*Standards and Trade Development Facility*

# Establishing Priorities for SPS Capacity-building:

# A Guide to Multi-Criteria Decision-Making

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## 1. Introduction

Many developing countries face considerable demands for the enhancement of sanitary and phytosanitary (SPS) capacity in the context of broader domestic economic and social policy objectives and in particular the desire to boost agri-food export performance. The available resources from national budgets and donors are generally insufficient to meet all of these needs and, as a result, priorities need to be made between competing capacity-building options. In this context, economic analysis appears to offer a structured framework that can help decision-makers make choices between competing investment options in a manner that is objective and accountable, and that helps to ensure resources are used in an efficient manner.

Henson and Masakure (2010) review experiences with the use of economic analysis to guide priority-setting for SPS capacity-building in developing countries, highlighting the challenges faced in using such methods and providing general guidance to decision-makers on which economic analysis approaches are best suited to particular decision scenarios. This review highlights how there have been numerous applications of economic analysis methods to the costs and benefits of improvements in food safety, animal health and plant health management capacity. However, relatively little attention has been given to the practical day-to-day application of these methods to the assessment and prioritisation of alternatives for SPS capacity-building, most notably in developing countries.

In the review by Henson and Masakure (2010) a framework for broad-based comparisons of SPS capacity-building options on the basis of multiple criteria is proposed. It is assumed that readers of this guide will have consulted this review, are familiar with the questions that economic analysis can (and cannot) answer with respect to guiding the formulation of prioritised plans for SPS capacity-building, and have a basic appreciation of the nature and role of multi-criteria decision analysis (MCDA). This guide outlines the framework in more detail and presents a roadmap for practitioners in developing countries that will help in the application of the framework in their particular country context.

This guide is intended to be a 'living document', which is further developed and revised in the light of the experiences of practitioners across a variety of SPS and/or country contexts. If you have any comments on the framework and/or on this guide, please do not hesitate to contact Spencer Henson, the corresponding author:

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## 2. A framework for the prioritisation of SPS capacity-building options

The framework outlined below aims to provide a structured process for establishing priorities, in the context of binding resource constraints, amongst a set of multiple SPS capacity-building options that might be funded by the government or the private sector in developing countries, and/or donors. The framework takes as its starting point work by Henson *et al*. (2007) on the development of a decision tool for priority-setting in the context of microbial food-borne disease. Importantly, the framework is designed to be applied to choices between relatively large numbers of options that can differ markedly in their characteristics and the associated flow of costs and benefits over time, including various elements of food safety, plant health and animal health capacity. Further, it permits priorities to be defined on the basis of multiple criteria which might be measured in a disparate manner and assigned differing weights. As such, the framework aims to mimic the way in which scarce resources are allocated across multiple capacity-building options in practice, although the elements of such processes are often not made explicit.

The driving principle of the framework is to improve the effectiveness of decision-making in the context of SPS capacity-building. Specifically, it aims to:

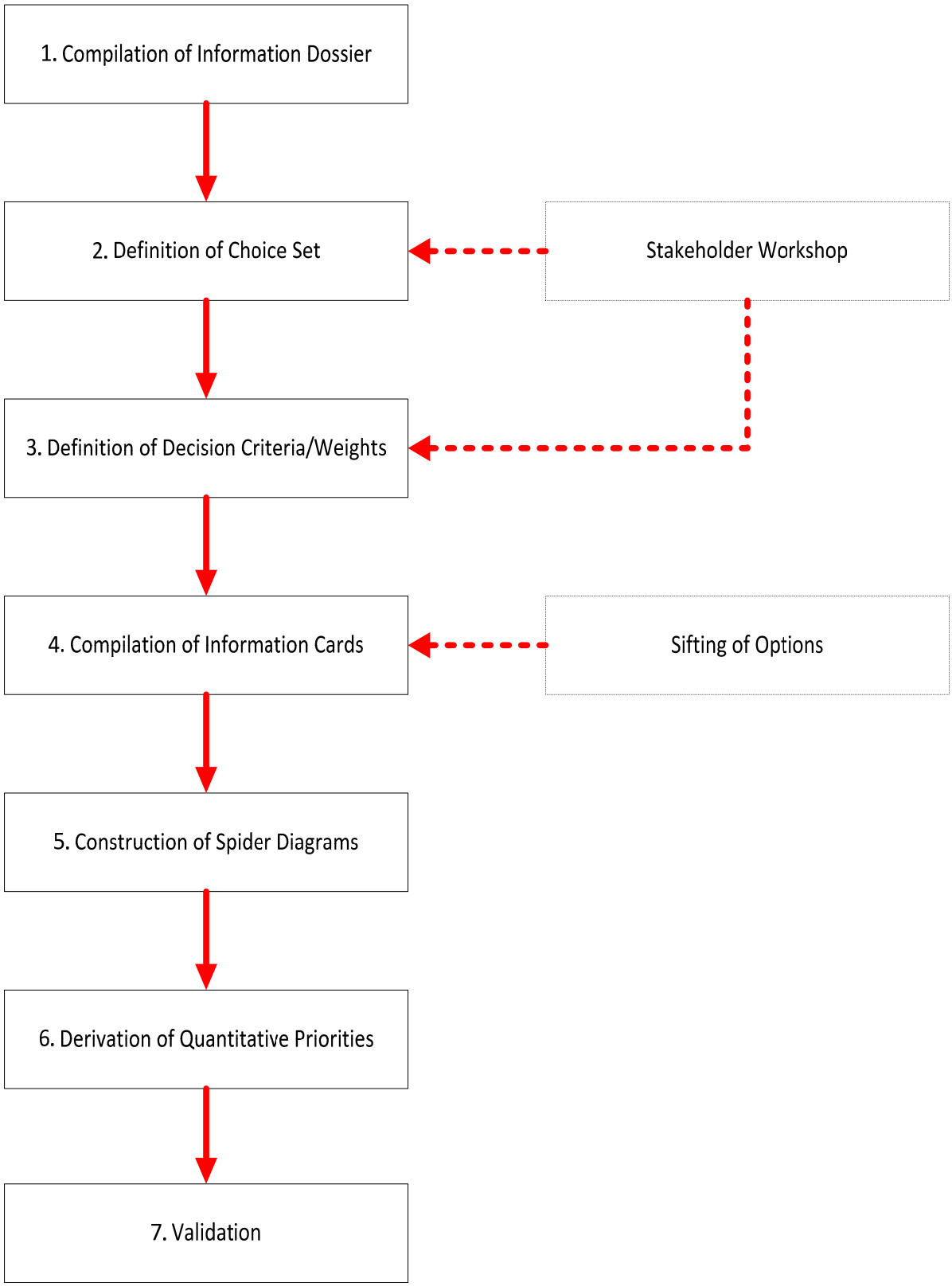
- Enhance the economic efficiency of SPS capacity-building decisions, such that scarce resources are allocated in a manner that best meets a country's economic development, poverty alleviation, public health and other objectives.
- Promote more transparent and accountable choices between multiple SPS capacity-building options.
- Facilitate more inclusive decision-making processes involving multiple stakeholders, including those that tend to be more marginalised in priority-setting processes in the context of SPS capacity-building.

The framework requires a more structured decision-making process than tends to be routinely applied. This may necessitate, in turn, that greater time and/or resources are allocated to decision-making, suggesting the need for buy-in at a relatively high managerial and/or political level.

The framework proceeds through a sequence of steps (Figure 1) that aims to guide the setting of priorities for the allocation of resources amongst multiple capacity-building options:

1. Bringing together available information on SPS capacity-building needs so as to facilitate informed selection of the options to be considered.
2. Defining the set of SPS capacity-building options to be considered in the priority-setting process.

**Figure 1. Stages in multi-factorial prioritisation of SPS capacity-building options**



3. Defining the criteria to be employed in prioritising the multiple capacity-building options under consideration and the relative weights to be assigned to each criterion.
4. Bringing the information collected and collated in Stages 1 to 3 together in a structured and coherent manner so as to facilitate a structured process of priority-setting and the communication of this information to stakeholders.
5. Derivation of quantitative priorities amongst the capacity-building options under consideration.
6. Communication of the established priorities to stakeholders, their refinement on the basis of feedback and their validation.

In so doing, the framework aims to be sufficiently pragmatic and flexible that the inevitable problems with establishing SPS capacity-building priorities, both generally and in the specific context of developing countries where there tends to be a paucity of data and/or data is of dubious quality, are not major 'stumbling blocks'. It needs to be recognised, however, that economic analysis in this area is far from easy and that there remain inevitable problems, for example with attributing outcomes and impacts to specific capacity investments, recognising spill-over effects, etc. These issues are discussed at relevant points below in order to alert the analyst to potential issues or problems.

In the remainder of this document, the key stages of the priority-setting framework are outlined.

***Stage 1: Compile information dossier***

The first stage of the analysis involves the compilation of a comprehensive dossier of information that aims to inform the priority-setting process, and notably the initial selection of capacity-building options (see below). The aim of the dossier is to:

- Build on and provide an opportunity for input from existing attempts to identify weaknesses in SPS capacity and/or capacity-building needs.
- Ensure, to the extent possible, that the priority-setting exercise is based on the full set of pertinent and substantive information on SPS capacity-building needs available.
- 'Level the playing field' across stakeholders giving input to the priority-setting exercise by providing a common set of core information.

The information dossier consists of plausible indicators of SPS capacity weaknesses and capacity-building needs that are gleaned from secondary sources and/or gathered through a primary data collection exercise. Some potential indicators are outlined in Table 1, which distinguishes three broad categories. It is important to recognise that this analysis and the indicators in Table 1 (both individually and as a collective) do not constitute an official

assessment of capacity. Rather, the aim is to 'build a picture' of potential capacity-building needs using the collective of information available. Given this, it is clearly important to be cognisant of how the various data have been collected, any potential biases, etc. It is also important to recognise that the validity of particular indicators may differ across the broad areas of food safety, animal health and plant health.

