amenable to being expressed in financial or monetary terms (e.g. environmental damage), as well as those that can be expressed in monetary terms.
A variant of this method is the Cost - Social Benefit Analysis, which takes into account and values benefits accumulated by the poor.

## DISADVANTAGES

The accuracy of the outcome of a cost-benefit analysis is dependent on how accurately costs and benefits have been estimated. The outcomes of cost-benefit analyses should be treated with caution, because they may be highly inaccurate.

These outcomes (almost always tending to underestimate, *unless significant new approaches are overlooked*) are to be expected, since such estimates:

1. rely heavily on past like projects (frequently differing markedly in function or size, and certainly in the skill levels of the team members),
2. rely heavily on the project's members to identify (*remember* from their collective past experiences) the significant cost drivers,
3. rely on very crude heuristics ('rules of thumb') to estimate the money cost of the intangible elements, and
4. are unable to completely dispel the usual (subconscious) biases of the team members (who often have a vested interest in a decision to "go ahead") and the natural psychological tendency to *"think positive"* (whatever that may involve).

Another challenge in cost-benefit analysis comes from determining which costs should be included in an analysis.

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## B. ECONOMIC SURPLUS

### MAIN CHARACTERISTICS

The economic surplus method is a single-criterion approach that estimates returns to investment (generally an average rate of return). It can be used (1) to estimate the distribution of research benefits among producers and consumers, (2) to assess the spillover of research benefits among different technologies, commodities, regions, or countries, and (3) to estimate the effects of agricultural policies on the benefits arising from research.
This method is based on the standard cost-benefits analysis used in projects.

### PROCESS

The economic surplus method proposes the following process:

1. estimating the benefits from research in terms of the change in consumer and producer surpluses resulting from technological change;
2. using the estimated economic surplus together with research costs to estimate an internal rate of return.

*Ex-ante* analysis of future research benefits requires information on expected values of production, expected yield increases, reduction of unit costs, probabilities of research success, market conditions, adoption rates, levels of supply and demand elasticity, and the appropriate discount rate for converting future benefits and costs into present values. Benefits and costs are projected over several years and internal rates of return to research, benefit-cost ratios, or net present values are calculated. These values are used to help rank commodities, research programs, or projects.

### ADVANTAGES

An important advantage to this approach is that it allows for more accurate and, thus, more credible calculations of efficiency and distributional effects of research, and it helps allocate resources to each commodity program or type of research.

### DISADVANTAGES

One limitation that the approach presents is that the method requires substantial expenditures for collecting, processing, and interpreting economic and technical data.
The method makes many assumptions.
It is not very transparent (to non-economists).
There is no place for group discussions during the priority-setting process (low active participation). It is also not very well suited for ranking non-commodity research areas, such as basic, socioeconomic, or interdisciplinary research.
In order to incorporate multiple objectives, the economic surplus approach needs to be combined with scoring.

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## C. GEOGRAPHIC RESEARCH PROBLEM DOMAINS

### MAIN CHARACTERISTICS

Geographic information systems (GIS) provide a useful approach to evaluating a set of site-specific resources and their relationship to a given problem domain. GIS can be used to identify suitable regions for growing specific crops, based on the analysis of conditions given on specific geographic areas. In the past, relating geographic factors was difficult due to limited capabilities of equipment. Nowadays, due to new computer tools, a highly sophisticated analysis of geographically based resources is possible, allowing a deeper understanding of geographic problem domains, as an input for research priority setting.

### PROCESS

To identify research problem domains there is a set of proposed steps:

1. identifying mappable conditions that broadly enable or constrain different development options identified as important for Neglected and Underutilized Species;
2. collecting information on identified conditions and organizing them on spatial maps;
3. using spatial summary analysis of the characteristics of different production regimes to evaluate the potential of NUS on certain domains.

A variant of the method may include the understanding of geographic distribution of non-domesticated species or strategic factors for genetic resource conservation.

### ADVANTAGES

This method captures important geographical factors that influence livelihood options and economic outcomes.
The method can help identify potential productive areas for certain NUS crops to promote dissemination.
This method can be easily combined with the analytic hierarchy process to arrange factors according to their importance for different stakeholders or other important criteria.

### DISADVANTAGES

Failure to go beyond agroecology towards a broader set of geographical development conditions will certainly limit the effectiveness of geographically-informed efforts guiding development and research strategies.

