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Establishing Priorities for Sanitary and Phytosanitary Capacity-Building in Mozambique Using a Multi-Criteria Decision-Making Framework

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Acronyms

APIS	Animal and Plant Inspection Service
CAADP	Comprehensive African Agriculture Development Programme
CBS	Citrus Black Spot
COMESA	Common Market for Southern and Eastern Africa
DAFF	Department of Agriculture Fisheries and Food
DRC	domestic resource costs
DSV	Department of Plant Health (*Departamento Sanidade Vegetal*)
DTIS	Diagnostic Trade Integration Study
EU	European Union
FAO	Food and Agriculture Organization
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
HACCP	Hazard Analysis and Critical Control Points
HTFA	high temperature forced air
IITA	International Institute of Tropical Agriculture
INIP	National Institute of Inspection of Fish (*Instituto Nacional de Investigação Pesqueira*)
IPPC	International Plant Protection Convention
ISPM	International Standard for Phytosanitary Measure
MCDA	Multi-criteria decision analysis
MDG	Millennium Development Goals
MRL	Maximum Residue Levels
NEPAD	New Partnership for African Development
NPPO	National Plant Protection Organization
OIE	World Organization for Animal Health
PCE	Phytosanitary Capacity Evaluation
PEDSA	Strategic Plan for Agricultural Development
PPECB	Perishable Products Export Control Board
PVS	Provision of Veterinary Services
RASFF	Rapid Alert System for Food and Feed
RCA	revealed comparative advantage
SADC	Southern African Development Community
SPS	Sanitary and Phytosanitary
STDF	Standards and Trade Development Facility
TA	Tripartite Agreement
TBT	Technical Barriers to Trade
UEM	University of Eduardo Mondlane
USAID	United States Agency for International Development
USDA-APHIS	United States Department of Agriculture - Animal and Plant Health Inspection Service
WITS	World Integrated Trade Solution
WTO	World Trade Organization

Establishing Priorities for Sanitary and Phytosanitary Capacity Building in Mozambique Using a Multi-Criteria Decision-Making Framework

Executive summary

As part of efforts to establish more coherent and accountable decisions in the allocation of scarce resources towards competing Sanitary and Phytosanitary (SPS) capacity-building needs the use of multi-criteria decision analysis (MCDA) is being advocated by the Standards and Trade Development Facility (STDF) as providing a structured framework for making the costs and benefits of alternative capacity-building investments explicit and for identifying options that offer the greatest return. The first practical application of MCDA by the STDF was in Mozambique. National SPS stakeholders were consulted through a workshop in April 2011, during which eleven distinct SPS capacity-building options were identified. These options were then prioritised on the basis of a series of decision criteria to which weights were applied, that were again derived by consulting national stakeholders.

The end result was a clear ranking of the 11 capacity-building options, which appears robust to changes in the weights attached to the decision criteria. The results of the analysis were presented in a stakeholder workshop in January 2012. At this workshop it was agreed that the options were a fair reflection of the SPS capacity-building needs facing Mozambique, that the data were robust as far as could be determined, and that the results of the analysis were clear. Of the 11 capacity-building options identified, the following six were consistently ranked as top priority:

- Determine the pest status of bananas.
- Maintain the pest-free status of bananas.
- Biological control of *B. invadens*.
- Mycotoxin controls for groundnuts and maize
- Post-harvest treatment for mangoes
- Hygiene controls for crustaceans.

This prioritisation is based not only on the respective costs and predicted trade impacts, but also on the basis of impacts on agricultural/fisheries productivity, domestic public health, local environmental protection, and impacts on poverty and on vulnerable groups. Given the robustness of the results, this basic ranking would appear to present a coherent basis on which to start defining a national action plan for SPS capacity-building in Mozambique.

It is important to recognize, however, that the results of the analysis represent just the starting point and that the results must be revisited and revised on an ongoing basis in the light of improvements in the availability and/or quality of data, changes in policy priorities that imply shifts in the decision weights and/or the introduction of new decision criteria. New capacity-building needs can be added to the analysis and completed options can be excluded and the priorities re-estimated accordingly. The intention is that the prioritization framework will become a routine element of SPS capacity-building planning in Mozambique and provide the economic justification for internal decision-making and the presentation project proposals to institutions supporting related investments

1. Introduction

Sanitary and phytosanitary (SPS) measures are applied by governments to control food safety, plant health and animal health risks, and to prevent incursions of exotic pests and diseases. In turn, such measures act to protect human health, promote agricultural productivity and facilitate the international marketability of agricultural and food products.[1] Increasingly, private standards are being applied in parallel as a mechanism for firms to manage food safety risks and to differentiate their products. Whilst the illegitimate use of SPS measures undoubtedly remains a problem, despite the obligations and rights laid down in the World Trade Organization (WTO) Agreement on Sanitary and Phytosanitary Measures, arguably the biggest challenge for developing countries is achieving and maintaining the required compliance capacity, both within the public sector and in exporting firms.[2]

In making efforts to expand their agri-food exports and to reposition themselves towards higher-value markets, developing countries face an often daunting array of SPS capacity-building needs that outstrip available resources, whether from national budgets or donors. Inevitably, hard decisions have to be made to prioritise particular capacity-building needs over others. At the same time, the drive towards greater aid effectiveness requires that beneficiary governments are able to present coherent and sustainable plans for capacity-building. Whilst, decisions have to be made between competing needs on an on-going basis, such decisions often lack coherence and transparency, and there are various accusations of inefficiencies in the allocation of resources, whether by developing country governments or by donors. [3]

As part of efforts to establish more coherent and accountable decisions in the allocation of scarce resources towards competing SPS capacity-building needs, various economic analysis techniques have been touted. Approaches such as cost-benefit and cost-effectiveness analysis are seen as providing structured frameworks for making the costs and benefits of alternative capacity-building investments explicit and for identifying options that offer the greatest return.[4] The quantity and/or quality of data in many developing countries, however, can seriously impede such analyses. Further, establishing priorities amongst capacity-building needs is often made on the basis of multiple criteria measured in disparate ways, pointing to the potential use of multi-criteria decision analysis (MCDA).

The Standards and Trade Development Facility (STDF) has supported the development of a framework for the establishment of priorities amongst competing SPS capacity-building needs that might be funded by the government or the private sector in developing countries, and/or donors.[5] Through the use of MCDA, the framework enables capacity-building options to be prioritised on the basis of a wide range of decision criteria (for example value of exports, impacts on small-scale producers, improvements in domestic public health and/or agricultural productivity and consequences for vulnerable groups) that are not necessarily measured or even measurable using the same metrics. At the current time, this framework is being applied in selected countries in order to assess its utility in practice and to lead the development of an easy-to-follow users guide.

One of the initial applications was in Mozambique, which is the focus of this report. Despite the fact that various assessments of the SPS situation and capacity-building needs have been undertaken in Mozambique, there remains a lack of coherence in the establishment of priorities. [6] Thus, many of the

existing assessments, whilst identifying a plethora of weaknesses in capacity, generate a virtual 'shopping list' of needs that evidently outstrip available resources. Further, many of these needs are rather general in their focus, with insufficient attention given to the benefits that will flow from specific investments in SPS capacity relative to the costs involved. Therefore, it is not surprising that Mozambique lacks a coherent and prioritised plan for the enhancement of SPS capacity that might guide government, donor and/or private sector investments. The analysis presented below aims to inform the development of such a plan.

This report starts by providing an overview of the agricultural policy environment followed by trade and trade support in SPS sensitive goods and related challenges in Mozambique. The priority-setting framework and related methods are then briefly described. The report then proceeds to lay out the SPS capacity-building needs identified in the analysis and that enter the priority-setting exercise. The results of the analysis are then reported, followed by an assessment of the implications for SPS capacity-building in Mozambique in the medium term.

2. Overview of sectoral policy in Mozambique as it affects agri-food trade

Mozambique, located on the south eastern coastline of Africa, is 799,382 km^2 in size with a population of just over 20 million, of whom one million live in Maputo, the capital city. Over 80 per cent of the workforce of eight million works in the agricultural sector. In 2009, Gross Domestic Product (GDP) was $17.64 billion, with a GDP per capita of $882. Agriculture accounts for around 21 per cent of GDP and has been growing in recent years at over seven per cent annually. The main sources of food for domestic consumption include maize, pigeon peas, cassava, rice, as well as beef, pork, chicken and goat. Major agri-food exports are prawns, cotton, cashew nuts, sugarcane, tea, cassava, maize, coconuts, sisal, citrus and tropical fruits, potatoes, sunflower seed, beef and poultry. Whilst bananas and groundnuts have always been widely consumed domestically, in recent years these have also become significant agri-food exports.

2.1 Government developmental objectives and trade support

Developing countries have, in cooperation with donor partners, built up a range of policies, analytical steps, tools and methodologies in order to map out their objectives in promoting agricultural sector growth. The policy basis for these tools are the L'Aquila principles (outlined at the G8 summit in Italy in July 2009), which emphasize investment in agriculture. These have been further developed by the Paris Declaration on Aid Effectiveness and the Accra Agenda for Action, and are now endorsed as the Rome Principles for Sustainable Food Security. A crucial element of these principles is that development assistance should be country-owned and serve as the foundation for countries to coordinate national and development partner interventions.