**Table 1. Categories of indicators of SPS capacity-building needs**

| Type of Assessment | Examples of Indicators |
|---|---|
| Capacity-based | Formal capacity evaluations and benchmarking<br>*Ad hoc* capacity assessments |
| Compliance-based | Inspection reports<br>Approved importer lists in export markets<br>Pest interception reports |
| Trade-based | Border rejections in export markets<br>Inventories of SPS requirements and other non-tariff measures (NTMs) in export markets<br>Trade flow trends and disruptions<br>Official restrictions/actions in export markets<br>Reports of trade problems from exporters<br>Exporter and/or importer interviews and surveys<br>*Ad hoc* problem reports/questionnaires |

Firstly, capacity-based indicators focus directly on weaknesses in SPS management capacity, either in the broad areas of food safety, animal health and plant health or with respect to particular SPS control functions, for example laboratory testing. A number of SPS-related capacity evaluation tools have been developed by international and regional organizations for this purpose that effectively benchmark national capacity to international standards and/or established norms.[1] These tools include FAO's biosecurity and food safety capacity evaluation tools (FAO, 2006), the IPPC's Phytosanitary Capacity Evaluation (PCE) Tool (FAO, 2004) and the OIE Tool for the Evaluation of Performance of Veterinary Services (PVS) (OIE, 2010,5th Edition). In many cases, less formal and even *ad hoc* assessments of capacity are also available, that might have been undertaken by public authorities in the country itself, by donors, researchers, etc. Whilst the latter may not present rigorous assessments of capacity *per se*, they may present useful indicators of potential areas of weakness. Critically, this group of indicators does not relate specific weaknesses in SPS capacity directly to particular trade problems and/or export performance, or to broader economic and social impacts such as poverty alleviation. Whilst weaknesses in capacity may influence trade

[1] For more information, see STDF (2008) *SPS-related Capacity Evaluation Tools: An overview of tools developed by international organizations*. Available at: www.standardsfacility.org/files/various/STDF_Capacity_Evaluation_Tools_Eng_.pdf

performance, other factors also play a role (for example agricultural productivity, transport infrastructure, etc.), meaning that direct attribution of SPS management capacity to trade is problematic.

Secondly, compliance-based indicators focus on evidence of non-compliance with SPS requirements in export markets; they identify instances where specific and required elements of capacity are missing or weak. For example, it might be that exporters are required to have implemented HACCP, that pest-free areas are defined and maintained, that an effective surveillance system for particular contaminants is implemented, or that tests for pesticide residues are undertaken in an internationally-accredited laboratory. Examples of such indicators include border inspection reports (such as those undertaken to assess the efficacy of veterinary controls in developing countries by the European Commission), official lists of approved countries and/or exporters maintained by importing countries (as with those maintained by the US Animal and Plant Health and Inspection Service (APHIS) for imports of animal and plant products) and plant pest inception reports. Such indicators may be based on a relatively objective assessment of capacity (for example in the form of an audit schedule) and/or be based on international standards or norms (for example pest risk assessments that conform to ISPM 13) or be less formal. Importantly, the focus of such indicators is on system-based weaknesses in capacity, whether through the value chain for particular products or official systems of SPS control. Such indicators may indicate where access to particular markets is impeded, for example when prior approval on the basis of compliance is required, but care must be taken in making links to export performance more generally that can be influenced by a range of other factors.

Thirdly, trade-based indicators can provide evidence that trade is impeded due to non-compliance with export market SPS requirements, especially in the case of specific disruptions where instances of non-compliance with export market requirements are evident. The focus of such indicators is on the compliance of products or of SPS management systems where systems of prior approval are in place. Examples include data on import detentions (for example as is available for the EU through the RASSF system or US through the OASIS system), analysis of trade flows, official restrictions/actions in export markets (for example bans), reports from exporters of import problems, etc. A key challenge with some of these indicators, however, is isolating the impacts of SPS compliance issues from other trade impediments. Thus, it may be necessary to consider a number of these potential indicators side-by-side; for example trade flows alongside inventories of SPS requirements and other non-tariff measures, such as those being developed by the International trade Centre (ITC) or available through UNCTAD's TRAINS database. In some cases, for example trends in border rejections, care must also be taken in interpretation because of uncertainties over the direction of causality.

Many of the compliance and trade-based indicators in Table 1 are readily available for countries that have established agri-food exports, especially to major industrialised

countries. Most developing countries, however, do not systematically gather and analyse this information. Further, at times this information is confidential. Whilst there are capacity-based indicators for many developing countries, predominantly these remain *ad hoc* and have employed inconsistent methods. The initiatives of FAO, OIE and IPPC in establishing a common framework for such assessments is a major improvement in this regard, although inconsistencies across these frameworks require that care is needed in comparing and contrasting the resulting assessments. Likewise, efforts by UNIDO to systematically analyse border rejection data provides the first attempt to compare the performance of developing countries and to examine trends over time and patterns across countries (UNIDO, 2011).

Both the compliance and trade-based indicators in Table 1 will be missing for countries that do not have established exports of a particular commodity, but do aspire to become exporters. Thus, for example, border rejection data is only created when a product consignment is exported and fails an instance of border inspection. While capacity-based indicators may be available for such cases, it can be difficult to relate these to potential export performance; latent exports can be constrained by a multitude of factors, including transport infrastructure, production efficiency and SPS capacity, and care must be taken not to over-attribute potential exports to SPS issues.

***Stage 2: Define choice set***

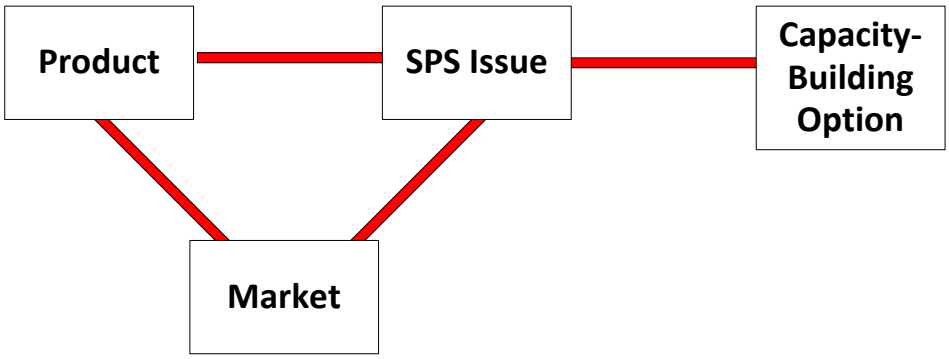
The second stage of the priority-setting exercise involves the definition of the set of SPS capacity-building options to be considered. This set will vary in the number and breadth of options according to the scope of the decision-making process. Thus, if the focus is on broad elements of SPS control - that is within and across the general categories of food safety, animal health and plant health - a relatively large number of quite diverse and broadly-defined options are likely to be included. Alternatively, if the focus is on decisions between alternative ways in which to enhance a particular element of SPS capacity (for example implementation of controls on a particular plant pest, improvements in laboratory testing facilities for pesticides or the upgrading of hygiene controls in food processing establishments) the choice set will likely contain a small number of specifically-defined options.

The challenge in identifying the SPS capacity-building needs to be considered in the analysis is to define a set of mutually-exclusive options to which a specific flow of costs and benefits can be assigned. In defining these options, four elements need to be considered (Figure 2). Firstly, the product(s) affected. Secondly, the specific SPS issue/problem faced by exporters of the product(s), whether relating to existing or potential exports. Thirdly, the export market(s) where this SPS issue/problem is faced. Finally, the distinct capacity-building options that would solve this SPS issue. The combination of these four elements defines a distinct capacity-building option. Imposing this structure on the definition of capacity-building aims to prevent the analysis focusing on more generic SPS weaknesses in SPS

capacity, for example out-dated legislative frameworks and/or shortages of trained personnel, that in and of themselves may be difficult to link to impacts on trade, domestic public health, etc.

The choice of options to be considered defines the parameters of the priority-setting exercise; no information will be provided by the analysis on any option that is excluded from the choice set. At the same time, the more options that are included the more onerous and resource-intensive will be the analysis. This suggests that the choice set should not be 'thrown together', but should be defined on the basis of clearly defined indicators and criteria, such that the initial 'sifting' of options is undertaken in an objective and transparent manner.

**Figure 2. Definition of SPS capacity-building options**




The challenge in defining the choice set of potential SPS capacity-building needs is to interpret the information provided by the various indicators in the information dossier compiled in Stage 1 of the analysis. A key principle in using this information is to employ triangulation; ensure that multiple indicators point to the same capacity needs in order to avoid being driven by false information and to offset the weaknesses of individual indicators. Broadly, a decision-maker can be confident that a substantive capacity need exists if this is highlighted by indicators within and across the three broad categories in Table 1. Use of multiple indicators helps to prevent the definition of the choice set from being driven excessively by interest groups that are more vocal and/or politically influential. It also guards against perceptual bias on the part of the observer (Kolstad and Wiig, 2002); for example, perspectives on priorities for SPS capacity-building will be quite different between a microbiologist and an entomologist, or between a government official and an exporter.

Too often SPS needs assessments produce lengthy 'shopping lists' of capacity-building requirements, or at least identify needs that exceed available resources. While the choice set defined prior to economic analysis should aim to include all potentially feasible capacity-building options, very quickly the analysis can become unwieldy if a large number of options are presented. In such instances, it may be necessary to 'sift-out' and/or prioritise the members of the choice set in order to define a more limited number of options that is amenable to in-depth analysis.

There are two approaches to the definition of the choice set, a stakeholder workshop or the Delphi method, as described in Boxes 1 and 2. These two approaches really only differ in the mechanism through which information is gathered; notably, whether through a face-to-face consultation process or remote survey. Across both, there are a number of key driving principles:

- The selection of options to be included in the choice set will reflect the stakeholders invited to participate. As a general principle, representatives of all substantive stakeholders groups should be included. Relevant stakeholders will include public sector policy-makers and technicians engaged in the day-to-day management and implementation of SPS controls, private sector, consumer groups, producer representatives, etc. It may or may not be considered appropriate for external stakeholders, for example bilateral or multilateral donors, to be present.
- The process of eliciting views on options to be included in the choice set is structured and transparent, such that a set of mutually-exclusive options for SPS capacity-building evolve as the process proceeds.
- The views of all stakeholders have equal weight in the process by which options are selected for inclusion in the choice set. That being said, it is possible to distinguish differences in the selection of options across stakeholders groups, such that it is possible to ascertain whether there are substantive differences in perspective.
- There is an opportunity for stakeholders to reflect on the views of others, including other members of their own stakeholder group as well as other stakeholder groups, and to adjust their own input to the process of identifying options to include in the choice set accordingly.