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## D. SCORING MODEL

### MAIN CHARACTERISTICS

The Scoring Model is a multi-criteria approach often recognized as a congruence method with many variables. The model incorporates multiple objectives by modifying the simple and traditional measures of research evaluation – changes in value of production – to consider the concerns of equity, sustainability and trade. Given the relative importance of objectives, the scoring model makes tradeoffs between objectives explicit.

### PROCESS

The scoring methods propose the following process:

1. selecting a broad set of research objectives (e.g., efficiency, equity, food security, or environment);
2. selecting research priority dimensions by establishing indicators of research contributions to achieve these objectives. Examples of such indicators are the value of production, probability of research success, cost of research, and expected adoption, among many others;
3. attaching relative weights to the objectives or criteria, and calculating weighted average scores for each research area;
4. ranking commodities or research programs according to each objective, and multiplying these rankings by the weights to derive a final composite ranking.

### ADVANTAGES

The scoring models can be developed in a relatively short period of time, they are relatively transparent, they allow extensive active participation, and they do not require advanced quantitative skills. They can be used to rank a long list of commodities, as well as research areas, including non-production-oriented research and both qualitative and quantitative information.
Scoring models can integrate other methods as criteria, allowing decisions to be based on several criteria.

### DISADVANTAGES

The scoring models seem simple to apply and, therefore, users often overlap objectives, duplicate criteria (indicators), and add criteria at random. Other shortcomings may result from inaccurately accounting for research spillovers and ignoring the effects of domestic and trade policies.

The precision of the scoring components can be improved, however, by combining them with economic surplus calculations. A final criticism, which indeed applies to all priority-setting procedures, is that the weights assigned to the objectives are highly subjective.

Nevertheless, the results of scoring models can be improved by combining them with other methods such as economic surplus and mathematical programming,

which consider the probability of research success, adoption rate, research spillover effects and distribution of research benefits.

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## E. ANALYTIC HIERARCHY PROCESS

### MAIN CHARACTERISTICS

The analytic hierarchy process (AHP) is a multi-objective, multi-criteria decision-making tool that employs multiple paired comparisons to rank alternative solutions to a problem, formulated in hierarchic terms (Ramanujam and Saaty 1981)

### PROCESS

AHP uses the following three-step procedure:

1. creating a hierarchy of a minimum of three levels to structure the decision-making problem. The overall goal of the priority-setting exercise (e.g. setting priorities among a set of research projects) is at the first (top) level, followed by a second (intermediate) level consisting of the decision-making criteria (e.g. research objectives) by which the alternatives (e.g. research projects), located in the third (bottom) level, will be evaluated;
2. weighting the criteria and evaluating the alternatives. Criteria are compared in pairs with respect to their importance to the goal, while alternatives are compared in pairs with respect to the criteria;
3. determining the overall priority of each alternative and obtaining the final ranking of the alternatives.

### ADVANTAGES

AHP is particularly suitable for situations in which much of the necessary data is subjective (such as biotechnology or neglected species). It can be consistently introduced into the priority setting and it can deal with decision-making problems involving multiple criteria dimensions.

Unique to AHP is that it recognizes biases and inconsistencies in subjective judgments. These inconsistencies can be tested and improved, resulting in a more consistent final ranking.

Other advantages of the approach are that it allows group decision-making by the different stakeholders in agricultural research (active participation in structuring the hierarchy and eliciting the judgments), and is a transparent process. The method can be combined with other methods such as economic surplus and mathematical programming in order to improve the allocation of resources.

It has a commercially developed computer software support – Expert Choice (www.expertchoice.com)

### DISADVANTAGES

One problem with AHP is the pair-wise comparison. If there are many alternatives (e.g. projects) to evaluate, then the number of comparisons will make the process tedious. For example, to evaluate 10 projects, 45

comparisons will be required for each criterion.

The commercial software has a market price that limits access for developing countries and small-scale initiatives.

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## F. MATHEMATICAL PROGRAMMING MODEL

### MAIN CHARACTERISTICS

Mathematical programming is an optimization procedure for guiding the allocation of limited resources. Unlike scoring and cost-benefit methods, which only produce a ranking of alternatives, mathematical programming aims to select an "optimal" research portfolio. This optimal portfolio is achieved by formulating an objective function that is maximized, subject to certain constraints. The objective function can include multiple objectives and a weighting system to reflect differences in the importance of the objectives. Several variations are possible, including multiple-objective programming, goal programming and compromise programming.