In a sub-Saharan African context national, regional and continental agricultural investments are guided through the New Partnership for African Development (NEPAD) process which has a specific agricultural sub-component, the Comprehensive African Agriculture Development Programme (CAADP).[78] It is, therefore, important that any support for agricultural trade builds on national and regional CAADP plans ('compacts'); in particular, where the intention is to direct support to regional and international trade in

agricultural and agri-food products. As part of the process of contextualizing any review of SPS capacity-building options it is necessary to review current and past trade support in the context of national development aspirations as laid out in the national CAADP compact as well of international obligations explicitly laid out in the WTO SPS Agreement. Such a review can draw on a variety of sources from country reports by the WTO, national reporting to/by international institutions responsible for administering various parts of the SPS Agreement, and *ad hoc* reports by a variety of organizations.

2.2. Agricultural sector policy

In 2010, Mozambique produced the Ministry of Agriculture Strategic Plan for Agricultural Development (PEDSA) 2010-2019[9] which presents a medium to long-term framework for agricultural development with priorities set out in line with CAADP. PEDSA is a logical extension of the National Action Plan for the Reduction of Absolute Poverty (PARPA II) which was concluded in 2009.[10] Five specific objectives are defined for PEDSA:

- Increase agricultural production and productivity and its competitiveness.
- Improve infrastructures and services for markets and marketing.
- Use land, water, forest and fauna resources in a sustainable way.
- Establish a legal framework and policies that are conducive to agricultural investment.
- Strengthen agricultural institutions.

In pursuit of these objectives, PEDSA has the following elements:

- Increasing the availability of food in order to reduce hunger, through growth in small producer productivity and emergency response capacity.
- Enlarging the land area under sustainable management and the number of reliable water management systems.
- Increasing access to the market through improved infrastructures and interventions in marketing.
- Improving research and extension for increased adoption of appropriate technologies by producers and agro-processors.

The overall approach aims to be value chain-driven towards an "integrated, prosperous, competitive and sustainable agriculture sector" as laid down in Mozambique's Vision 2025.[11] PEDSA aims to present a harmonized framework to guide decisions across a range of interventions and investments in the agricultural sector. Importantly, it is intended as a guide for development partners and specifically to help them align agricultural development with national, regional and international guidelines. The five-year program for 2010-2014 is aligned with the overall objective of achieving the Millennium Development Goals (MDGs).

The basis of current Mozambican trade policy in SPS sensitive goods is outlined in the Diagnostic Trade Integration Study (DTIS) completed in 2004 and signed off by the national government.[12] Recommendations relating to agriculture included:

1. Development of a strong commercial farming sector.

2. Promotion of higher value product lines, particularly fruit.
3. Promotion of crops; particularly via irrigation and drainage and agricultural technology.
4. Promotion of agro-processing.

While the DTIS study identified the existing SPS support framework as being weak, it did not specify the nature of these weaknesses or suggest detailed remedies. The DTIS study did, however, highlight the fruit and fish export sectors as having high existing and future export potential, coupled with potentially high SPS constraints and weak SPS support infrastructure and systems.

2.3. Sector support for trade in SPS sensitive agri-food products

Mozambique is currently in the process of forming a National SPS Committee. Whilst the Committee has not been formally constituted, a taskforce has begun to identify cooperation and resource-sharing opportunities amongst the Ministries of Commerce and Industry, Health, Fisheries and Agriculture, and Rural Development. These ministries also form the core membership of the National CODEX committee which is operational. Since its first Trade Policy Review in 2001, Mozambique has taken steps to liberalize its trade regime by lowering its maximum tariff rates and improving its investment regime. The reforms have contributed to achieving high economic growth, averaging 8.7 per cent annually over the period 2001 to 2007, driven mainly by foreign direct investment and public spending that has been largely financed by foreign aid.

Table 1; Existing reviews of SPS compliance and capacity in Mozambique

Source		Status
Enhanced Integrated Framework	Diagnostic Trade Integration Study (2004)	Yes
	WTO Trade Policy Review (2009)	Yes
CAADP Compact	Strategic Plan for Agricultural Development (PEDSA) 2010-2019	Yes
Integrated Approach to Food Safety, Plant & Animal Health: National Biosecurity Capacity Evaluation		No
Performance, Vision and Strategy [Provision of Veterinary Services] (PVS) Tool		(Yes)
Food and Agriculture Organization (FAO) Guidelines to Assess Capacity-Building Needs to Strengthen National Food Control		No
Phytosanitary Capacity Evaluation (PCE) Tool		Yes
Ad hoc and other national case studies		Yes

Key: Yes = Conducted and in public domain.
(Yes) = Conducted but not in public domain.
No = not aware of any.

Various reviews of SPS capacity in Mozambique have been carried out in recent years (Table 1). In terms of more specific issues relating to trade a Trade Policy Review of Mozambique was completed by the WTO in 2009.[13] The findings of the Review were that, whilst Mozambique does use international standards, these tend only to be adopted when necessary:

> '*Mozambique's sanitary and phytosanitary regime has not, in fact been revised substantially since 2001. SPS measures on imports are based on international standards drawn up by the World Organization for Animal Health (OIE), the International Plant Protection Convention*

(IPPC), and the Codex Alimentarius. Certain imported products (plants and plant products, and the products of apiculture) require a Phytosanitary Licence of Importation and are subject to inspection and control. Imports of animals and products of animal origin must obtain a Sanitary Licence of Importation.'[14]

Mozambique has been a member of the WTO since 1995. Table 2 summarises the status of administrative structures required under the SPS and Technical Barriers to Trade (TBT) Agreements as of August 2010.

Table 2. Contact information and SPS notifications for Mozambique as lodged with the WTO, August 2010

WTO TBT enquiry point	Biosafety national focal point	WTO SPS national notification authority	WTO SPS enquiry point	Codex contact point	NPPO contact point	Official website[15]
Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: WTO SPS Notification Database[161718]

As a member of the Southern African Development Community (SADC), Mozambique signed an agreement in July 2008 to undertake trade in safe products and to protect regional animal and plant health. This agreement is in the form of an SPS Annex to the SADC Trade Protocol. It is generally in line with the SPS Agreement, but includes a number of additional obligations to SADC Member States in terms of regional information sharing and cooperation. Through its membership of SADC, Mozambique is a party to the Tripartite Agreement (TA) between SADC, Common Market for Southern and Eastern Africa (COMESA) and the East African Community. The TA contains an SPS Annex that broadly accords with the WTO SPS Agreement and the SADC SPS Annex.

3. Overview of Mozambican Sanitary and Phytosanitary sensitive trade

Mozambique's exports over the period 2007 to 2009 averaged US$2.4 billion annually.[19] Over the same period, exports of agricultural and food products amounted to US$0.47 billion, representing 19 per cent of total exports. Table 3 provides an overview of Mozambique's principle agri-food exports together with the key associated SPS requirements. These exports include all products that can be considered SPS sensitive, including the food and non-food outputs of agriculture. Substantive exports which are highly SPS sensitive are fish and edible fruit and nuts. Within these categories, however, there is appreciable variation in sensitivity to particular SPS issues, for example between fish produced by capture and by aquaculture or exported fresh or frozen.[20] Major exports for which SPS issues are of little importance include sugar, cotton and tobacco.

Table 3*; Average annual value and SPS sensitivity for each value chain of agri-food exports from Mozambique, 2007 to 2009*