**Box 1. Stakeholder workshop**

The aim of the stakeholder workshop is to provide an opportunity for all relevant stakeholder groups to provide input in defining critical parameters for the priority-setting exercise. Namely:

1. Identification of capacity-building options to be considered.
2. Definition of choice criteria.
3. Definition of decision weights.

Each of these parameters is described more fully in the main text. By providing for wide-ranging stakeholder input, the priority-setting exercise should produce results that encompass the differing priorities of diverse stakeholder groups, whilst these results are more likely to be recognised as legitimate across these groups.

The workshop employs the *nominal group technique*; a structured procedure for gathering and collating the thoughts and ideas of a diverse group of people (Delbecq *et al*., 1975; Moore, 1994). Ahead of the workshop, participants are provided with the dossier of information compiled in Stage 1. The procedures is structured as follows:

1. The background and aims of the workshop are clearly articulated to participants.
2. The first task presented to participants is the identification of the capacity-building options to be included in the priority-setting exercise. Thus, participants are asked to identify all of the SPS capacity-building needs faced by the country at the current time, taking account of their own knowledge and experiences and the dossier of background information provided to them. Individual participants write each of their ideas in private on a separate card with sections for each of the elements in Figure 2, namely: 1) Product(s) affected; 2) SPS issue/problem faced; 3) market(s) where the SPS issue/problem is experienced; and 4) option(s) for addressing the defined SPS issue/problem (Appendix 1).
3. The moderator collects the cards and shuffles them. The cards are then read out one-by-one. If the idea is unclear, the participants may discuss it to remove ambiguities. The aim of this discussion, however, is only to clarify meanings rather than to begin a debate on the 'rights' or 'wrongs' of a particular option. The clarified capacity-building options are listed on a flip chart.
4. If there are more than say 15 capacity-building options, the workshop participants are asked to rank order their top ten. Participants vote individually by writing the name of their selected options on a card and assigning a vote from one to 10. The moderator then collects these cards, shuffles them and calculates the mean rank. On the basis of the total votes given to each capacity-building option, a ranking is derived and communicated to the workshop participants along with the overall pattern of votes.
5. The capacity-building options to be included in the priority-setting exercise are selected on the basis of the mean ranks and pattern of votes. Normally, there is a clear cut-off in the pattern of votes, with a relatively small number of options receiving a substantial proportion of the total votes, and then a long 'tail' of options, each of which receives a relatively small number of votes. However, the choice of the cut-off is somewhat subjective and should be discussed within the workshop, such that participants as a whole are 'generally happy' with the choice made.
6. The workshop then proceeds to define the decision criteria. Participants are presented with a list of possible criteria (Appendix 2) that has been compiled on the basis of a review of literature and previous applications of the framework. Participants are then asked to identify any decision criteria that are missing from the list and any criteria that are on the list that should be excluded.
7. Having defined the list of decision criteria, weights are assigned to each. Participants are asked to allocate 100 points across the agreed list of decision criteria according to their relative importance in driving the setting of priorities between alternative SPS capacity-building options. The form in Appendix 2 is used for this purpose, duly adapted to reflect the results of Stage 6 above. Not all of the criteria have to be allocated points. Participants write the name of each criterion and the allocated points on separate cards. The cards are then collected by the moderator, shuffled, and the points written next to the respective criterion on the flip chart. The mean allocation of points for each item is then calculated and communicated to participants. Finally, the distribution of points across the decision criteria is discussed amongst participants to ensure everyone is 'generally happy' with the result.

The choice between use of a workshop or the Delphi method will depend on factors such as logistics, available resources, time constraints, etc. It is also possible to employ both approaches simultaneously, for example holding a workshop to provide input from stakeholders that are centrally located (notably in a capital city) and the Delphi method to facilitate the inclusion of stakeholders that are geographically dispersed.

**Box 2. Delphi method**

The Delphi method is a method for developing consensus views on a particular set of issues amongst a group of informed (expert) individuals (Debecq *et al*., 1975; Moore, 1994). The method is based on a structured series of surveys through which the views of participants in the exercise are sought, with the results being fed back to participants who are then given an opportunity to revise their initial responses. This process can be repeated, with the aim of drawing the participants as a whole towards some form of consensus.

The Delphi method can be used to provide input in defining critical parameters for the priority-setting exercise, either alongside or as a substitute for the stakeholder workshop described in Box 1. Namely:

1. Identification of capacity-building options to be considered.
2. Definition of choice criteria.
3. Definition of decision weights.

As with the workshop (Box 1), participants in the Delphi exercise should encompass all substantive stakeholder groups.

The procedure is structured as follows:

1. Participants are sent the information dossier and a first questionnaire that asks them to provide a list of all of the SPS capacity-building needs faced by the country at the current time, taking account of their own knowledge and experiences and the dossier of background information. The questionnaire can be in the form of a Word document, fillable PDF or (preferably) a link to an internet-based survey platform (for example Survey Monkey). The questionnaire is formatted in the same way as the card in Appendix 1.
2. On the basis of the responses in Stage 1, a list of possible capacity-building options for inclusion in the priority-setting exercise is derived. The moderator of the process plays a key role in compiling this list in order to ensure that all options are mutually-exclusive.
3. Respondents are sent a second questionnaire that includes two tasks:
    a. The list of capacity-building options from Stage 2 is presented and respondents are asked to rank order their top ten items. If less than 15 capacity-building options are defined in Stage 2, this element is excluded and the list in Stage 2 taken as final.
    b. A list of factors that should be taken into consideration when establishing priorities between alternative SPS capacity-building options based on the form in Appendix 2 is presented. Respondent are asked to define any factors that are

missing and to indicate if any of the provided factors should be excluded.

4. On the basis of responses to Stage 3a, a final list of SPS capacity-building options with their average rank is prepared. If less than 15 capacity-building options are defined in Stage 2, this elements is excluded.
5. On the basis of the responses to Stage 3b, a final list of decision criteria is derived. The moderator of the process plays a key role in compiling this list in order to ensure that all options are mutually-exclusive.
6. Respondents are sent a third questionnaire that presents the final list of decision criteria from Stage 5. Respondents are asked to allocate 100 points across the list of agreed decision criteria according to their relative importance in driving the setting of priorities between alternative SPS capacity-building options. Not all of the criteria have to be allocated points.
7. On the basis of responses to Stage 6, the minimum, mean and maximum ranks are calculated for each of the decision criteria and recalibrated as necessary to sum to 100.
8. In the final questionnaire, the means ranks from Stage 7 are reported back to respondents. They are asked again to allocate 100 points across the list of choice criteria according to their relative importance in driving the setting of priorities between alternative SPS capacity-building options, making any changes they wish to their allocation of weights on the basis of this new information.
9. On the basis of responses to Stage 8, the final mean decision weights are calculated and recalibrated as necessary to sum to 100.

Having identified the range of SPS capacity-building options, through either the workshop or Delphi survey approaches, before proceeding to Stage it is necessary to 'sift' the options to ensure they are viable and relevant to the priority-setting exercise Key questions are as follows:

- *Does the option relate to a current and substantive compliance problem?* In some cases, the options defined above may relate to historic SPS capacity problems that have since been 'fixed', whether because the trade partner changed their requirements or because capacity gaps have been addressed. In other cases, the identified options may relate to perceived trade problems relating to SPS requirements in export markets, but these are based on misinformation. Consulting exporters and experts in the specific SPS issue of concern will be critical in answering these questions.
- *Is the option economically viable?* For example, if the option relates to establishing new exports, is there evidence that demand exists for the product concerned in the defined target market(s) and that this demand can be fulfilled in a commercially-viable and sustainable manner given prevailing production costs, transport capacity, reliability and costs, etc. Consulting exporters, and maybe also potential customers in the target export market(s), will likely be important sources of information here.

- *Are the sector concerned and the level of existing and/or potential exports substantive?* SPS capacity-building options may be proposed that relate to a small sector, perhaps consisting of only a single firm, or to levels of exports that are insignificant in the context of the overall level of agri-food trade. If so, the impacts of any investments in the associated SPS capacity are likely to be minimal and this option will almost automatically be ranked low in the formal priority-setting exercise below. This emphasises the need to consider each of the proposed options in the context of the wider agri-food sector and exports.
- *Are there other SPS capacity gap(s) that also need to be fixed?* In some cases, trade is impeded by multiple SPS issues, and related capacity constraints, not all of which may be immediately apparent. For example, whilst an option may relate to a particular plant pest, it might be that other plant pests also need to be addressed in order to gain access to the target export market(s). This may require that other capacity-building options in the choice set are undertaken simultaneously, that the scope of the option under consideration is expanded, etc.

Options that fail any of these questions will likely be excluded at this stage and do not enter the final choice set. It is important, however, to be explicit about which options are excluded from the final choice set and the basis on which this decision is made.

***Stage 3: Define decision criteria and weights***

Having identified the SPS capacity-building options to be considered, the next stage is to define the decision criteria against which these options will be compared. These decision criteria are generally grouped into objectives that reflect broader categories driving the priority-setting process. Figure 3 provides an overview of potential decision criteria that are organised into four distinct objectives: 1) cost and difficulty of implementation; 2) trade impacts; 3) impacts on domestic agri-food sector; and 4) wider socio-economic impacts. These represent the collective of criteria elicited in applications of the framework to date in Mozambique, Zambia, Malawi, Belize and Vietnam. Collectively, the choice criteria should aim to encompass the anticipated costs and benefits associated with each of the capacity-building options under consideration, as would normally be the focus of economic analysis (Henson and Masakure, 2010).

The first of the four objectives relates to the cost and difficulty of implementation of each of the capacity-building options, including the non-recurring investments and recurring costs of establishing, operating and maintain the respective element of SPS capacity. Presumably, the aim is to minimise these costs, and also the difficulties likely to be faced in upgrading capacity, such that capacity-building options with lower costs and that are easier to implement will be preferred, everything else being equal.