### PROCESS

1. defining objectives and weighting system to reflect differences in the importance of objectives;
2. defining constraints;
3. designing an objective function;
4. collecting data;
5. testing and running the model.

### ADVANTAGES

An interesting feature of mathematical programming methods is their ability to deal with varying levels of funding for each activity. This means that decisions can be made on partial funding of activities, but the functional relationship between the level of funding and the benefits must be known.

It can also be used to illustrate the trade-offs among objectives, and to analyze the implications of changing constraints.

### DISADVANTAGES

Considerable analytical skill is required for the proper formulation of a model.

These methods are time consuming.

The data collection requires some effort and time, with additional time required for designing, testing and running the model.

### LITERATURE REVIEW


- Braunschweig, T., 2000. Priority Setting in Agricultural Biotechnology Research: Supporting Public Decisions in Developing Countries with the Analytic Hierarchy Process. Research Report No. 16. The Hague: International Service for National Agricultural Research.

## F. RULE OF THUMB

### MAIN CHARACTERISTICS

This method is the starting point for the precedence and congruence methods. The precedence method uses the previous year's funding as the basis for the current year's allocations. Changes in budgets and other resources are shared proportionally by each research activity. In congruence analysis, the available resources are allocated across research areas in proportion to their relative value of production.

### PROCESS

The precedence method analyzes the level of funding in the previous year as a basis for the following year's allocation of resources.
The congruence method ranks alternative research themes or areas on the basis of a single measure. Frequently, the measure is the value of production of research areas and/or initiatives.

### ADVANTAGES

This method is the least sophisticated and the simplest to use. Its major advantage is that its data requirements are low.
The precedence method permits continuity in terms of accumulating research skills and experience.
The congruence approach is more flexible than the precedence, in that it allows research activities in areas of decreasing value to be phased out.

### DISADVANTAGES

The precedence approach does not consider the diminishing returns on certain research investments that may warrant shifts in funding.
The precedence approach does not take into account the emerging problems in agriculture or any promising new areas of research.
The precedence approach focuses exclusively on economic efficiency, at the expense of other research objectives.
Both methods emphasize the status quo and rely heavily on historical data.
The disadvantages of the congruence method are that the logic is poor, it is difficult to compare commodities with resource factors, and usually a single criterion cannot express the complexity of a situation.

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# ANNEX II
# DEMAND-ORIENTED PRIORITY-SETTING METHODS

## A. IN–DEPTH STUDY OF DEMANDS

### MAIN CHARACTERISTICS

To achieve quality and efficiency in project or program execution, there must be an adequate congruence between demand and supply. For this purpose, the projects INNOVA and FOCAM, financed by the United Kingdom Department for International Development (DFID), designed and tested the "In–depth study of demands" method, as a participatory instrument allowing researchers to understand problems and the need for technology innovation at a local level.

The "In-depth study of demands" method seeks to contribute to innovation adoption by promoting the identification of project ideas centered on the farmers' demands and inspired by their vision of development.

The method incorporates the sequential use of a set of participatory tools such as: problem trees, priority-setting matrix, community maps, valuation tools, etc.

### PROCESS

A supposition for the application of this method is that there is a broad idea, demand or project proposal that needs to be analyzed in-depth.

**Step 1.** Zonification of influence area
Local criteria are used to characterize the area of influence. Local people may use criteria such as population, access to water resources, traditional indigenous organization, or others. These criteria are complementary to other geographic or scientific information and, in some cases, may determine the viability of an intervention.
**Step 2.** Organization of working groups according to the zonification generated in step 1.
**Step 3.** In-depth analysis and set priorities of demands in relation to the vision of development of the target group. This step is the heart of the method and it basically consists of a workshop where the target group (divided in smaller groups – see step 1) works with participatory techniques to identify problems at different levels and to value them according to the importance they have for the group.
**Step 4.** Synthesis of workshop results. At this point, information from every group is shared with all others, in order to analyze it and seek consensus.
**Step 5.** Triangulation of information
The information obtained in the participatory workshop is arranged in a survey to be delivered to a sample of the target group population. The survey collects information about the priorities of the sample, with regard to the demands expressed in the workshop, including some flexibility to express additional demands. This information is systematized to be presented to the target group.
**Step 6.** Consensus workshop
Information from the participatory workshop and the survey is arranged to show similarities and differences. This information is presented at a plenary meeting with representatives of the target group. The objective of the meeting is to achieve consensus about demands and their importance in different areas,

according to the local zonification prepared in step 1.
**Variant**
When the participation of the target group during the first workshop is representative enough of the population, steps 5 and 6 may not be necessary.