Category (HS 1992 2 Digit)*	Average Annual Exports (US$)	Proportion of Total SPS Sensitive Exports (%)	Sensitivity				
			Plant Health	Animal Health	Food Safety	Environmental standards	Private standards
01 Live animals	1,100,643	<1		XXX		X	
02 Meat and edible meat offal	43,096	<1		XXX		X	
03 Fish, crustaceans, molluscs, aquatic invertebrates, nes	70,412,447	15		XXX	XXX	XXX	XX
04 Dairy products, eggs, honey, edible animal product, nes	61,180	<1		XX	XX	X	XXX
05 Products of animal origin, nes	503,394	<1		X		XX	
06 Live trees, plants, bulbs, roots, cut flowers etc	28,819	<1	XX			XX	
07 Edible vegetables and certain roots and tubers	19,346,611	4	XX				XXX
08 Edible fruit, nuts, peel of citrus fruit, melons	34,620,942	7	XXX				XXX
09 Coffee, tea, mate and spices	3,673,635	1	X		X	X	XXX
10 Cereals	6,214,393	1	XX		XX	X	
11 Milling products, malt, starches, inulin, wheat gluten	6,609,261	1	X		XX		
12 Oil seed, oleagic fruits, grain, seed, fruit, etc, nes	39,057,890	8	XXX		XX		XXX
13 Lac, gums, resins, vegetable saps and extracts ne	63,097	<1			XXX		XXX
14 Vegetable plaiting materials, vegetable products, nes	6,367,241	1	X			X	
15 Animal, vegetable fats and oils, cleavage products, etc	35,328	<1			XX		
16 Meat, fish and seafood food preparations, nes	35,328	<1		X	XXX	X	XXX
17 Sugars and sugar confectionery	41,044,434	9			X	X	
18 Cocoa and cocoa preparations	365	<1			X	X	
19 Cereal, flour, starch, milk preparations and products	190,891	<1			X		
20 Vegetable, fruit, nut, etc. food preparations	28,150	<1			XX		XX
21 Miscellaneous edible preparations	70,405	<1			X		
22 Beverages, spirits and vinegar	1,226,369	<1			X		
23 Residues, wastes of food industry, animal fodder	12,982,011	3	XX	XX		X	
24 Tobacco and manufactured tobacco substitutes	142,475,207	30			X		
44 Wood and articles of wood, wood charcoal	36,271,172	8	X				X
46 Manufactures of plaiting material, basketwork, etc.	1,048,968	<1	X				
47 Pulp of wood, fibrous cellulosic material, waste, etc.	69,077	<1			X	XX	X
48 Paper & paperboard, articles of pulp, paper and board	2,002,105	<1			X	XX	
50 Silk	115	<1		X			
51 Wool, animal hair, horsehair yarn and fabric thereof	0	0		X			
52 Cotton	38,081,112	8			X	X	
53 Vegetable textile fibres nes, paper yarn, woven fabric	3,925,544	1					
TOTAL	467,589,231	100					

nes = not elsewhere specified

Source: COMTRADE

Given the overall composition of Mozambique's agri-food exports and experiences to date, SPS requirements appear to be a potentially major constraint. Indeed, a number of studies have highlighted SPS issues as a problem for various major export commodities including seafood, fruit, cashews and groundnuts. The accompanying national SPS capacity in many of these areas is weak, although efforts are being made to address the most critical issues in strategically important areas. It is important to recognise, however, that other competitiveness factors are of (arguably greater) importance, including primary producer and processor productivity, continuity/reliability of supply of producer inputs, logistical costs, macroeconomic factors and international commodity price trends.

Mozambique's export performance in more perishable and more SPS sensitive agri-food exports, notably seafood, fresh vegetables, and fruit, has been relatively strong. Many of these commodities originate in the coastal and/or southern parts of the country where logistics are better and infrastructure and service support for various sectors is more available. Indeed, the southern third of Mozambique can be considered an extension of the logistical infrastructure of South Africa with many of that country's SPS sensitive exports, including fruit from the North Eastern lowveld, being exported through Maputo. However, supply chain problems, logistics and seasonality remain significant constraints.

In the case of exports to the European Union (EU), SPS issues are particularly an issue for fish and fishery products (prawns) and groundnuts. The EU Rapid Alert System for Food and Feed (RASFF) Portal lists 27 Notifications for Mozambican imports between 1997 and 2011, of which most relate to temperature controls in prawns or aflatoxins in groundnuts. Of these alerts, 18 have occurred in the last three years (Table 4). Other major SPS issues relate to the discovery of the invasive fruit fly (*Bactrocera invadens*) in Mozambique in 2007, which has principally affected fruit exports, to South Africa and Zimbabwe.

Table 4; Rapid Alert System for Food and Feed (RASFF) alerts for Mozambican imports from 1997 to November 2011[21]

Product	Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Prawns	Temperature										1				4	10
	Microbiology		1	2												
	Chemical								1							1
Groundnuts	Aflatoxin											3		3		
Other	Unspecified	1														
TOTAL		1	1	2	0	0	0	0	1	0	1	3	0	3	4	11

4. Establishing priorities using a Multi-Criteria Decision-Making Framework

The framework employed here aims to present a more comprehensive analysis of options for SPS capacity-building that can feed into the development of a prioritised action plan for the enhancement of SPS capacity. Thus, its ultimate objective is to *generate a prioritised schedule of options for SPS-related capacity-building in Mozambique on the basis of the multiple economic and/or social criteria*. The rationale behind the framework, therefore, is that priorities need to be established on the basis of a range of economic and social considerations that may, at least on the face of it, be difficult to reconcile.

In turn, this assumes that the rationale for investments in SPS capacity-building is not compliance with export market SPS requirements *per se*, but the economic and social benefits that might flow from such compliance, whether in terms of enhanced exports, incomes of small-scale producers and/or vulnerable groups, promotion of agricultural productivity and/or domestic public health, etc. The framework provides an approach for different decision criteria to be taken into account, even though they may be measured in quite different ways.

In pursuit of this objective, the framework aims to:

- Identify the current set of SPS-related capacity-building options in the context of existing and/or potential exports of agri-food products. Below this is termed the *choice set*.
- Determine the *decision criteria* that should drive the establishment of priorities between SPS-related capacity-building options and the relative importance (*decision weights*) to be attached to each.
- Prioritize the identified SPS-related capacity-building options on the basis of the defined decision criteria and decision weights.
- Examine the sensitivity of the established priorities to changes in parameters of the framework.

The framework employs a highly structured process that aims to be applied in a wide variety of contexts and to provide various diagrammatic and numerical outputs. The framework and its practical implementation are described in detail in a draft user's guide.[22] Thus, here a relatively brief outline of the seven stages of the framework (Figure 1) is provided, with a particular focus on how they were implemented in Mozambique.

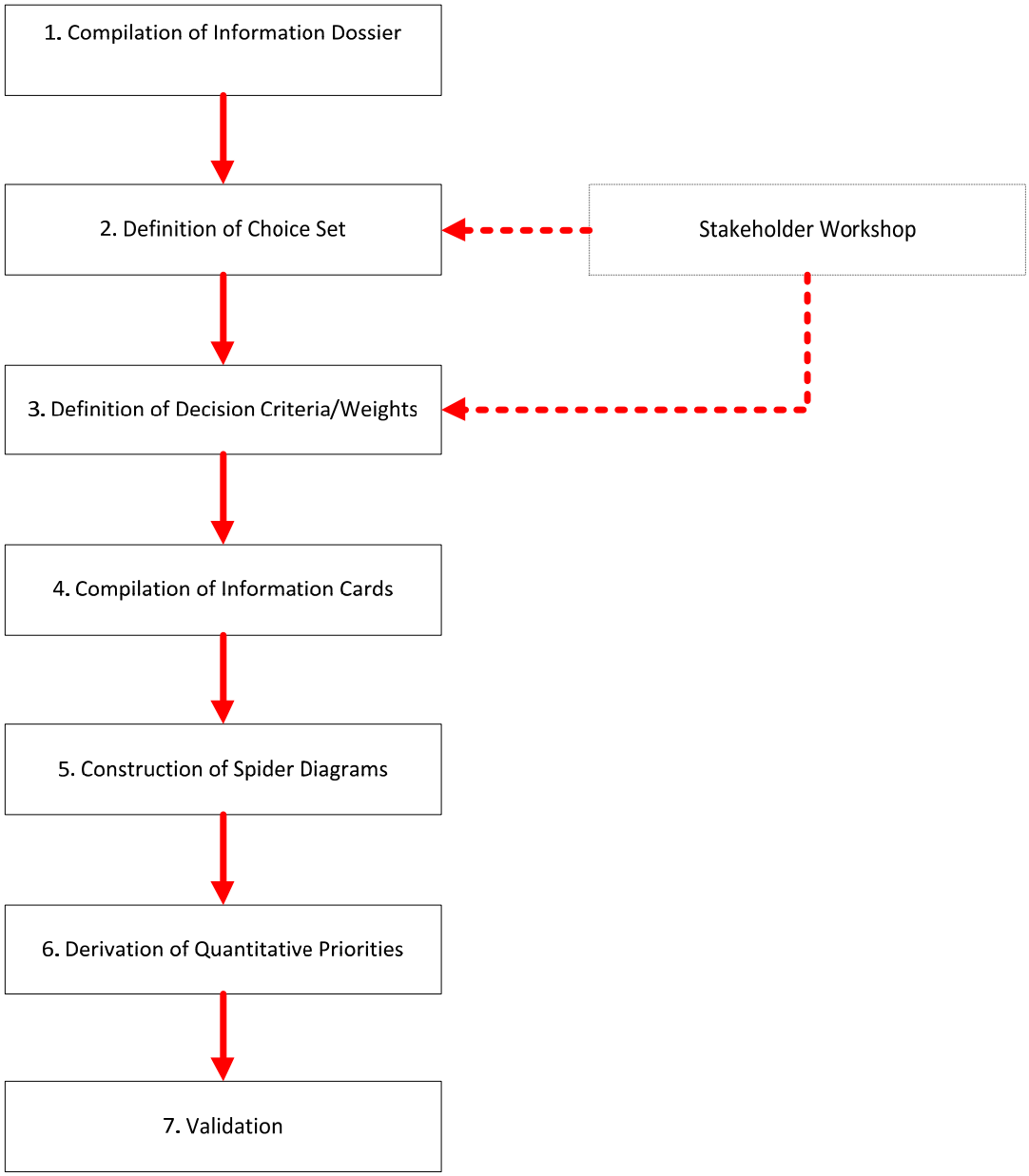
Stage 1: Compilation of information dossier

The first stage of the analysis involved the compilation of a comprehensive dossier of existing information on the SPS challenges facing agri-food exports from Mozambique and the associated capacity-building needs. In so doing, the aim was to ascertain what work had already been undertaken to identify capacity-building options and the definition of priorities for related investments. The documents/information in the dossier are itemised in Appendix 1.