**Figure 3. Potential choice criteria for assigning priorities amongst SPS capacity-building options**

| Objective | Decision Criteria |
|---|---|
| Cost and difficulty of implementation | Up-front investment |
| | On-going costs |
| | Difficulty of implementation |
| Trade impact | Change in absolute value of exports/export losses avoided |
| | Degree to which diversifies exports by products and/or markets |
| | Impact on international reputation for SPS management |
| | Impact on ability to deal with future SPS problems/issues |
| Domestic agri-food impacts | Impact on agricultural/fisheries productivity |
| | Impact on domestic public health |
| | Impact on local environmental protection |
| Wider socio-economic impacts | Impact on employment |
| | Impact on levels of poverty |
| | Impact on vulnerable groups |

The next three objectives relate to the impacts of the capacity-building options; it is here that the potential benefits are captured. Taking a narrow view, the analysis could focus on the effects on export performance of the capacity-building options. A broader perspective requires that consideration is given to both the direct (for example changes in export performance) and indirect (for example impacts on the poor) impacts of SPS capacity improvements.

Importantly, whilst the three broad impact objectives in Figure 3 and their associated decision criteria encompass the 'benefit side' of the cost-benefit equation, not all of these impacts are necessarily positive. For example, if a particular SPS capacity acts to boost trade, this could result in the exclusion of small-scale producers, with potentially negative social impacts. Thus, priorities may be driven by the maximisation or minimisation of particular decision criteria.

Note that the three impact objectives in Figure 3 are based on a very broad perspective on the potential consequences of enhancements in SPS capacity, both within and across the objectives. Thus, the trade objective is captured through changes in the aggregate value of trade; whether through trade expansion or averting lost trade. It is also recognised that, whilst SPS capacity-building may have a primary focus on facilitating exports, there can be significant spill-over effects domestically, through agricultural productivity, public health (for example because of enhanced food safety) and/or local environmental protection. Finally, the ultimate aim of SPS capacity-building is often the broader and longer-term socio-economic impacts. The social impacts objective includes decision criteria focused on overall poverty impacts and impacts on vulnerable groups, for example women, people in disadvantaged areas, etc.

In assessing the potential impacts of a particular capacity-building option, care needs to be taken both to avoid over-attribution and to include spill-over effects. For example, numerous factors may explain future export flows and these factors must be taken into account when predicting the impact of a particular improvement in SPS capacity. At the same time, whilst a particular investment may be focused on a rather specific weakness in SPS capacity (for example pesticide residue analysis for fresh fruits and vegetables), the associated infrastructure could have wider benefits (for example for pesticide residue analysis in cereal products and/or analysis of other chemical contaminants in a range of food products). It can be difficult to identify some of these spill-over effects *ex ante*, and certainly the temptation to over-estimate in order 'to be safe' should be avoided. At the minimum, the potential for over-attribution and/or under-estimation of spill-over effects should be noted and taken into consideration when interpreting the final results.

Figure 3 can be used as a checklist to guide thinking as to the objectives and associated decision criteria that might be used to determine priorities amongst the SPS capacity-building options under consideration. The specific objectives and decision criteria to be used in a particular context should, however, be determined following consultation with stakeholders through a workshop and/or the Delphi method as described in Boxes 1 and 2. It is important to note that differing weights might be applied to particular decision criteria (see below). Thus, stakeholders should be encouraged to apply a very wide lens when defining the costs and impacts of the capacity-building options under consideration, such that even relatively minor impacts are captured. Note that any impacts that are not included amongst the decision criteria will have no influence on the prioritisation of the capacity-building options under consideration.

Having identified the broad objectives and related decision criteria, the next stage is to assign weights; clearly, some objectives and decision criteria will be more important than others and this needs to be reflected in the priority-setting exercise. These weights reflect the relative importance of each of the decision criteria and should encompass the perspectives of as wide a range of stakeholders as possible. Decision weights can be derived through a stakeholder workshop and/or Delphi survey as described in Boxes 1 and 2. The mean weights represent the collective view of the relative importance of the choice criteria amongst stakeholders. Examination of the dispersion of these weights for any objective and/or decision criteria provides an indication of the degree of agreement across stakeholders. Where there is appreciable disagreement, alternative sets of weights might be applied in the prioritisation exercise (see below) to see whether changes in these weights has a significant impact on the ultimate prioritisation of the capacity-building options under consideration.

***Stage 4: Construction of information cards***

The next stage involves the construction of information cards that bring together the information on each of the capacity-building options being considered. This information is structured around the chosen decision criteria. It is envisaged that, for each of the decision criteria, the following information will be provided:

- A Quantitative measure of the predicted impact of the capacity-building option.
- Brief details on how the predicted impact was estimated.
- An indicator of the level of confidence or uncertainty associated with the predicted impact.

An example, derived from the application of the framework in Belize, is provided in Appendix 3.

One card should be prepared for each of the options under consideration such that all of the pertinent data are brought together in a manner that enables a relatively quick scan of its characteristics (see Henson *et al*., 2007). Critically, each information card must be seen as a 'living document'. As discussed below, limitations in the availability and/or quality of data may require compromises in how the costs and/or impacts are measured; the card should give some indication of the degree of confidence the analyst has in the data provided. However, as more and/or 'better' data become available, the information on the cards can be updated and subsequent stages in the priority-setting process re-run.

For each of the decision criteria, measurements need to be derived relative to a defined baseline (Krieger *et al*., 2007). This baseline should reflect the 'state of the world' over time given that a particular option is not undertaken, recognising that change is likely to happen regardless of whether the option is implemented or not. The challenge here is to separate out the impact of each option on a particular criterion from all other influences, such that over-attribution is avoided. For example, exports from a particular country might expand even in the absence of investments in SPS capacity-building. In the event that such investments are made, care needs to be taken to identify the incremental impact of enhanced SPS capacity on observed export growth. Attributing all of the observed export growth to the enhancement of SPS capacity would over-estimate its impact.

The costs associated with planning, implementing, operating and maintaining a particular enhancement in SPS capacity include non-recurring investments and recurring costs (Wilson and Henson, 2002). In order to estimates these costs, it is first necessary to examine the specific actions required to create or enhance the elements of SPS capacity under consideration. The up-front investments and on-going costs associated with these actions are then estimated. Figure 4 provides a simple framework to aid this process (World Bank, 2002).

**Figure 4. Framework for identifying costs of compliance associated with SPS capacity-building**

| | | Costs of Compliance | |
|---|---|---|---|
| | | Up-front Investments | On-going Costs |
| Current capacity | | | |
| Desired capacity | | | |
| Implied change in current controls | Institutional/administrative structures<br>Regulatory controls<br>Technical infrastructure<br>Human capital<br>Risk analysis<br>Information dissemination<br>Surveillance and monitoring<br>Other | | |
| Costs of compliance | Capital investment<br>Supplies<br>Staff time<br>General operating expenditures<br>External services<br>Other | | |
| Total cost of compliance | | | |

Source: World Bank (2002)

Key elements of capacity-building include the following (Kolstad and Wiig, 2002; Wilson and Henson, 2002):

- **Institutional/administrative structures**: Regulations and rules reflecting current scientific understanding and international commitments, a system of enforcement with sanctions for non-compliance, clearly delineated administrative responsibilities between separate departments and agencies of government, effective communication and coordination of efforts between departments and agencies, transparency in the processes by which regulations and rules are developed, implemented and enforced.
- **Regulatory controls**: Systems for registration and control of the production, distribution and use of agricultural inputs that pose a risk to food safety or plant and animal health. Systems for verifying and certifying the status of food and agricultural products and the origin, nature and quality of biological materials. Capacity for tracing products through the supply chain, diagnosing pests and diseases and appropriate quarantine and eradication procedures.
- **Technical infrastructure**: Includes laboratory facilities for testing, surveillance and research activities, production and processing establishments for which hygienic controls can be implemented effectively, coordinated and well-functioning supply chains, computer facilities and access to the Internet.
- **Human capita**l: Includes scientific and technical expertise and experience in methods of surveillance, testing and control, risk assessment and other elements of risk analysis, and methods of hygienic control, research capabilities, and the legal and administrative knowledge to implement and enforce regulations and other rules. In turn, this requires appropriate teaching, training and research capacity.
- **Information dissemination**: Procedures for utilizing epidemiological information in decision making with respect to SPS controls in domestic production.
- **Surveillance and monitoring**: Epidemiological surveillance and monitoring of new and emerging hazards.

For each of the capacity-building options in the choice set these elements need to be itemised and described in sufficient detail so as to facilitate identification of the associated up-front investments and on-going costs. Figure 4 provides broad categories to facilitate this process. Note that, where the up-front investments are incurred over a protracted period of time, these need to be converted into a net present value (NPV) using an appropriate discount rate.

In assessing the impacts of a particular capacity-building option, the focus should be on the broad economic and social perspective rather than being restricted to the specific context of the commodity, sector or market that the option directly addresses. Remember, that the framework is focused on setting priorities across a wide range of capacity-building options that may differ significantly, for example in terms of the size of sector, magnitude of exports potential affected, etc. This implies that, in assessing the impact along a particular dimension (for example, the change in aggregate value of exports or impact on poverty) account needs to be taken of:

- The relative importance of the dimension in broad economic and social terms prior to implementation of the capacity-building option (for example the value of exports relative to agri-food and/or total commodity exports or the number and/or proportion of poor farmers engaged in production of the respective commodity).
- The scale of change brought about by the capacity-building option (for example the percentage increase in the value of exports or the degree to which the income of poor farmers is enhanced).

Thus, the impact of a particular capacity-building option will be greater, everything else being equal, the more significant the dimension in relative terms and the greater the scale of change brought about by the capacity-building option. For example, a capacity-building option will be judged to have a greater (lesser) impact if a relatively large (small) number of poor farmers are engaged in the production of the respective commodity and/or if the predicted impact on their income is predicted to be positive and large (small).