## ADVANTAGES

The method helps understand local demands and is easily applied on a small scale.
It can be focused on a specific demand avoiding other demands that cannot be handled by the institution or project.
It does not rely on data sets or secondary information, which are usually scarce or inexistent with regard to poor areas and NUS crops.

## DISADVANTAGES

It has some limitations in being applied on a bigger scale.
The abilities of the facilitators in using participatory methods and techniques may influence the results of the process.
Some leaders may influence the process to their favor; this is why it is important to count on appropriate representation from the target group.

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## B. QUALIFIED DEMAND AND RISK MANAGEMENT APPROACH

### MAIN CHARACTERISTICS

Often times, when producer organizations or target groups express their demands, one element that is not taken into consideration is risk. This is why the method was developed by ATTICA to include risk management in the process of understanding the target group's demands.
The method seeks to work with a target group in order to identify genuine demand and transform it into qualified demand through management.

### PROCESS

A supposition for the application of this method is that there is a broad demand identified. A second supposition is that the facilitators of the process are skilled in the use of participatory methods and techniques.

**Step 1.** First Participatory Workshop
The first workshop, held with representatives of the target group, focuses on confirming the demand and introducing risk management elements. Once the genuine demand is confirmed and risk elements properly introduced, a Farmer Impact Hypothesis is formulated, its components identified and a clear definition of what needs to be done is outlined.
All the information collected in the first participatory workshop is analyzed and prepared for the next step.
**Step 2.** Second Participatory Workshop
The second workshop, held with representatives of the target group, concentrates on the analysis of actors, the establishment of priorities within the problems identified and, finally, the planning of alternatives to respond to the demand.
The facilitating team provides support after the workshop to outline a minimum log-frame and to prepare the information for the next workshop.
**Step 3.** Third Participatory Workshop
The third participatory workshop guides target group representatives in analyzing risks and vulnerability for the proposed alternatives. Local indicators are formulated and a final technical alternative is proposed. Furthermore, the group works on developing the basic log-frame of a proposal and defining activities and responsibilities.
The facilitating team aids in the final proposal elaboration and its presentation to financial aid and/or support institutions.

### ADVANTAGES

One of the advantages of the method is that it has as a final product the document of a project proposal fully supported by the target group organization.
The method helps legitimize local demands and is easily applied on a small scale.
It does not rely on data sets or secondary information, which are usually scarce or inexistent with regard to poor areas and NUS crops.

## DISADVANTAGES

It has some limitation in being applied on a bigger scale.
The abilities of the facilitators in using participatory methods and techniques, as well as log-frame and stakeholder analysis, may influence the results of the process.
Some leaders may influence the process to their favor; this is why it is important to count on appropriate representation from the target group.
Sometimes the demands may focus on infrastructure for production or other investment needs, rather than on technology innovation and research.

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## C. PARTICIPATORY ADJUSTMENT OF PROPOSALS

### MAIN CHARACTERISTICS

In many cases, priority setting is developed at a higher level (global, regional, national) for the formulation of big projects or initiatives that need to be delivered later at a local level with municipalities, communities and local organizations. In such cases, there may be difficulties in applying the project as it was formulated, usually due to local characteristics, needs and demands. The Participatory Adjustment of Proposals methodology seeks to achieve a better articulation of big projects at the local level, by adjusting expected outcomes, activities and indicators to that level. In this way, both technology innovation and intervention systems may be adjusted to fit the particular needs of different target groups.

The method incorporates the sequential use of a set of participatory tools such as: problem trees, priority setting matrix, valuation tools, ranking rating and sorting, local stratification etc.

### PROCESS

A supposition for the application of this method is that there is a larger-scale project or a local project that needs to be validated locally before application. A second supposition is that the facilitators of the process are skilled in the use of participatory methods and techniques.