Stage 2: Definition of choice set

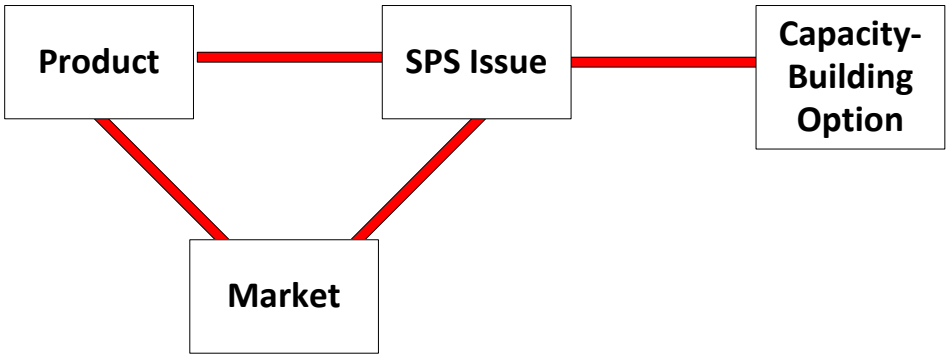
In order to identify the SPS capacity-building options to be considered in the priority-setting framework, a one-day stakeholder workshop was held on Wednesday 13th April 2011. A total of 21 stakeholders (Appendix 2) attended the workshop, drawn predominantly from government and donors. Participants were presented with a series of cards and asked to identify the SPS capacity-building needs of Mozambique. Critically, respondents were asked to define a series of mutually-exclusive needs consisting of four key elements (Figure 2). First, the product(s) affected. Second, the specific SPS issue faced by exports of this product(s). Third, the market(s) where these SPS needs were an issue. Fourth, the capacity-building option(s) that would solve the SPS issue being faced. The combination of these four elements defined a distinct capacity-building option. Respondents were free to define as many specific SPS capacity-building needs as they wished.

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



The cards of all respondents were collected, shuffled and then reported back to the workshop as a whole through listings on flip charts. The collection of items was then discussed in order to remove any ambiguities and to ensure that each represented a mutually-exclusive capacity-building option. A total of 11 SPS capacity-building options were defined through the above process, as described in Table 5.

Figure 2; Definition of SPS capacity-building options



A number of other more generic capacity issues, for example reform of legislative frameworks and upgrading of inspection institutions, were also identified through this process. These were excluded from the choice set, however, because they failed to relate the respective SPS issue to a particular product or market.

Stage 3: Definition of decision criteria and weights

In the second stage of the stakeholder workshop, respondents were asked to define an appropriate set of criteria to drive the priority-setting process and to assign weights to these. First, participants were presented with a series of potential decision criteria organised into four categories as set out in Table 6, and asked which (if any) should be excluded and whether any potentially important criteria were missing. No substantive changes to the list of decision criteria were made as a result.[23]

Table 5; Choice set of SPS capacity-building options

Option Number	Name	Details
1	Pesticide residue testing	Currently Mozambican exporters of agricultural products have pesticide tests conducted outside the country. Establishing this capability in Mozambique will get round the need to use external laboratories. The activity will establish an internationally credible pesticide residue testing capability in Mozambique.
2	Mycotoxin testing of groundnuts	Groundnut exporters cannot get certified tests for mycotoxins inside Mozambique. Laboratories in the country conduct tests for aflatoxin (not mycotoxins) residues prior to shipping. Tests are conducted in the destination country to ISO/IEC 17025 standard on a consignment basis. Exporters run the risk that domestic testing is inaccurate and/or that aflatoxin levels have increased in transit leading to rejection of the consignment. The activity will establish an internationally credible aflatoxin testing capability in Mozambique.

Option Number	Name	Details
3	Mycotoxin controls for groundnuts and maize	The ability of smallholders to meet aflatoxin standards is limited. In addition the control of aflatoxin by conventional means (e.g. improved post harvest management) has had limited impact over the years. The intervention aims at making a low cost aflatoxin bio-control remedy available to smallholders that will increase the likelihood of meeting EU limits for the contaminant, as well as reducing dietary intake of the population as a whole. Applications of the bioremedy will also benefit maize and cassava crops grown in the same or nearby fields. The activity will enable Mozambican smallholders to achieve export standards for aflatoxin levels in groundnuts and maize, as well as reducing local dietary intake.
4	Hygiene controls for crustaceans	Addresses remaining weaknesses in hygiene controls for the export of crustaceans to the EU. Main issues are the need to achieve accreditation of four fisheries testing laboratories and upgrading of hygiene controls amongst artisanal fishers supplying the export value chain for crustaceans. The latter involves training, upgrading of landing sites, provision of plastic boxes, etc.
5	Hygiene controls for bivalves/molluscs	This option is aimed at putting in place legal provisions and hygiene controls for the export of bivalves and molluscs, predominantly to EU markets. Currently, only one firm exports these products, to Japan, Hong Kong and China, under special provisions that by-pass the lack of a legal framework for the control of exports. The necessary investments include legislative reform (legislation has already been drafted), upgrading of laboratories for the preparation and testing of samples for testing of biotoxins (upgrading of the Maputo laboratory has commenced and the necessary equipment procured), classification and monitoring of production areas and upgrading of processing facilities.
6	Determine pest status of bananas	The pest status of bananas as a host for *B. invadens* is not known with any degree of certainty. There is a single controversial reference in one scientific paper. Nevertheless this reference is used by the South African NPPO as the basis for the exclusion of banana imports from areas where *B. invadens* has established itself in Mozambique (the Province of Nampula in particular). The activity seeks to duplicate work by United States Department of Agriculture - Animal and Plant Health Inspection Service (USDA-APHIS) in Hawaii which established the non-host status of banana with respect to *B. zonata* (a close relative of *B. invadens*).

Option Number	Name	Details
7	Post-harvest treatment for mangoes	Mangoes are grown in the Dombe area of Manica Province in Mozambique which has a low prevalence of *B. invadens*. Nevertheless the presence even at low levels is sufficient to exclude South Africa and potentially Europe as a market for mangoes from this area as the fruit is a known host. The proposed activity will develop a post harvest treatment based on high temperature forced air technology (HTFA) to disinfest the fruit of *B. invadens*, and provide the equipment to treat export fruit.
8	Maintain pest-free status for bananas	The Mozambican NPPO has succeeded in containing the spread of *B. invadens* to the area north of the Save River and thus has declared the province of Maputo (among others) to be free of the pest. The declaration has allowed exports of bananas from the province of Maputo, where there are significant investments in banana production, to continue. The declaration of a pest free zone requires continued surveillance by the NPPO of Mozambique.
9	Biological control of *B. invadens*	B. *invadens* is now the dominant fruit fly species in Northern Mozambique since its discovery there in the Cuamba district in the Northern Province of Niassa. Reports indicate that several types of fruit including mango that are seasonally important in local diets are now heavily infested with the fruit fly leading to severe losses. The intervention proposes the upgrading of facilities for the rearing a release of biological control agents for *B. invadens* and ensuring that they are at self sustaining levels in the region.
10	Hazard Analysis and Critical Control Points (HACCP) controls for cashews	The Mozambique cashew nut processing industry is pursuing a HACCP accreditation program together with additional support (in the form of a pre-requisite program) for the necessary capital investments. Markets are increasingly demanding certification as a minimum entry requirement and the current uncertified status of Mozambique processors already automatically bars them from a number of lucrative outlets. The activity will ensure continued access for shelled cashew nuts to European and other markets.
11	Controls on Black Spot for citrus	Black Spot disease is an issue for exports of citrus from Africa to the European Union. While citrus can be exported from Africa to EU markets the procedure involved requires a certification procedure on a pack-house and orchard basis via the NPPO coupled with a specified disease control programme.

To define the decision weights, the workshop participants were each asked to assign 100 points amongst the eight decision criteria. The scores of participants were then collated and an average

weighting calculated. This average weighting was reported back to the workshop participants to identify any discrepancies. The final agreed weightings are reported in Table 6.