A variety of information sources can be used to populate Figure 4 with the actions required to enhance the specific SPS capacity under consideration and the associated non-recurring investments and recurring costs. These include:

- Prior assessments of capacity-building needs and costs for the study country.
- Extrapolations from prior assessments or cost estimates for other countries with broadly the same capacity-building needs.
- *Ad hoc* or structured consultations and/or surveys of domestic public and/or private sector stakeholders that have experience with implementing comparable capacity-building needs and/or can provide reliable appraisals of the required actions and associated investments and costs.
- *Ad hoc* or structured consultations and/or surveys of international experts that have experience with implementing comparable capacity-building needs and/or can provide reliable appraisals of the required actions and associated investments and costs.

Broadly, similar approaches as above can be used to quantify the benefit-related decision criteria.

The choice between these alternative information sources will reflect the availability of prior information in the study country, access to resources and time constraints, amongst other factors. In the absence of all of the above approaches, the analyst may have to rely on 'educated guesses'.

Given the potentially broad range of cost and benefits incorporated into the analysis, it is important to recognise the various measurement instruments that might be required to quantify the impacts of a particular capacity-building option. Table 2 derived from the application of the framework in Belize, provides an example of the range of metrics that might be employed. There are four main categories: 1) discrete variables; 2) ordinal scales; 3) count data; and 4) continuous measures (Henson *et al*., 2007). Each is described in turn below.

A discrete measure takes a value of zero or one, typically with the value of one being used to indicate the presence of the attribute of interest. Discrete measures are sometimes referred to as indicator or dummy variables. As an example, an indicator variable may be used to show when a discrete impact occurs; such as if a particular SPS capacity enhancement option will permit access to a new market. Alternatively, an indicator variable can be used for non-discrete impacts where there is a lack of data to enable the magnitude to be quantified; for example, whether the value of exports is likely to increase or not.

Where there is sufficient information to get at least some measure of the degree of impact of a particular enhancement in SPS capacity, ordinal scales can be employed.[2] The idea here is to use a numerical scale to represent the order (or rank) of affect, for example using Likert scales.[3] The number assigned to a particular response reflects the ordering of some impact, for example on future exports flows: 1= 'no impact'; 2 = 'slight impact'; 3 = 'moderate impact'; 4 = 'large impact'; 5 = 'very large impact'. Note that the distance between the categories along the scale is not necessarily equal. Ordered scales can also be used to impart categorical information on particular impacts, for example: 1 = 'decrease; 2 = 'no change; 3 = 'increase'. While somewhat vague in terms of meaning, the advantage of such an approach is that it allows decision-makers to see the gradations of potential impacts.

[2] An ordinal scale presents numerically the order (or rank) of a series of items. Note that the numbers assigned to each item give no indication of their position relative to one another.

[3] A Likert scale is a multi-item scale indicating the level of agreement or disagreement with a series of statements, for example: 'strongly disagree' (1), 'disagree' (2), 'neither agree nor disagree' (3), 'agree' (4) and 'strongly agree' (5). This scale is widely used in consumer and market research.

**Table 2. Decision criteria measures employed in application of the framework in Belize**

| Criterion | Measurement |
|---|---|
| **Cost/Difficulty of implementation** | |
| Up-front investment | Absolute value (US$) |
| Annual on-going costs | Absolute value (US$) |
| Difficulty of implementation | Very easy (1)<br>Somewhat easy (2)<br>Neither easy nor difficult (3)<br>Somewhat difficult (4)<br>Very difficult (5) |
| **Trade impact** | |
| Absolute change in value of exports | Absolute value in 2017 (US$) |
| Trade diversification – new products | Large negative (-2)<br>Negative (-1)<br>No impact (0)<br>Positive (+1)<br>Large positive (+2) |
| Trade diversification – new markets | |
| **Domestic agri-food impacts** | |
| Agricultural/fisheries productivity | Large negative (-2)<br>Negative (-1)<br>No impact (0)<br>Positive (+1)<br>Large positive (+2) |
| Domestic public health | |
| Environmental protection | |
| **Social impacts** | |
| Employment impacts | Large negative (-2)<br>Negative (-1)<br>No impact (0)<br>Positive (+1)<br>Large positive (+2) |
| Poverty impacts | |
| Impact on vulnerable groups/areas | |

In some cases it might be possible to translate ordinal data into monetary estimates of impacts. For example, if the recurring costs of a range of SPS capacity-building options have been categorised into 'low' (1), 'medium' (2) and 'high' (3) and existing data provides a broad indicator of the magnitude of the costs in each of these categories. Here average cost data may be used: thus 'low' = $100,000/year; 'medium' = $300,000/year and 'high' = $1, 000,000/year. Alternatively, where quite detailed information on non-recurring costs exists a probability distribution function of costs or their measures of distribution (namely the expected value combined with the variance or the standard deviation) can be employed (Krieger *et al*., 2007). This would allow the determination of probabilities for ranges of non-recurring costs.

The third category of measurement of the impacts of options for SPS capacity-building is count data. Examples include the number of small-scale producers and the number of persons employed in associated value chains.

Finally, continuous measures can be used to capture measures such as value, volume, ratios, percentage changes, etc. Examples include the estimated up-front investment and/or on-going costs of SPS capacity enhancements, absolute value or percentage change in predicted export flows and the average change in producers incomes engaged in associated value chains. Where costs and/or benefits are expressed in monetary unit flow over time, these can (and should) be collapsed to a single net present value (NPV) using an appropriate discount rate.[4]

Having compiled quantitative information on the decision criteria for each of the SPS capacity-building options under consideration, the series of information cards can be assembled. Importantly, the information on these cards is not analysed in any way, and no attempt is made to aggregate across the decision criteria. At this stage, decision-makers may choose to exclude certain options because they violate a particular acceptance threshold. For example, if the on-going costs of an option exceed available resources. Thus, the information cards bring together information on all of the decision criteria into one place and on a 'level playing field', striving to increase the consistency with which each of the criteria is considered by decision-makers. However, in and of themselves the information cards do not facilitate trade-offs between decision criteria except on the basis of 'gut instinct' or simple 'rules of thumb'.

As illustration, Table 3 provides an example of four hypothetical SPS capacity-building options with measures of the associated costs and impacts that variously employ the four types of data described above:

- **Option 1**: Low-cost intervention that is predicted to increase exports the least ($10 million per year). Minor impact on agricultural productivity but no impact on domestic public health or local environmental protection. Of all the options has the greatest impact on the poor. Produces benefits to vulnerable groups.
- **Option 2**: A low to medium-cost intervention that is expected to increase exports by $15 million per year. Has a moderate impact on the poor. Has minor impact on domestic public health and local environmental protection. Brings about benefits to vulnerable groups.

[4] The discount rate is used to reflect the time value of a flow of money at various points over time, for example in calculating the NPV (see previous footnote).

- **Option 3**: A moderate-cost intervention that increases exports by $20 million per year. Brings about significant improvements in public health and moderate improvements in local environmental protection. No impact on vulnerable groups and only minor impact on the poor.
- **Option 4**: A high-cost intervention that is expected to result in significant increases in exports of $ 50 million per year. Has a moderate impact on agricultural productivity and on the poor. No impact on domestic public health, local environmental protection or vulnerable groups.

**Table 3. Example of decision criteria and associated measurements for four hypothetical SPS capacity-building options**

| Criterion | Scale | Option | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| Up-front investment | US$ million | 1.2 | 3.0 | 4.5 | 10.0 |
| On-going costs | High (3)/Moderate (2)/Low (1) | 1 | 1 | 2 | 3 |
| Change in value of exports | US$ million | 10 | 15 | 20 | 50 |
| Change in agricultural productivity | Significant increase (3)/Moderate increase (2)/Minor increase (1)/No change (0) | 1 | 0 | 0 | 2 |
| Change in domestic public health | Significant increase (3)/Moderate increase (2)/Minor increase (1)/No change (0) | 0 | 1 | 3 | 0 |
| Change in environmental protection | Significant increase (3)/Moderate increase (2)/Minor increase (1)/No change (0) | 0 | 1 | 2 | 0 |
| Poverty impact | Significant (3)/Moderate (2)/Minor (1)/No change (0) | 3 | 2 | 1 | 2 |
| Impact on vulnerable groups | Yes (1)/No (0) | 1 | 1 | 0 | 0 |

In describing later stages of the economic evaluation process below, these data are employed to provide worked examples.

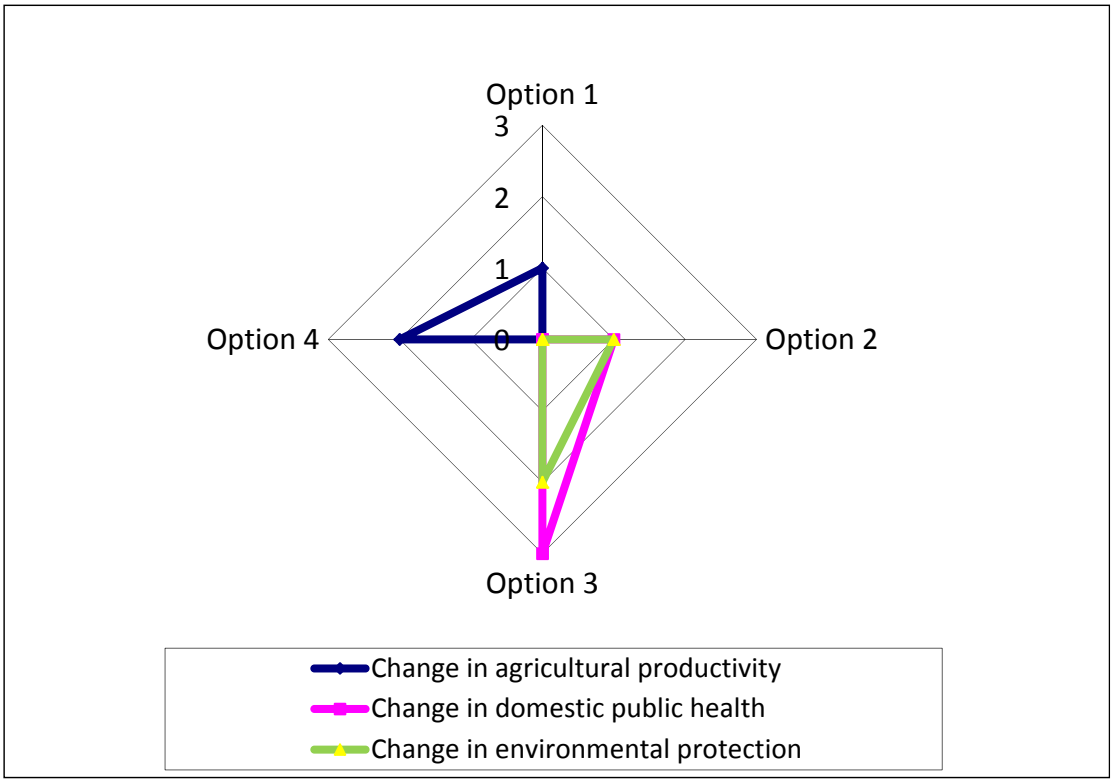
***Stage 5: Construct spider diagrams***

To provide a visual characterisation of differences in the costs and benefits of each of the capacity-building options, the data on the information cards is next mapped onto spider diagrams. These diagrams present a graphical profile of each of the options with respect to specific objectives and/or decision criteria. In turn, this provides a mechanism to consider, visualise and better compare the costs and benefits of each of the options under consideration. Figure 5 provides an example using the data in Table 3, plotting the four capacity-building options against the three decision criteria associated with domestic impacts.