**Step 1.** Characterization of communities and/or target groups, according to local criterion of wellbeing.
**Step 2.** First participatory workshop
During the first part of the workshop, the facilitating team socializes the proposal, its objectives and products.
During the second part, the target group is divided into smaller groups according to the local classification of wellbeing (Step1), and these groups validate the products and formulate activities to achieve the expected outcomes. Furthermore, the groups assign hierarchical values to products and activities according to the importance they have for the target group. Finally, local indicators are formulated to measure progress.
**Step 3.** Systematization and adjustment to the original proposal
With the information collected at the first workshop, the facilitating team works on adjusting products and expected outcomes and activities, producing an adjusted proposal that will still be validated by the target group.
**Step 4.** Adjustment workshop
During the adjustment workshop the adjusted proposal is presented to the target group. If the group agrees with the adjustments, the final proposal can be approved and implemented, otherwise there is still a chance to make adjustments until it responds to both the original objectives of the proposal and to local needs and demands.
**Step 5.** Final adjustment of proposal, approval and execution

In some cases, the first workshop and the adjustment workshop may be held in one, depending on the dimension of changes and adjustments needed.

## ADVANTAGES

The method helps adjust an already formulated proposal to local particularities. It works well with big initiatives that need to be applied in multiple areas of a smaller scale, or adjusting small proposals that were formulated on the basis of strategic priority setting rather than responding to a specific local demand.
It does not rely on data sets or secondary information, which are usually scarce or inexistent with regard to poor areas and NUS crops.

## DISADVANTAGES

The abilities of the facilitators in using participatory methods and techniques may influence the results of the process.
The facilitators need to have full knowledge of the original proposal and must have the possibility of making decisions for the adjustment.
Some leaders may influence the process to their favor; this is why it is important to count on appropriate representation from the target group.

## LITERATURE REVIEW


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## D. PARTICIPATORY MARKET CHAIN APPROACH

### MAIN CHARACTERISTICS

The participatory market chain approach is a method developed by "Papa Andina", a program of the International Potato Center (CIP), and it seeks to articulate small producers in the market.
The method fosters interaction among market chain actors in order to identify, prioritize and generate technology, market and institutional innovations. It develops interest, trust and collaboration among actors of the market chain.

### PROCESS

A supposition for the application is that there is a defined market chain.
A second supposition is that target groups are organized.

**Phase 1.** Research and diagnosis
The objective of this phase is to get to know the different market chain actors, with their activities, interests, ideas and problems. It includes a sequence of activities on working groups that express their capacities, potential and demands. The phase ends with a big event or workshop where all actors share the information drawn together.
**Phase 2.** Analysis of potentials
During this phase, there is an active analysis of joint business opportunities to respond to demands and potentialities expressed during Phase 1.
**Phase 3.** Response to opportunities
The final phase seeks to implement joint market innovations (new products, new technologies, and new institutions).

### ADVANTAGES

The method analyzes demand on a multilateral perspective, where all actors of the market chain interact and express their potentialities, needs and demands. This particular element makes priority setting a dynamic process where there are no pre-established criteria or hierarchy. Priorities for innovation in technology, market and institutional arrangements are set by the market in response to the needs and demands of the productive chain actors.

### DISADVANTAGES

One of the suppositions for the application of the method is that the target group is organized. This is not always true in the case of target groups working with NUS crops. This is why there will probably be the need to work previously or in parallel with a method for organizational strengthening, depending on the specific case and market chain.
When one or more actors are dominant, this may stop other actors from innovating because they fear retaliation.

### LITERATURE REVIEW

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## E. OUTCOME MAPPING

### MAIN CHARACTERISTICS

Outcome mapping is a method for planning and assessing the social effects and internal performance of projects, programs, and organizations. The axis of the method is a holistic and multidimensional vision of reality, thus promoting the active participation and interaction of different actors.
Throughout the process, the method uses a sequence of participatory tools that allow all actors to express themselves in the construction of a common vision and agreed intervention.

### PROCESS

A supposition for the implementation of the method is that there is a global intervention defined, or that strategic lines of action are somehow defined.

**Stage 1.** Intentional Design
The intentional design responds to answering 4 key questions: Why?, Who?, What?, and How? The following steps are designed to respond to these questions.

1. **Vision** reflects improvement in livelihood conditions supported by the project.
2. **Mission** expresses the particular way in which the project will contribute to the achievement of the vision.
3. **Boundary Partners** are the individuals, groups or organizations with whom the project relates directly, in order to achieve change.
4. **Outcome Challenges** are effects achieved by the project through the activities and strategies executed.
5. **Progress Markers** are sets of indicators that reflect changes in progress and the achievement of results.
6. **Strategy Maps** describe the approach of the project for the purpose of working with the direct partner and other partners.
7. **Organizational Practices** are assessed and new practices are introduced to promote and enhance creativity and innovation, in addition to best practices for accountability and partner assistance.