Table 6; Decision criteria and weights for setting priorities of SPS capacity-building options

Objectives	Decision Criteria	Minimum	Maximum	Mean
Costs	Up-front investment	0	31	0.13
	On-going costs	0	29	0.10
Trade impacts	Change in absolute value of exports	0	43	0.14
Direct agri-food impacts	Change in agricultural productivity	0	66	0.21
	Change in domestic public health	0	31	0.14
	Change in local environmental protection	0	31	0.10
Social impacts	Poverty impact	0	31	0.10
	Impact on vulnerable groups	0	14	0.08

Stage 4: Construction of information cards

Having identified the choice set of SPS capacity-building options and the decision criteria and weights to be applied in the priority-setting exercise, this information was assembled into a series of information cards. The aim of these cards is not only to ensure consistency in the measurement of each decision criterion across the capacity-building options, but also to make the priority-setting exercise more transparent and open to scrutiny.

First, the specific nature of each of the SPS capacity-building options was described in some detail on the basis of existing documentation, consultation with stakeholders, etc. Descriptions of each of the 11 capacity-building options are provided in Section 4 below.

The metrics to be employed for each of the eight decision criteria were then defined, taking account of currently available data and the range of plausible ways in which each of the criteria might be represented. Table 7 sets out the final metrics. Note that the choice of metrics involves a sometimes difficult compromise between the availability and quality of data, and the imperative to employ continuous quantitative measures. However, it is important to recognise that the aim of the framework is not to provide a final and definitive prioritisation of the capacity-building options. Rather, the priorities that are derived should be revisited on an ongoing basis and revised as more and/or better data for the decision criteria become available. Information cards for each of the 11 SPS capacity-building options were then compiled. These are reported in Appendix 4. Each card presents data for the eight decision criteria, measured according to the scales outlined in Table 7. For each criterion, details are provided of how measures for each of the decision criteria were derived. There is also an indicator of the level of confidence in the measure reported. Where there is a lack of underlying data and/or these data are of dubious quality, a low or medium level of confidence is indicated. Conversely, where fairly rigorous and comprehensive prior research is available, a high level of confidence is reported. These confidence measures need to be considered in interpreting the results of the prioritisation exercise, and in considering how the analysis might be refined in the future.

Table 7; Decision criteria metrics

Decision Criterion	Details	Measure
Cost		
Up-front investment	Monetary costs of investments to upgrade SPS capacity	Monetary amount ($)
On-going cost	Direct costs of maintaining and operating the upgraded SPS capacity	% of export value in 2015
Trade impacts		
Change in absolute value of exports	Predicted enhancement of exports in 2015 or avoided loss of exports in 2015	Monetary amount ($)
Domestic agri-food or impacts		
Change in agricultural/fisheries productivity	Changes in productivity of agricultural or fisheries production of commodities to export and/or domestic markets	Major reduction (-2) to Major improvement (+2)
Change in domestic public health	Changes in domestic public health, through food safety, occupational exposure to hazards, etc.	Major reduction (-2) to Major improvement (+2)
Change in local environmental protection	Changes in protection of natural environment	Major reduction (-2) to Major improvement (+2)
Social impacts		
Poverty impact	Change in incidence of poverty	Significant negative impact (-2) to significant positive impact (+2)
Impact on vulnerable groups	Impact on each of women, children, vulnerable areas and smallholders/artisanal fishers	Impact on each group measured on scale: Significant negative impact (-2) to significant positive impact (+2). Four individual measures aggregated such that overall measure on scale -8 to +8

Stage 5: Construction of spider diagrams

Through Stages 1 to 4, the inputs to the priority-setting process were collected and then assembled into the series of information cards. The aim of Stage 5 was to present the information in the information cards in a manner that permits easier comparison of the 11 capacity-building options. Thus, a spider diagram was derived that plotted the 11 SPS capacity-building options against the eight decision criteria. Scrutiny of this diagram permits the assessment of which decision criteria against which each of the capacity-building options performs relatively well/badly compared to the other capacity-building options in the choice set.

Stage 6: Derivation of quantitative priorities

The formal priority-setting analysis involves the use of outranking through the D-Sight software package. The mechanics of the analysis are described in some detail in the user guide to the framework.[24] The inputs to the model are the data assembled in the information cards. For most of the decision criteria preferences were modelled using a level function since these were measured using categorical scales. However, the up-front investment, on-going cost and criteria were measured continuously and modelled using linear functions.

Three models were estimated using D-sight:

- *Baseline model* using decision weights derived in Stage 3.
- *Equal weights model* in which all of the decision criteria are weighted equally.
- *Costs and trade impact model* in which *only the cost and trade impact decision criteria are included in the analysis, all of which are equally weighted.*

The baseline model is considered to provide the most reliable set of priorities, in that it uses the full set of information derived through stages 1 to 4. The two subsequent models were estimated to examine the extent to which the derived priorities are sensitive to changes in the decision weights; if the broad ranking of the 11 SPS capacity-building options remains broadly the same under the three scenarios presented by these models, we can be reasonably confident that the results of the framework are robust. The sensitivity of the derived rankings to changes in decision criteria measures for which there are low levels of confidence was also explored, notably by adjusting the expected change in the absolute value of exports from investments in hygiene controls for bivalves and molluscs.[25]

Stage 7: Validation

The final stage of the priority-setting analysis is on-going. The aim of the validation process is to ensure that the results of the priority-setting framework are broadly in accordance with expectations, or that unexpected rankings can be explained through the pattern of data in the information cards. To facilitate this process, the preliminary results were presented to donors in Maputo on Monday 18th April 2011. Subsequently, a draft report was prepared and distributed amongst stakeholders in Mozambique for comments. A final feedback workshop was held in Maputo on January 17 2012. The consultation process did not lead to any substantive revisions to the initial ranking of SPS capacity-building options presented in the draft report.

5. SPS capacity-building options

This section provides a more detailed description and rationale for each of the 11 SPS capacity-building options considered in the priority-setting analysis.

5.1. Pesticide residue testing in Mozambique

Currently Mozambican exporters of agricultural products have pesticide tests conducted outside the country. The aim of establishing this capability in Mozambique is to by-pass this requirement through the establishment of internationally-recognised pesticide residue testing capability in Mozambique. Due to the existence of sub-standard laboratories in terms of hardware and human capacity, Mozambique is currently not able to make scientific assessments of compliance to the pesticide Maximum Residue Levels (MRLs) of export markets. Although there are a few accredited laboratories in the region, particularly in South Africa, there is limited sharing of these resources within and between countries. While the agricultural trade arena is getting increasingly complex and highly technical, there continues to be limited investment in human or other resource capacity for determining pesticide levels in food in Mozambique.

There are pros and cons of investments in pesticide residue testing capacity in Mozambique. Clearly, credible controls must be in place for exporters to ensure compliance with destination market MRLs, including those of private buyers. Mozambique's principle markets are currently South Africa and the Middle East where standards are relatively easy to meet; generally the agro-chemicals used for export crops in Mozambique are registered in the importing countries or no limits are set. However, there is great interest in accessing EU markets where far stricter limits, and associated testing requirements, are applied. At the same time, however, the main mechanism for the control of pesticide residues as required by EU buyers is the application of certified Good Agricultural Practices (such as GlobalGAP). The implementation of GAP is generally backed-up by the testing of crops on the basis of risk assessment rather than on a consignment basis. This means that relatively few samples require testing, which most exporters can obtain through laboratories in the destination market. At the same time, the very limited use of pesticides in Mozambique suggests that the risk of violating export market and/or buyer MRL's is low.

5.2. Mycotoxin testing of groundnuts

Mycotoxins have emerged as a major problem impacting exports of groundnuts from Mozambique.[26] Tackling the aflatoxin problem, not only in groundnuts but in other commodities destined for export and local markets, requires a two-pronged approach. First, mycotoxin controls need to be implemented along the value chain, and notably in production and post-harvest handling (see below). Second, facilities are needed to enable the testing of consignments prior to export and also to monitor the impact of the aforementioned controls on the exposure to mycotoxins within the domestic population.

Currently, exporters cannot obtain certified tests of export consignments of groundnuts or maize for mycotoxin residues inside Mozambique. Whilst laboratories inside the country can conduct semi-quantitative tests for aflatoxin (although not mycotoxins more generally) residues prior to shipment, they cannot provide internationally-recognised quantitative results at the consignment level. Thus,

exporters run the risk that local test results are inaccurate and/or that aflatoxin levels increase during transit, leading to rejection of the consignment.

Although there are a few accredited laboratories in the region, particularly in South Africa, there is limited sharing of and access to such resources within and between countries. While the agricultural trade arena is getting increasingly complex and highly technical, there continues to be limited investment in human or other resource capacity for determining mycotoxin levels in food in Mozambique.

This option would fund the establishment of internationally-recognised quantitative testing capacity for mycotoxin residues in Mozambique. Credible controls and testing must be in place for exporters to ensure compliance with destination market standards, notably those of the EU. At the current time, consignments are retested in Europe and this cost would be avoided if internationally-recognised testing capacity existed in Mozambique. At the same time, there are serious domestic public health considerations relating to the presence of dietary mycotoxins. The establishment of laboratory testing capacity in Mozambique is necessary in order to ensure monitoring and assessment of the levels and occurrence of these contaminants in the local diet.