The spider diagrams perform two functions. First, they provide a first opportunity to compare the capacity-building options. It is important to recognise, however, that

they tend to facilitate comparison on the basis of single decision criteria; they take no account of the relative importance and trade-offs across criteria. Second, the spider diagrams provide an opportunity to validate the data in the information sheets to ensure consistency across the capacity-building options. Thus, for example, the degree to which there is consistency in the use of scale can be assessed. Thus, are the same values assigned to capacity-building options with broadly similar impacts along particular criteria? Further, are capacity-building options with bigger/smaller impacts assigned larger/smaller values than options with smaller/bigger impacts? Having scanned the spider diagrams there may be a need to make some adjustments to the information sheets ahead of the formal MCDA analysis.

**Figure 5. Spider plot of four SPS capacity-building options against decision criteria capturing impacts on the domestic agri-food sector**

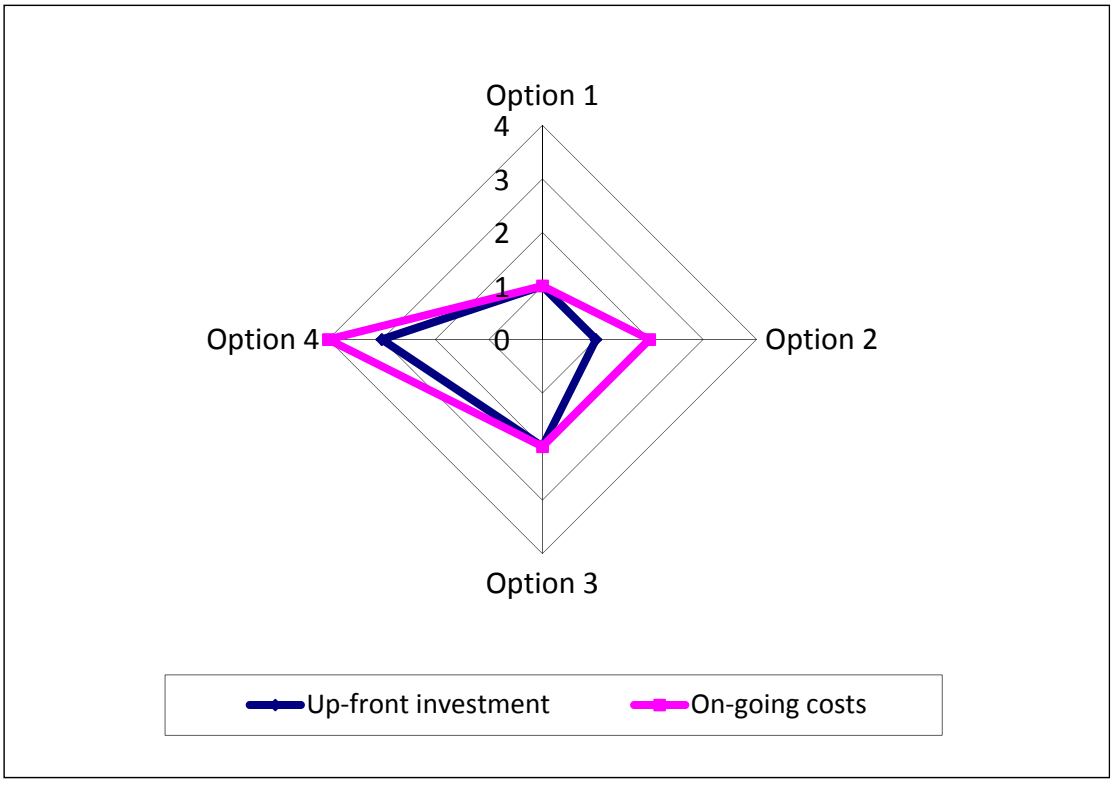



***Stage 6: Derive quantitative priorities***

The penultimate stage introduces formal multi-criteria decision-making (MCDA) into the priority-setting process. The MCDA approach enables alternative opinions and priorities to be considered and can help in developing consensus (Henson and Masakure, 2010). In addition, the MCDA approach enables decisions to be 'diagnosed', for example using scenario analyses, to look at how they might change if the weights placed on various decision criteria are altered. This can be especially important where stakeholders have differing perspectives and/or priorities.

The approach to MCDA employed here is outranking.[5] Outranking methods (Brans *et al*., 1986; Roy, 1996) are based on the principles of pair-wise comparison. The performance of each capacity-building option with respect to a particular decision criterion is compared to the other options under consideration using the particular scale used to measure that criterion. It should be noted that, given the pair-wise comparison nature of the approach, outranking is most suited to problems with discrete choices. Thus, in the context of SPS capacity-building, it is best employed to simple yes/no decisions with respect to the various options being considered rather than 'how much' of each option. Most SPS capacity-building options can be specified in this manner.

**Figure 6. Spider plot of four SPS capacity-building options against up-front investment and on-going costs**




The process for deriving quantitative priorities between the capacity-building options under consideration using outranking requires that the following are defined:

1. Set of options to be considered.
2. Decision criteria against which the options will be compared.
3. Performance scores for each option with respect to each criterion.

[5] And specifically the PROMOTHEE approach (see Henson and Masakure, 2010).

4. Weights for each decision criterion.
5. Preference relationships and thresholds for each decision criterion.

The first four of these inputs are defined through Stages 1 to 5 as described above. The final parameter that needs to be defined here are the preference functions and associated thresholds. These functions represent the preferences of the decision-maker when the capacity-building options are compared to one another in a pair-wise manner (for example Option 1 versus Option 2, Option 1 versus Option 3, Option 1 versus Option 4, Option 2 versus Option 3, etc.) with respect to a particular decision criterion. There are two elements to preference functions:

- **Indifference threshold (q):** The largest difference in the decision criterion between the two options that the decision-maker considers negligible.
- **Preference threshold (p):** The smallest difference in the decision criterion between the two options that the decision-maker considers significant.

Clearly, the preference threshold is always larger than the indifference threshold.

There are various forms of preference function, although not all have much relevance to choices between SPS capacity-building options. The main preference functions of interest here are as follows[6]:

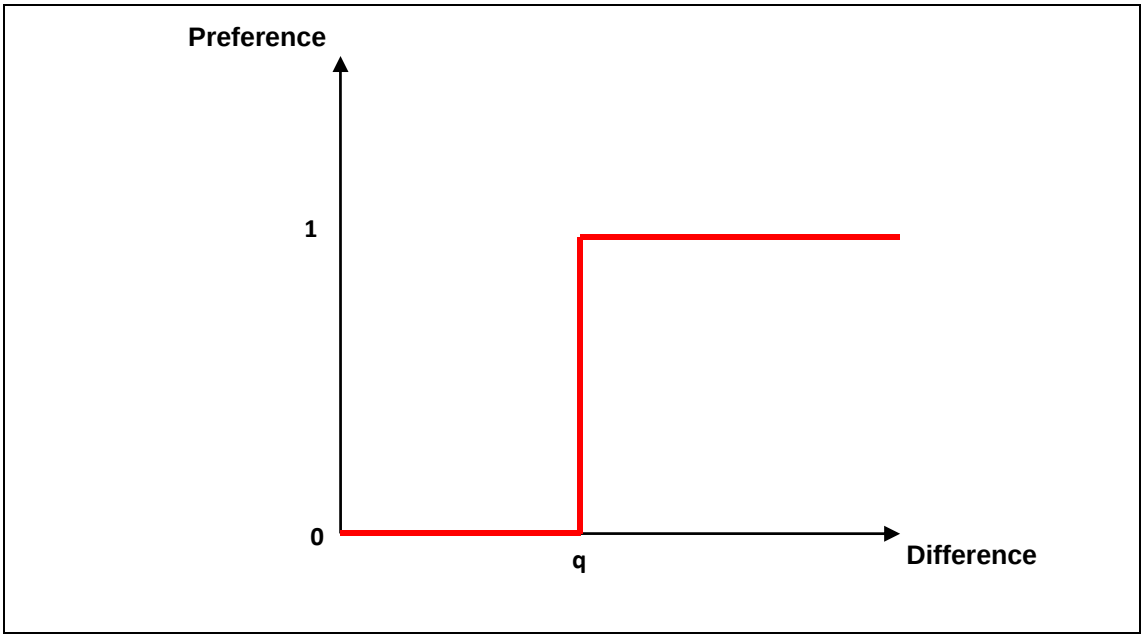
- **U-shaped:** This is applied where there is strict preference between two capacity-building options only if a particular discrete criterion is present (for example if smallholders are engaged in the respective export value chain) or the difference in a quantitative criterion (for example growth in value of exports to existing markets) exceeds the indifference threshold (q) (for example 10%). There is no preference threshold (p) in this preference function. This function is shown in Figure 7.
- **V-shaped:** The V-shaped preference function (Figure 8) is applied where there is increasing preference between two capacity-building options as the difference in a quantitative criterion (for example increase in employment) increases. However, there is an upper limit to this increase in preference, defined by the preference threshold (p) (for example 100%). There is no indifference threshold (q) in this preference function.
- **Level:** This type of preference function has both an indifference (q) and preference (p) threshold (Figure 9). Here, for example, a capacity-building option will not be preferred if it has lesser impact on the poor than other options, will have some preference if it has a moderately greater impact on the poor (parameter q) than other capacity-building options, and will be

[6] For more technical details see Brans and Mareschal (2005) and/or Podvezko and Podvezko (2010).

strictly preferred if it has much greater impact on the poor (parameter p) than other options.