**Stage 2.** Outcome and Performance Monitoring

8. **Monitoring Priorities** are continuously defined by the project team.
9. **Outcome Journal** follows up on the progress of every partner over time.
10. **Strategy Journal** is a systemic mechanism to monitor activities. It helps the project adjust and modify activities.
11. **Performance Journal** registers information about project operation to achieve the mission. It feeds the project planning process.

**Stage 3.** Evaluation Planning

12. **Evaluation Plan** is a brief description of the main elements in an evaluation study.

### ADVANTAGES

It stimulates the learning process within a network and is highly participatory.

It is very useful for networks, because it is a systemic, non-linear approach and a flexible tool that takes into account unexpected results.
It is most useful in complex, open and dynamic situations where results are unpredictable.

## DISADVANTAGES

It requires important changes in the user of the methodology.
It takes some time to deliver the method and this may not always be understood, especially by target groups that need to see results in the short term.
It's inappropriate in situations where relationships of cause and effect are known.

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## F. PARTICIPATORY IMPACT PATHWAY ANALYSIS (PIPA)

### MAIN CHARACTERISTICS

Participatory Impact Pathway Analysis is a project planning, monitoring and evaluation approach. It draws from program theory evaluation, social network analysis and research, in order to understand and foster innovation. It is designed to help actors involved in a project make explicit their theories on change.

### PROCESS

The method works to describe how the projects will develop their research outputs and who, outside the projects, will use them to develop outcomes and impact. For this purpose there are 6 proposed steps:

**Step 1.** Draw a problem tree
It's a one-day workshop where participants develop a problem tree for the project. Participants initially identify problems that the project could address and, at the end, they have a short list of problems that the project will address.
**Step 2.** Derive project outputs
With the information from the problem tree, the group identifies the project's deliverables, products or results.
**Step 3.** Create a vision
Based on the problem tree, once again, the group is led to develop a common vision, if there was none beforehand.
**Step 4.** Draw network maps
Participants draw a current network map showing key relationships between stakeholders. Later on, they develop a future network map showing how things would change with the action of the project.
**Step 5.** Develop an outcome logic model
To develop an outcome logic model, the information from previous steps needs to be distilled and integrated. The logic model specifies the changes that will occur in practice or knowledge, attitude and skills. These changes are mapped according to the actor that will experience them and how the project's strategies contribute to bringing these changes about.
**Step 6.** Develop an M&E system
The M&E system is developed based on the outcome logic model. It includes identifying the outcome targets, milestones that measure progress, and the design of reflection workshops to follow up progress.

### ADVANTAGES

An important feature of the method is that it encourages participants to think beyond the scope of a single project.
The method is useful when two or more projects in the same program wish to integrate more effectively.
It works well in building understanding and commitment with project stakeholders.

### DISADVANTAGES

An important element in obtaining good results from the implementation of PIPA is having a good representation of all stakeholder groups. If representation from the target group is not adequate it may mislead the process.

## LITERATURE REVIEW


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## G. PARTICIPATORY MONITORING AND EVALUATION (PM&E)

### MAIN CHARACTERISTICS

PM&E is a method that seeks to identify demand at a local level and strengthen local target organizations by making them responsible for the planning, monitoring and evaluation of any research and development initiative. The method uses a sequence of participatory tools to identify demand, structure local planning, monitor progress and evaluate results.

It is a method adapted to work with groups of a particularly low level of schooling and multi-cultural or ethnic background.

The method incorporates the sequential use of a set of participatory tools such as: problem trees, priority setting matrix, valuation tools, ranking rating and sorting, seasonal and labor calendars, local stratification etc.

### PROCESS

The method works well in areas where there is already a project working or in progress, and where there is no initiative or idea for development identified.