5.3. Mycotoxin controls for groundnuts and maize

This option would explore the field application of atoxigenic strains of *Aspergillus flavus* to maize and groundnut crops to reduce aflatoxin levels. The atoxigenic strains would be developed from local land races similar to those developed by the International Institute of Tropical Agriculture (IITA) in Nigeria. Studies have shown, not only a reduction in aflatoxin concentration in crops through use, but also that these strains can displace toxin producing strains in the soil. The long term effect is a sustained reduction of aflatoxins in affected crops by between 90 and 99 per cent through use of this technology alone.

Whilst having the ability to test groundnut and maize exports prior to exportation will help ensure consignments are not dispatched that have a high likelihood of rejection at the EU border, this does little to achieve compliance in the first place. Further, prior efforts to control levels of mycotoxins through improved post-harvest handling have been of limited effectiveness. Thus, this option aims to enhance the ability of smallholder to meet export market mycotoxin (and especially of aflatoxins) limits through the use of a low cost bio-control approach.

Application of the atoxigenic strain will also benefit maize and cassava crops grown in the same or nearby fields, with benefits in terms of their own and local consumer dietary intake of mycotoxins. The death rate from liver cancer, hepatocellular carcinoma (HCC), in Mozambique is estimated to exceed 93.3 per 100,000 of the population annually. The rate in countries with a similar climate but good mycotoxin management systems, for example South Africa and Brazil, is less than 10 per cent of this rate. It is estimated that the use of the atoxigenic strain could result in a significant decline in the HCC rate in Mozambique.

5.4. Enhanced hygiene controls for crustaceans

Mozambique has well-established exports of crustaceans (mainly prawns), predominantly to the EU. Over time, hygiene controls have been upgraded along the value chain, and especially in processing facilities. In parallel, public oversight of the sector has been enhanced, and the establishment of a recognised Competent Authority. Thus, responsibilities for the fish sector were taken from the Ministry of Agriculture and Fisheries in 2000 through the creation of the Ministry of Fisheries (*Ministério das Pescas*). At the same time, the semi-autonomous National Institute of Inspection of Fish (*Instituto Nacional de Investigação Pesqueira*) (INIP) was created. The INIP is the Competent Authority responsible for hygiene controls for fish and fishery product exports to the EU. This process has received considerable donor support.

Whilst the European Commission has recognised the significant improvements to hygiene controls for crustaceans in Mozambique, its inspection visit in November 2007 found that a monitoring programme for environmental contaminants (notably heavy metals, polycyclic hydrocarbons and dioxins) had not been fully implemented.[27] Critical here is the lack of accredited laboratories to undertake the related tests. Although there are well-equipped laboratories, these lack the functional control systems necessary to apply for accreditation according to ISO/IEC 17025:2005, in particular for the testing of heavy metals. There are also remaining issues with hygiene controls on fishing boats and at landing sites.

Whilst there is no immediate threat to EU market access, the concern is that failure to address these discrepancies could cause problems in the future, most probably in the form of additional requirements and/or EU border inspections. The impact on the competiveness of crustacean exports from Mozambique could be considerable, with the possibility of eroding its entire market position in European markets and requiring exports to be diverted to lower-value markets such as China.

5.5. Hygiene controls for bivalves/molluscs

Although exports are currently quite limited, there is the expectation that these could increase significantly if higher-value EU markets could be accessed. Whilst many of the necessary controls are in place as required to export prawns to the EU, for example a Competent Authority and HACCP-based hygiene controls in fish processing, there are additional requirements in the case of bivalve molluscs.

Under Regulation (EC) 853/2004, bivalve molluscs are defined as filter feeding lamellibranch molluscs. Requirements are laid down for production areas, harvesting, transportation, relaying and purification, since these species are either filter feeders or feed exclusively on filter feeders and are susceptible to the accumulation of toxins or bacteriological contaminants from the environment.[28] Therefore, these species can only be commercially harvested from approved production areas, which are monitored to ensure they meet specified toxin and microbiological criteria.[29]

In order to meet obtain approval for the export of bivalve molluscs to the EU, a series of reforms and investments are needed:

- Legislative framework for the classification and monitoring of production areas and laying down additional requirements for the processing sector (which has already been drafted).

- Implementation of a monitoring programme covering bivalve mollusc production areas.
- Upgrading of laboratory facilities to install sample preparation areas and new testing.
- Installation of holding tanks in fish processing facilities.

Currently, one firm exports bivalve molluscs, to Japan, Hong Kong and China, under special provisions that by-pass the lack of a legal framework for the control of exports. Such provisions do not enable this firm to export to the EU.

5.6. Determine pest status of bananas with respect to *Bactrocera invadens*

The invasive fruit fly *Bactrocera invadens* has presented challenges for Mozambique's exports of a range of fresh fruit, including bananas and mango (see below)[30]. In the case of bananas, there is currently considerable controversy over the pest status of *B. invadens*. There is a very limited literature on this subject[31], such that the true status of bananas has not been scientifically established. Although the costs of such an investigation are quite limited at $75,000 (Table 8), this is considered to be beyond the resources available to the government of Mozambique.

A particular problem in Mozambique is the prominence of large-scale banana production in Nampula province. Production here is severely constrained by the inability to move banana fruit southward because of the confirmed presence of *B. invadens* in the provinces of Nampula, Zambezia, Niassa and Cabo Delgado, as well as more recently in Manica and Sofala. In effect, the country is compartmentalized into three zones[32] such that all fruit produced in Zones A and B cannot be moved to Zone C or onwards to export destinations in Zimbabwe and South Africa.

A potential solution to this problem, as applied to Hawaiian bananas destined for the continental USA, involves post-harvest packing and shipping protocols that exclude fruit suitable as a host for fruit flies, namely ripe bananas.[33] Having established the pest status of bananas, this protocol could be developed and implemented.

Table 8; Costs of options for the surveillance, control and mitigation of invasive fruit flies in Mozambique[34]

Costs	Option 6	Option 7	Option 8	Option 9
	Pest Status of Bananas	**Post-harvest Treatment for Mangoes**	**Maintain Pest-Free Status for Bananas**	**Biological Control**
Up-front investment	$75,000	$120,000	$0	$157,085
On-going costs	$0	$0	$100,000	$0

5.7. Post-harvest treatment for mangoes

Mangoes are grown in the areas of Mozambique where *B. invadens* has been detected (Zone B)[35], notably the Dombe area of Manica Province, and as such cannot be exported to South Africa and potentially even the EU. This option would involve the development of a post-harvest treatment facility

based on hot water treatment, high temperature forced air (HTFA) or a similar technology to disinfest the fruit of *B. invadens*. The estimated up-front investment is $120,000 (Table 8).

As well as the installation of the necessary equipment, determination of the most heat tolerant stage of *B. invadens* on mango would need to be undertaken[36]. This is achieved by inoculating mango fruit with *B. invadens* eggs at a constant temperature and waiting for the appropriate time to obtain different life stages. Fruit containing *B. invadens* at these different life stages is immersed in water maintained at 45^{o}C and their survival determined after different exposure times to heat treatment. It is assumed that the basic research for determining the exact treatment conditions using either hot water baths or HTFA will be carried out at no additional cost as part of similar programs in other countries.

5.8. Maintain pest-free status for bananas

The Mozambican National Plant protection Organisation (NPPO) has succeeded in confining *B. invadens* to the area north of the Save River and has declared the area south of the Save River to be free of the pest (Zone C).[37] This option would involve efforts to maintain this status.

As visual signs of infestation (particularly in recently infested fruit) may not be present, visual inspection alone is not considered to be an appropriate risk management option. Thus, South Africa requires that Mozambique comply with the requirements for the establishment of pest-free areas set out in the International Standard for Phytosanitary Measures (ISPM), namely *Requirements for the Establishment of Pest-Free Places of Production and Pest-Free Production Sites* (ISPM No 10, 1999) and/or *Establishment of Pest Free Areas for Fruit Flies* (Tephritidae) (ISPM No 26, 2006). Compliance has to be demonstrated by scientific evidence provided by the NPPO and not by private sector exporters.

The South African Department of Agriculture Fisheries and Food (DAFF) has evaluated the data provided by the NPPO of Mozambique and determined that a number of sites can be accepted as pest-free and from which exports are permitted (namely Zone C).[38] Each year the NPPO must supply DAFF with relevant survey results to keep existing sites on the export list and/or to add new ones. If fruit flies are detected in traps or at pre-export inspections, area freedom has to be suspended and trade immediately suspended pending the outcome of an investigation by DAFF and the NPPO. The objective of these measures is to maintain area/orchard freedom through monitoring and management and to verify that regulated articles for export to South Africa are free from fruit flies through targeted inspection.