- **Linear (or V-shaped with indifference)**: This preference function also has an indifference (q) and preference (p) threshold (Figure 10). This is applied, for example, where a decision-maker is indifferent between two capacity-building options if the difference in impact on the value of exports is less than (say) 10 per percentage points (the indifference threshold), whilst an option is strictly preferred if the difference in impact on growth in exports is greater than (say) 50 per cent (preference threshold). Between the indifference (q) and preference (p) thresholds, preference increases linearly; it increases in direct proportion to the magnitude of the difference in impact on the value of export sales.

**Figure 7. U-shaped preference function**




In many cases the choice of preference function will be clear, either because of the data being used to measure the respective decision criterion and/or the nature of the criterion itself. For example:

- Criteria measured using discrete (for example 'no' = 0; 'yes' = 1) data are generally modelled using a U=shaped preference function with an indifference threshold of 0 and preference threshold of 1.
- Where an ordinal scale is employed to measure a decision criterion, a level preference function is usually employed. If the scale is measured in equal units of one (for example, 0 = 'no impact'; 1 = 'little impact'; 2 = 'moderate impact; 3 = 'major impact') the indifference threshold is set at 0 and the preference threshold at 1.

- Where a criterion is measured using continuous data (for example the monetary value of exports) a linear preference function is generally used, with an indifference threshold of 0 and preference threshold of 1.

If not, there may need to be a degree of experimentation to determine the extent to which the choice of preference function influences the eventual ranking of capacity-building options.

**Figure 8. V-shaped preference function**

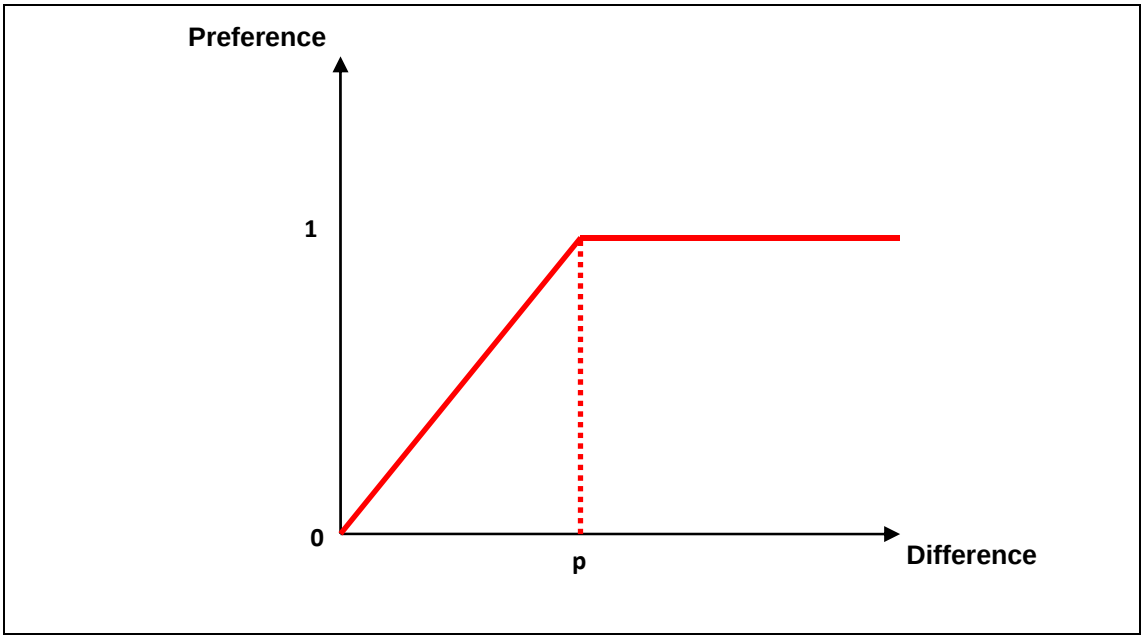



**Figure 9. Level preference function**

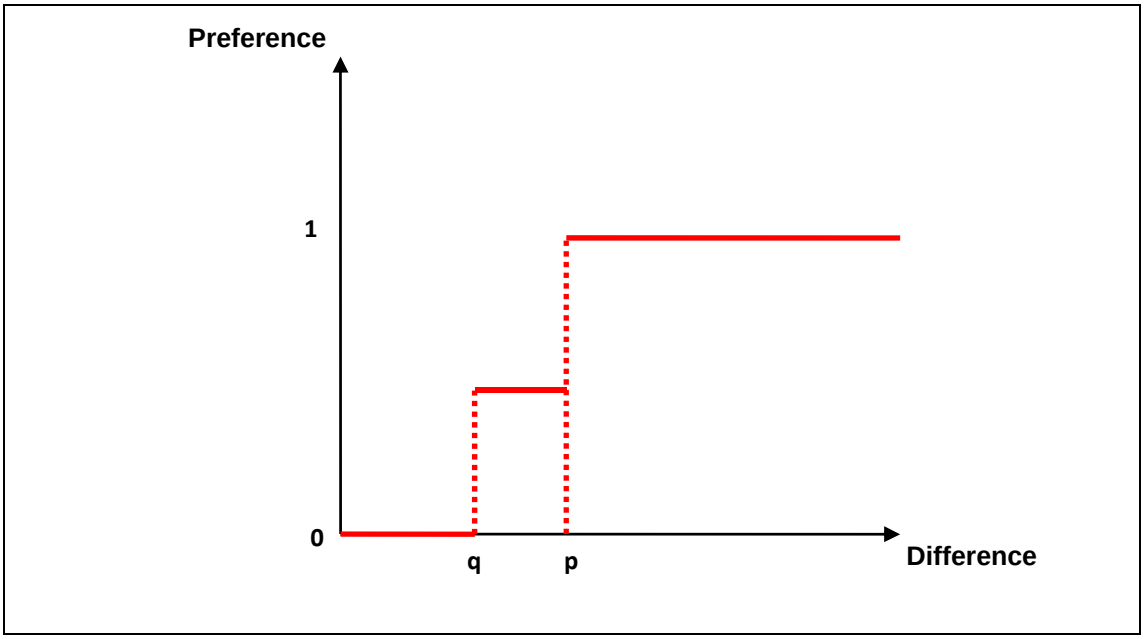
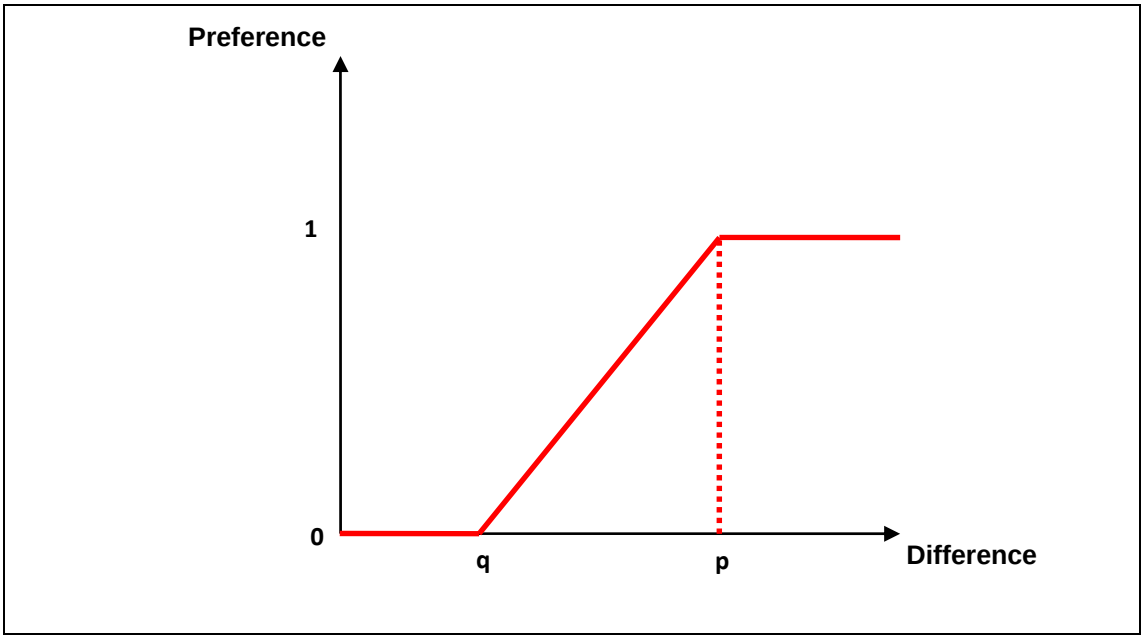


**Figure 10. Linear preference function**




Whatever form of preference function chosen, decisions will need to be made over the relevant level of the indifference (q) and/or preference (p) thresholds. Again, in many cases the choice will be clear from the data being used to measure the respective decision criterion and/or the nature of the criterion itself (see above). If not, input will be required of stakeholders. Such input can be obtained through an extension to the workshop and/or Delphi survey, using the approach described in Boxes 1 and 2.

Two software packages are available to undertake outranking analysis of the capacity-building options under consideration, and thus to derive a numerical prioritisation of these options, namely D-Sight[7] (Decision Sights, 2009) and Decision Lab 2000[8] (Visual Decision, 2000). Both are relatively easy to use and produce the output described below.[9] Below the hypothetical four options described above (see Table 3) are employed to demonstrate the use of outranking and the outputs it produces.

The outranking method calculates positive and negative preference flows for each of the four options. The positive flow expresses how much an alternative is *dominating* the other options being considered, and the negative flow how much it is *dominated* by the other options, given its performance according to the defined decision criteria. On the basis of the net preference, the positive flow less the negative flow, the four options can be ranked (Figure 11). Assuming that all of the decision criteria

[7] See http://www.decision-sights.com/.