**Step 1.** Key word definition
Important words in the process are introduced and a collective definition is constructed to make sure that all target group participants have a common understanding of the process. It is a particularly important step in low-schooling and multi-cultural groups.
**Step 2.** Construction of dreams or vision of future
Depending on the schooling level of the group, diverse participatory techniques such as "rain of ideas", "drawing past, present and future" and others are used in developing a common vision of the future. From the vision, objectives are derived.
**Step 3.** Identification of indicators
Once the objectives are clear, the target group is supported in identifying local indicators of progress and achievement.
**Step 4.** Activity planning
The target group plans activities to achieve the objectives they have set for themselves. In this particular case, activities do not only reflect those that may be executed by facilitating the institution or project, but more importantly, include activities delivered by the target group. The planning process also defines responsibilities both inside and outside the target group.
**Step 5.** Construction of formats for monitoring
Simple formats for progress monitoring are designed with the target group. These formats are specific for every activity or indicator and are adapted to be used according to the schooling level and diversity of the group.
**Step 6.** Establishment of a PM&E committee
A committee of 3–5 people is selected by the target group to support data collection for the duration of the initiative.
**Step 7.** Use of information
The information collected by the committee is shared periodically with the group. This information supports any adjustment process that may need to take

place in order for the target group to achieve the goals and objectives they have set for themselves. This adjustment process leads to a continuous cycle where priorities, objectives and plans are regularly updated.

## ADVANTAGES

The method helps in understanding local demands and is easily applied on a small scale.
It can be focused on a specific demand, avoiding other demands which cannot be handled by the institution or project.
It does not rely on data sets or secondary information, which are usually scarce or inexistent with regard to poor areas and NUS crops.
It is a method that can be used with multicultural groups as well as with participants of a low schooling level.

## DISADVANTAGES

It has some limitations in being applied on a bigger scale.
The abilities of the facilitators in the use of participatory methods and techniques may influence the results of the process.
The application of the method takes time and the target group will not perceive the benefits at first.

## LITERATURE REVIEW


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# ANNEX III

## SUMMARY OF PRIORITY-SETTING METHODS AND THEIR CONTRIBUTION TO THE ANALYSIS OF VARIABLES REFLECTING NUS OBJECTIVES

| Priority Setting Method | Level of Assessment | OBJECTIVES OF NEGLECTED AND UNDERUTILIZED SPECIES | | | | Advantages of the Method | Disadvantages of the Method |
|---|---|---|---|---|---|---|---|
| | | Increased Incomes for the Rural Poor | Food Security and Better Nutrition | Ecosystem Stability | Cultural Diversity | | |
| Rule of thumb | Global<br>Regional<br>Local | • Value of production of research areas | • | • | • | • Simple to use<br>• Allows continuity of processes (precedence) | • The logic is poor and includes solitary variables. |
| Cost - Benefit Analysis | Global<br>Regional<br>Local | • Benefit-Cost Ratio<br>• Net Present Value<br>• Internal Rate of Return | • | • Social Benefit - Cost Ratio | • | • Analyzes the efficiency of proposed alternatives in terms of monetary value. | • Depends on accuracy of estimates<br>• Lack of available data for NUS |
| Economic Surplus Model | Global<br>Regional<br>Local | • Producer surplus<br>• Consumer surplus<br>• Internal rate of return | • | • | • | • Analyzes the efficiency of proposed alternatives in terms of monetary value. | • Depends on accuracy of estimates<br>• Lack of available data for NUS |
| Geographic research problem domains | Global<br>Regional | • Mapping of Unsatisfied Basic Needs<br>• Can include other variables depending on the combination with other methods. | • Can include other variables depending on the combination with other methods. | • Agroecological zonification<br>• Zonification by production potential<br>• Identification of species' niches of origin<br>• Identification of traditional areas of species cultivation | • Can include other variables depending on the combination with other methods. | • Captures important geographic factors<br>• Combined with other methods, can arrange factors by importance | • Lack of available data for NUS |
| Scoring Model | Global<br>Regional<br>Local | • Unsatisfied Basic Needs<br>• Family income<br>• Livestock ownership and commerce<br>• Income generated by NUS | • Prevalence of underweight children under 5 years of age.<br>• Proportion of population below minimum level | • Land management practices<br>• Number of species cultivated<br>• Diversity of NUS managed<br>• Potential for NUS species or cultivars recovery | • Potential for recovery of ancient knowledge of NUS in nutrition<br>• Potential for recovery of ancient knowledge of NUS | • It can address multiple objectives according to their importance<br>• Transparent and easy to conduct.<br>• Can integrate other methods or models as criteria | • Weights assigned to objectives can be subjective. |