Mozambique needs to maintain a system of operational procedures in order to ensure that the phytosanitary status of fresh fruit is maintained and verified during the process of production and export to South Africa. In turn, this ensures that the objectives of the risk mitigation measures described above have been met and are being maintained. The system of operational maintenance for the production and export of plant products from Mozambique to South Africa consists of the following:

- Registration of export orchard.
- Registration of pack-houses and auditing of procedures.
- Pre-export inspection by the NPPO.
- Packaging and labeling compliance.
- Phytosanitary certification by the NPPO.

- Implementation of specific conditions for the storage and movement of fruit.
- On-arrival quarantine inspection by DAFF in South Africa.

The on-going cost to Mozambique of these measures is estimated at $100,000 per year (Table 8).

5.9. Biological control of *B.* invadens

B. invadens is now the dominant fruit fly species in Northern Mozambique (Zone A)[39] with reports indicating that several types of fruit are heavily infested, leading to significant losses. Some of these fruit, including mango, are seasonally important in local diets. This option proposes the upgrading of facilities for the rearing and release of biological control agents for *B. invadens* and ensuring that these are at self-sustaining levels in the region.

The efficacy of the natural enemy (*Fopius arisanus*) introduced from Hawaii has been completed against *B. invadens.*[40] Mozambique is one of three countries in Africa and the only one in southern Africa selected for experimental releases of *F. arisanus*.[41] In 2009, University of Eduardo Mondlane (UEM) was recruited and contracted to assist the Government of Mozambique with preparations for importing *F. arisanus* from ICIPE in Nairobi. Total funds for the project amounted to €73,000 which was spent primarily on monitoring. The calculated needs for successful completion of this activity alone are estimated at US$157,085 (Table 8).[42]

It is important to note that the introduction of these parasitoid species is not without controversy. In particular some have concerns about their potential impact on indigenous fruit fly species which are important pollinators. This has not been properly assessed.

5.10. HACCP controls for cashews

Mozambique was one of the leading cashew nut producers in the 1970s, exporting 240,000 tonnes annually of which only 30,000 tonnes were unprocessed. However, due to the civil war and poor policy support, production of cashews collapsed through the 1980s and by the 1990s exports were negligible. More recently, production of cashews has recovered somewhat, with considerable donor support from the United States agency for International Development (USAID) and Swiss Aid (SECO). Indeed, cashew exports were valued at almost $30 million in 2009. Until recently, however, most of these exports were as unprocessed nuts, predominantly to India. Whilst efforts have been made, with some success, to establishing a cashew processing sector in Mozambique most facilities have not implemented certified HACCP-based systems of control, which has limited their access to markets for processed (shelled) cashews, most notably in the EU.[43] Indeed, higher-value markets are increasingly requiring HACCP certification as a minimum entry requirement for shelled cashews.[44]

The Mozambique cashew nut processing industry is currently pursuing a HACCP accreditation programme together with additional support (in the form of a pre-requisite programme) for the necessary capital investments. This has attracted considerable donor support, although questions have been raised about the amount of progress made given the level of resources invested by donors.[45] The estimated up-front investment is $168,000 with little or no on-going costs.

5.11. Controls on Black Spot for citrus

Citrus Black Spot (*Guignardia citricarpa* Kiely) (CBS) is a leaf-spotting and fruit-blemishing disease that affects most commercially-grown citrus species and cultivars. In 1997, the presence of CBS in Southern Africa became an issue for citrus growers targeting EU markets when the European Commission issued a notification listing Third Countries and areas recognised as being CBS-free and that are approved to export to the EU.[46]

Citrus can be exported to the EU under either of the following conditions:

- The fruit originates in an area recognised as being free from *Guignardia citricarpa* Kiely.
- The fruits originate in a field of production subjected to appropriate treatments against *Guignardia citricarpa* Kiely (all strains pathogenic to citrus), and none of the fruits harvested in the field of production has shown, in appropriate official examination, symptoms of this organism.

Currently, Mozambique is not approved to export citrus to the EU. Since CBS is present throughout Mozambique, only the second of these two options is feasible. To obtain approval, the European Commission's FVO would need to undertake an inspection visit to assess the efficacy of CBS controls in Mozambique and specify the controls deemed necessary. It is likely that these controls would be similar to those in the South African province of Mpumalanga and/or Swaziland, which is nearest to Mozambique and does export citrus to the EU.

In South Africa and Swaziland, when production units such as farms, portions of farms or pack houses are registered pre-season for exports to the EU, it is mandatory for growers to comply fully with documented GAP requirements for the control of CBS.[47] Production areas are subject to examination by an official national body. In Southern Africa this is usually the Perishable Products Export Control Board (PPECB), a parastatal organisation which operates in some neighbouring states. In South Africa, the Animal and Plant Inspection Service (APIS) represents the NPPO directly and inspects and registers production units for export to the EU.

At the enterprise level, CBS controls require some or all of the following:

- Increased spraying regime required in order to minimise risk of interceptions in sensitive markets.
- Replacement of old trees more likely to be affected by CBS.
- Orchard hygiene in the form of leave litter removal.
- More intensive grading required in pack houses in order to sort out blemished fruit.

In turn, the margins of exporters tend to be reduced as a result of fruit having to be diverted onto other markets, and/or increased production and pack house costs. The exporter also has to cover the costs of inspection.

Table 9 provides an overview of measures put in place along the citrus value chain in South Africa and Swaziland in order to minimise CBS- related risks, including interceptions post-harvest or the spread of the disease. The on-going cost of maintaining these measures in Mozambique, based on cost estimates for South Africa, is estimated at US$1, 261,400 per annum.

6. Results

The descriptions presented above, and the results of the stakeholder workshop, suggest all 11 of these options are credible options for SPS capacity-building. However, the associated costs and resulting benefits may differ substantially, such that it is possible to define clear priorities amongst the options on the basis of the defined decision criteria and weights. Below are presented the results of the prioritisation exercise using outranking through the software package D-Sight.

Table 9; CBS-related control measures in citrus value chain

Stage in Value Chain	Activities
Production	Old trees are being replaced. Orchard hygiene, tree pruning (CBS-related) and removal of leaf litter. Spraying: at least one additional spraying is required as a result of the risk of interceptions in sensitive markets. Movement of citrus plants is controlled at provincial level; only registered nurseries can officially sell plants.
Pack house	Grading: sorting out of blemished fruits (CBS-related or otherwise). Inspections by PPECB and APIS. Both Swazi and SA inspectors are present in Swaziland.
Transport	No temperature treatment required.
Port (Southern Africa)	PPECB inspectors. Pre-shipment inspection by Japanese, Korean or USDA/APHIS inspectors.
Port (Export market)	Inspections. If interception then notification by EU Member State NPPO to South African NPPO (i.e. DPH).

To provide a first scan of the relative strengths and weaknesses of the 11 capacity-building options, spider diagrams were constructed (Figures 3 to 10). Because of the relatively large number of options, a separate diagram is presented for each of the eight decision criteria. Although this depiction only permits comparison of the capacity-building options according to the decision criteria on a one-by-one basis, it does enable the key dimensions along which each of the options performs relatively well/badly to be identified. As such, the spider diagrams are a useful way in which to present information on the SPS capacity-building options to more senior decision-makers.

Figures 3 and 4 present the up-front investment and on-going costs profiles of the 11 SPS capacity-building options. It is immediately obvious that mycotoxin controls for groundnuts and maize involves the higher level of up-front investment ($2,700,000), with all other options being $300,000 or lower. Controls for Black Spot in citrus involve on-going costs (6.5% of the annual value of exports) that far exceed all other options, with the nearest option having on-going costs of one per cent (hygiene controls for bivalves and molluscs).

There are dramatic difference in the predicted impact of the capacity-building options on the absolute value of exports (Figure 5); in some cases this reflects an increase in exports (as in the case of determining the pests status of bananas and hygiene controls for bivalves and molluscs) and in others prevention of losses of exports (as in the case of maintaining the pest-free status for bananas and

hygiene controls for crustaceans). For most of the options, the predicted trade effects are quite limited. The exceptions are hygiene controls for crustaceans, with an estimated change in the absolute value of exports of over $30 million and maintaining the pest-free status of bananas with an estimated trade impact of $15 million.