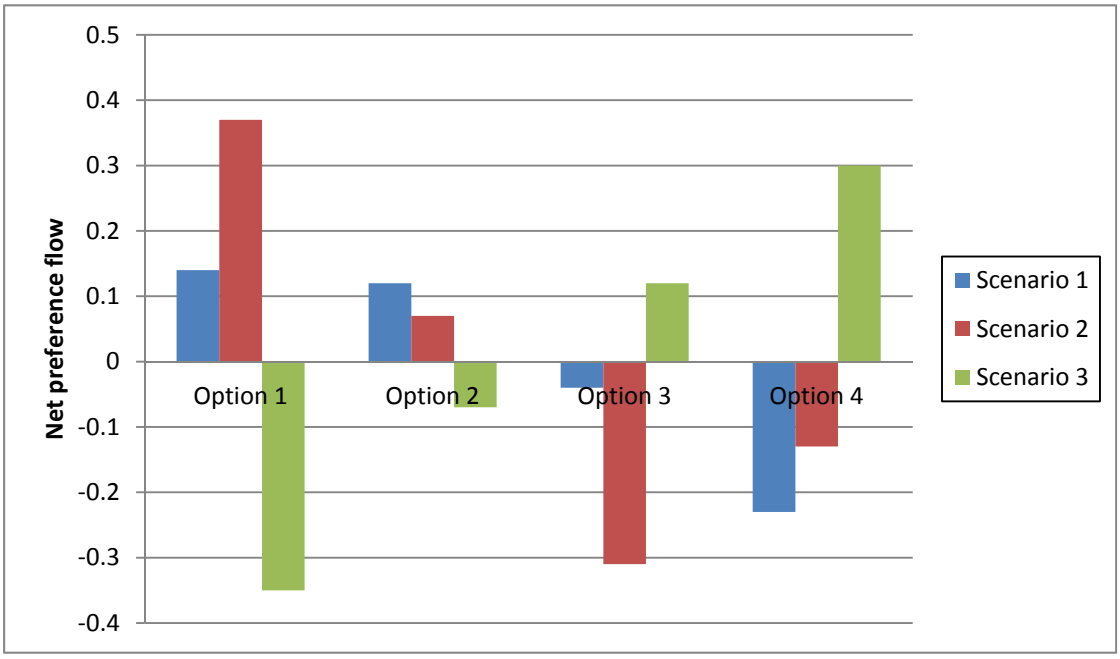
[8] See http://www.visualdecision.com/dlab.htm.

[9] At the current time, Decision lab 2000 appears to be unavailable for purchase.

are equally weighted (Scenario 1), Option 1 is the most preferred, followed closely by Option 2. Option 4 is least preferred.

The performance of each option with respect to specific decision criteria is shown by the unicriterion net flows (Table 4). Across any one decision criterion, the unicriterion net flows sum to one. Positive values correspond to decision criteria for which an option performs well with respect to the other options under consideration. Conversely, negative values indicate criteria for which the option exhibits a weakness with respect to the other options. It can be seen, for example, that Option 3 has negative unicriterion net flows for all of the decision criteria with the exception of impact on domestic public health, impact on environmental protection and change in the value of exports.

**Figure 11. Net preference for four capacity-building options under three alternative scenarios**




Of course, a decision-maker may not weight all of the criteria equally, as assumed in Scenario 1. Sensitivity analysis can be undertaken to explore the extent to which the ranking of the options changes as differing weights are employed. This can be very useful information and enables decision-makers to explore how the views of different stakeholders, that weight particular criteria more/less heavily, change perspectives on the decision. Here two alternative scenarios are explored as illustration (Table 5):

- **Scenario 2**: Heavy weight put on poverty impact. All other decision criteria weighted equally.
- **Scenario 3**: Heavy weight put on trade impact. All other decision criteria weighted equally.

The net preferences and ranking of the four options are somewhat different under these two alternative scenarios Thus, under Scenario 2 Option 1 is strongly preferred, reflecting the fact that it is the only option for which the impact on poverty is scored 'significant' (3). Conversely, under Scenario 3 Option 4 has the highest net preference. Note that Option 4 is predicted to have the greatest impact on exports. Under Scenario 3, Option 1 has a negative net flow and is least preferred.

**Table 4. Unicriterion net flows for the four capacity-building options under Scenario 1**

| Criterion | Option | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Up-front investment | 1.000 | 0.333 | -0.333 | -1.000 |
| On-going costs | 0.667 | 0.667 | -0.333 | -1.000 |
| Change in value of exports | -1.000 | -0.333 | 0.333 | 1.000 |
| Change in agricultural productivity | 0.167 | -0.500 | -0.500 | 0.833 |
| Change in domestic public health | -0.500 | 0.000 | 1.000 | -0.500 |
| Change in environmental protection | -0.500 | 0.167 | 0.833 | -0.500 |
| Poverty impact | 0.667 | 0.000 | -0.667 | 0.000 |
| Impact on vulnerable groups | 0.667 | 0.667 | -0.667 | -0.667 |

It should be noted that one of the key benefits of the outranking approach is that estimates of net benefits and the ranking of options can be updated over time as more (and better) data become available. Thus, the results should be seen as 'living' rather than end points of the analysis in themselves. For example, as data are improved and impacts are measured using continuous rather than categorical or dichotomous data, these can be incorporated into the model and new rankings derived. Even ahead of improvements in the availability of data, sensitivity analysis can be employed to check the extent to which the ranking of options substantively changes if key model parameters are altered. This can help build the confidence of the decision-maker as to the appropriate setting of priorities under conditions of uncertainty and to fend off criticism from competing stakeholders that put distinct emphases on particular impacts.

***Stage 7: Validation***

The final stage of the priority-setting exercise involves the validation of the results. The aim here is to ascertain that all stakeholder groups are generally 'generally happy' with the prioritisation produced by the framework and understand how it has been derived. Key to the success of the validation stage is a general appreciation that the prioritisation is a product of two key categories of parameters. First, the

selection of capacity-building options to be considered, decision objectives and criteria and decision weights that have been derived through an inclusive and structured process of stakeholder engagement. Second, the scoring of each of the capacity-building options according to the defined decision criteria based on best available data. Importantly, the derived prioritisation is not a product of the outranking method *per se,* but of these parameters.

**Table 5. Alternative weighting scenarios for decision criteria choice**

| Criterion | Relative Weight | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Non-recurring costs | 12.5% | 7.1% | 7.1% |
| Recurring costs | 12.5% | 7.1% | 7.1% |
| Aggregate value of exports | 12.5% | 7.1% | 50.0% |
| Change in agricultural productivity | 12.5% | 7.1% | 7.1% |
| Change in domestic public health | 12.5% | 7.1% | 7.1% |
| Change in environmental protection | 12.5% | 7.1% | 7.1% |
| Poverty impact | 12.5% | 50.0% | 7.1% |
| Impact on vulnerable groups | 12.5% | 7.1% | 7.1% |

The validation exercise is best undertaken through a second stakeholder workshop, involving a larger gathering of stakeholder representatives. Having outlined the key stages of the analysis, and the nature of the key parameters that drive the derived priorities, it is best that two sets of results are presented:

- The 'best' estimates of priorities based on the decision weightings derived in Stage 3, including the various outputs produced by the outranking software that provide a diagnosis of the derived priorities.
- A range of alternative estimates based on variants in the decision weights that demonstrate how sensitive the derived priorities are to changes in the relative importance of particular decision criteria.

The aim here is to ensure that stakeholders understand how and why the various SPS capacity-building options have been prioritised as they have. This provides a constructive platform on which stakeholders can air their grievances with the results of the exercise. Thus, if a particular group is unhappy that a particular option is prioritised too high/low, they need to argue for a change in the decision weights, or alternatively must present new data that permits the performance of the various capacity-building options to be better scored according to a particular decision criterion.

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**Appendix 1**
**Cards for Eliciting Capacity-Building Options**

| | |
|---|---|
| **Product(s) affected** | |
| **SPS issue/problem experienced** | |
| **Market(s) where SPS issue/problem is experienced** | |
| **Capacity-building option(s) that will address the issue/problem** | |

**Appendix 2**
**Decision Weight Scoring Sheet**

Sector from:

Public sector ☐

Private sector ☐

Research ☐

International organisation ☐

Other (*Specify*): _____

| Criterion | Weight |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | **100** |

## Appendix 3
## Example of Information Card

### Food safety controls for papaya exports from Belize

| Decision Criterion | Value | Details | Confidence |
|---|---|---|---|
| **Cost and difficulty of implementation** | | | |
| Up-front investment | US$0.2 million | Both facilities and fields would have HACCP certification and be on a monitoring programme for pesticide residues and microbiological contaminants. It entails testing of the produce and water. | High |
| On-going cost | US$110,325 | HACCP audit are conducted annually and monitoring for pesticide residues and microbiological contaminants is ongoing. Both fields and packing facility are inspected. | High |
| Difficulty of implementation | 2 | Only five or so exporters. Small number of larger producers. Supply chain quite highly integrated. | High |
| **Trade impact** | | | |
| Change in absolute value of exports | $5.1 million | Threat to 15% of established exports to US. Only one exporter currently meets requirements, which accounts for 85% of exports. Exports in 2012 predicted at $34 million and so loss of $5.1 million | Medium |
| Trade diversification – products | 0 | Established exports of papaya. | High |
| Trade diversification – markets | 0 | Established exports of papaya to US. | High |
| **Domestic agri-food impact** | | | |
| Agricultural/fisheries productivity | +1 | Threat to existence of three or four exporters and associated producers. | Medium |
| Domestic public health | +1 | Lower levels of pesticides residues in papaya on domestic markets. Better practices for application of pesticides leading to improved worker safety. | High |
| Environmental protection | +1 | Better controls on pesticide use and disposal of water used in processing facilities. | Medium |
| **Socio-economic impact** | | | |
| Impact on employment | +2 | Avoided significant loss of employment. Facilitates expansion of production. One of larger employers in production area. | Medium |
| Poverty impact | +2 | Employment in production and processing significant source of livelihood to poor people in production areas. | Medium |
| Impact on vulnerable groups | +1 | Production not in marginal areas. Significant sources of female employment. | Medium |