| Priority Setting Method | Level of Assessment | OBJECTIVES OF NEGLECTED AND UNDERUTILIZED SPECIES | | | | Advantages of the Method | Disadvantages of the Method |
|---|---|---|---|---|---|---|---|
| | | Increased Incomes for the Rural Poor | Food Security and Better Nutrition | Ecosystem Stability | Cultural Diversity | | |
| Analytic Hierarchy Process | Global Regional | • Assets | of dietary energy consumption<br>• Proportion of population with hidden hunger<br>• Infant mortality rate<br>• Maternal mortality rate | | in health | • It can address multiple objectives employing a paired comparison to rank alternative solutions. | • If there are many alternatives to evaluate, the comparison process is tedious. |
| Mathematical Programming Model | Global Regional | | | | | • It can deal with varying levels of funding for each activity.<br>• It can illustrate trade-offs among objectives | • Time consuming<br>• Requires considerable analytical skills<br>• Data collection is costly. |
| In-depth study of demands | Local | • Stratification by local criterion of poverty.<br>• Local market information on prices, demand, preferences, quality<br>• Assets | • Food Balance (production, consumption) Perception of food insecurity<br>• Food frequency assessment<br>• Nutritional status assessment<br>• Diversity of food sources | • Information on natural resources<br>• Agroccological models<br>• Agricultural production, crops, animals<br>• Agorecological models<br>• Land Use Practices<br>• Livestock production practices | • Crop-use practices<br>• Livestock-use practices<br>• Migration<br>• Women's role in production and marketing<br>• Risk and Loss management strategies | • Focuses on local demands<br>• Easy application on small scale<br>• It can focus on specific demands<br>• Does not rely on data sets | • Limitations for large-scale application<br>• Abilities of facilitators influence the process |
| Qualified demand and risk management approach | Local | • Local market information on prices, demand, preferences, quality<br>• Assets<br>• Information about market risks | • | • Agricultural production, crops, animals<br>• Land Use Practices<br>• Livestock production practices<br>• Productive risks | • | • It produces a project proposal<br>• It legitimizes local demands<br>• Easily applied on small scale<br>• Does not rely on datasets | • Limitations for large-scale application<br>• Abilities of facilitators influence the process |
| Participatory adjustment of proposals | Regional Local | • Stratification by local criterion of poverty. | • Food Balance (production, consumption) | • Information on natural resources<br>• Agroecological | • Crop-use practices<br>• Livestock-use practices | • Can be used to adjust proposals or priorities set on a | • Abilities of facilitators influence the |

| Priority Setting Method | Level of Assessment | OBJECTIVES OF NEGLECTED AND UNDERUTILIZED SPECIES | | | | Advantages of the Method | Disadvantages of the Method |
|---|---|---|---|---|---|---|---|
| | | Increased Incomes for the Rural Poor | Food Security and Better Nutrition | Ecosystem Stability | Cultural Diversity | | |
| | | • Local market information on prices, demand, preferences, quality<br>• Assets | Perception of food insecurity<br>• Food frequency assessment<br>• Nutritional status assessment<br>• Diversity of food sources | models<br>• Agricultural production, crops, animals<br>• Agorecological models<br>• Land Use Practices<br>• Livestock production practices | • Migration<br>• Women's role in production and marketing<br>• Risk and Loss management strategies | previous level<br>• Does not rely on data sets | process |
| Participatory market chain analysis | Local | • Market chain actors characterization<br>• Market characteristics and opportunities<br>• Cost/Benefit analysis of alternatives<br>• | • | • | • Understanding cultural diversity for market purposes | • Analyzes market demands on a multilateral perspective<br>• Market opportunities are prioritized by actors<br>• Innovation is market-oriented | • Needs a strengthened target group<br>• Results are not optimal when one or more actors are dominant. |
| Outcome mapping | Local | • Variables defined by users | • Variables defined by users | • Variables defined by users | • Variables defined by users | • Stimulates learning process<br>• Highly participatory<br>• Most useful in complex, open, dynamic situations | • It requires important changes in the user of the method<br>• Takes time to deliver |
| Participatory impact pathway analysis | Global<br>Regional<br>Local | • Variables defined by users | • Variables defined by users | • Variables defined by users | • Variables defined by users | • Encourages going beyond the scope of a project<br>• Integrates initiatives | • Requires adequate representation of stakeholders and their interests |
| Participatory monitoring and evaluation | Regional<br>Local | • Variables defined by users | • Variables defined by users | • Variables defined by users | • Variables defined by users | • Stimulates learning process<br>• Highly participatory | • Abilities of facilitators influence the process |

Source: own elaboration ((DFID, 1999), Maxwell and Frankenberger, 1992), (PREVAL/PROGENERO, 2004), (UN, 2003)