Figure 3; Decision criteria measures scores for SPS capacity-building options – up-front investment

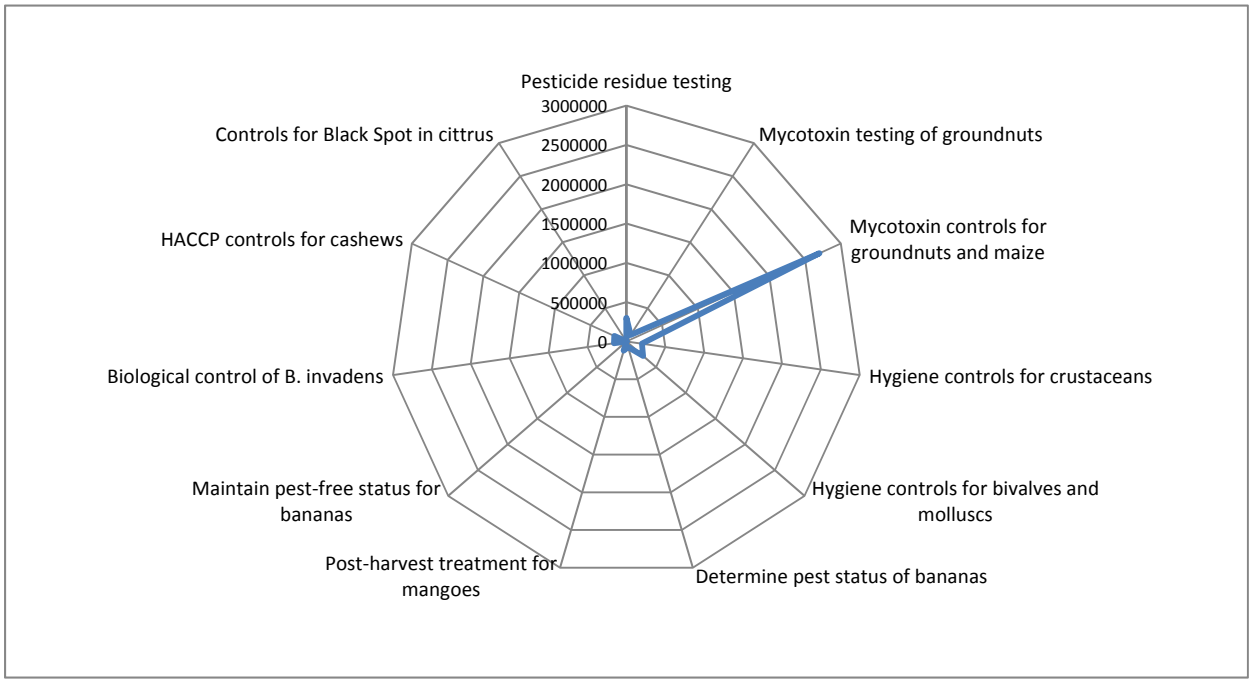


Figure 4; Decision criteria measures scores for SPS capacity-building options – on-going costs

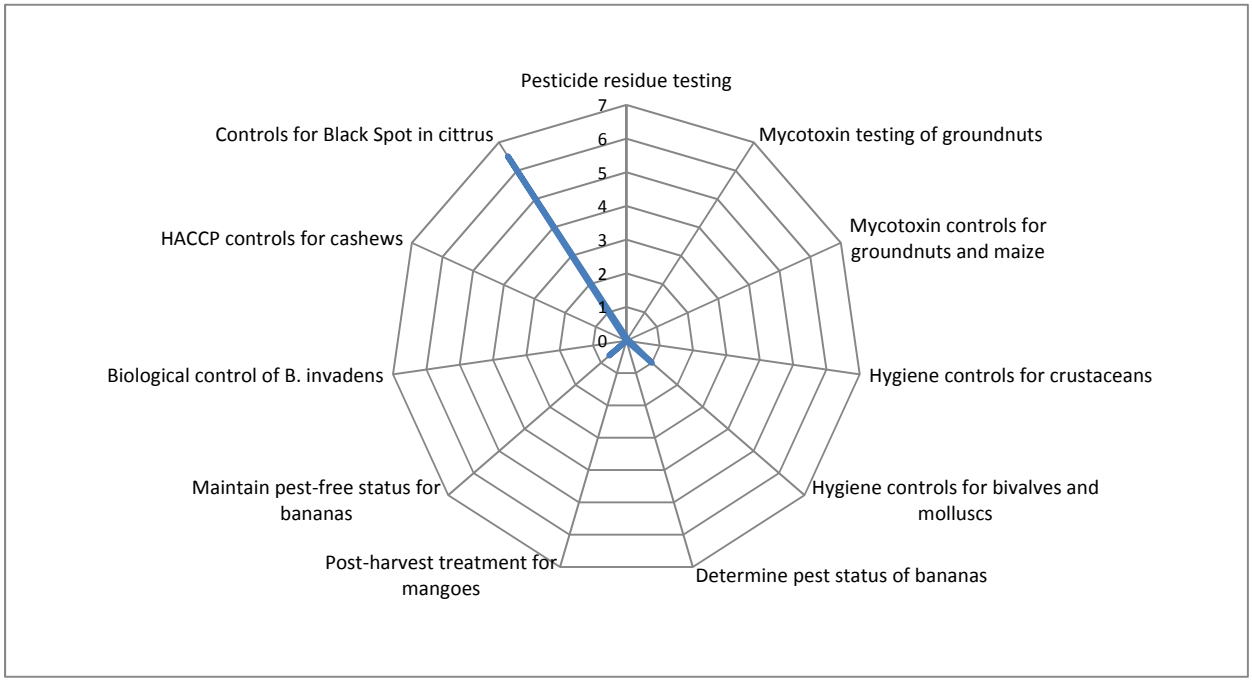
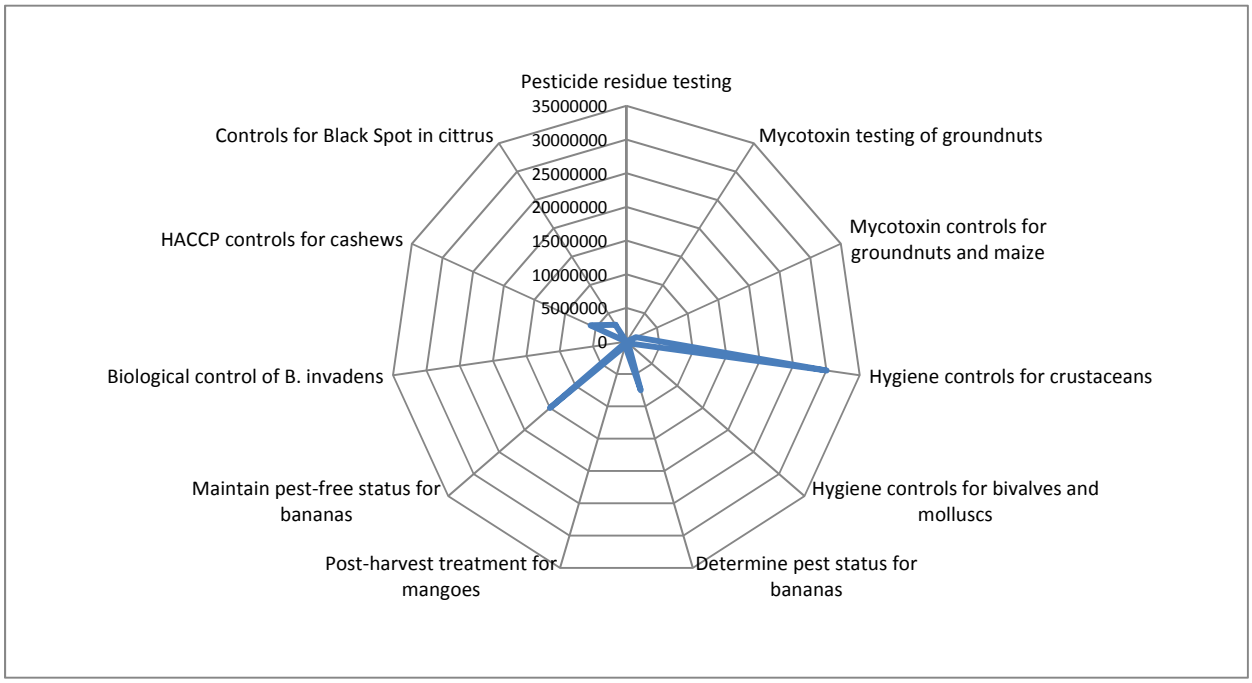


Figure 5; Decision criteria measures scores for SPS capacity-building options – change in absolute value of exports



Figures 6 to 8 present the predicted impact of the SPS capacity-building options on agricultural/fisheries productivity, domestic public health and local environmental protection. Of the 11 options, determining the pest status of bananas, post-harvest treatment of mangoes and biological control of *B. invadens* are expected to bring about a significant increase in agricultural/fisheries productivity. Most of the options have little or no impact on domestic public health, with the exception being mycotoxin controls for groundnuts and maize which is predicted to bring about significant improvements. None of the capacity-building options is predicted to have positive impacts on local environmental protection, but some might have a negative environmental impact, for example enhanced hygiene controls for crustaceans and bivalve's and molluscs, determining the pests status of bananas and controls for Black Spot in citrus.

Finally, Figures 9 and 10 provide the poverty and social vulnerability impact profiles of the capacity-building options under consideration. The options judged to have the greatest impact on poverty are mycotoxin controls for groundnuts, hygiene controls for crustaceans, hygiene controls for bivalves and molluscs and biological controls for *B. invadens*. Only one of the capacity-building options, HACCP controls for cashews, is likely to have an adverse impact on poverty. Two options are predicted to have a significantly positive impact on vulnerable groups, namely mycotoxin controls for groundnuts and maize and biological control of B. *invadens*.

Figure 6; Decision criteria measures scores for SPS capacity-building options – change in agricultural/fisheries productivity

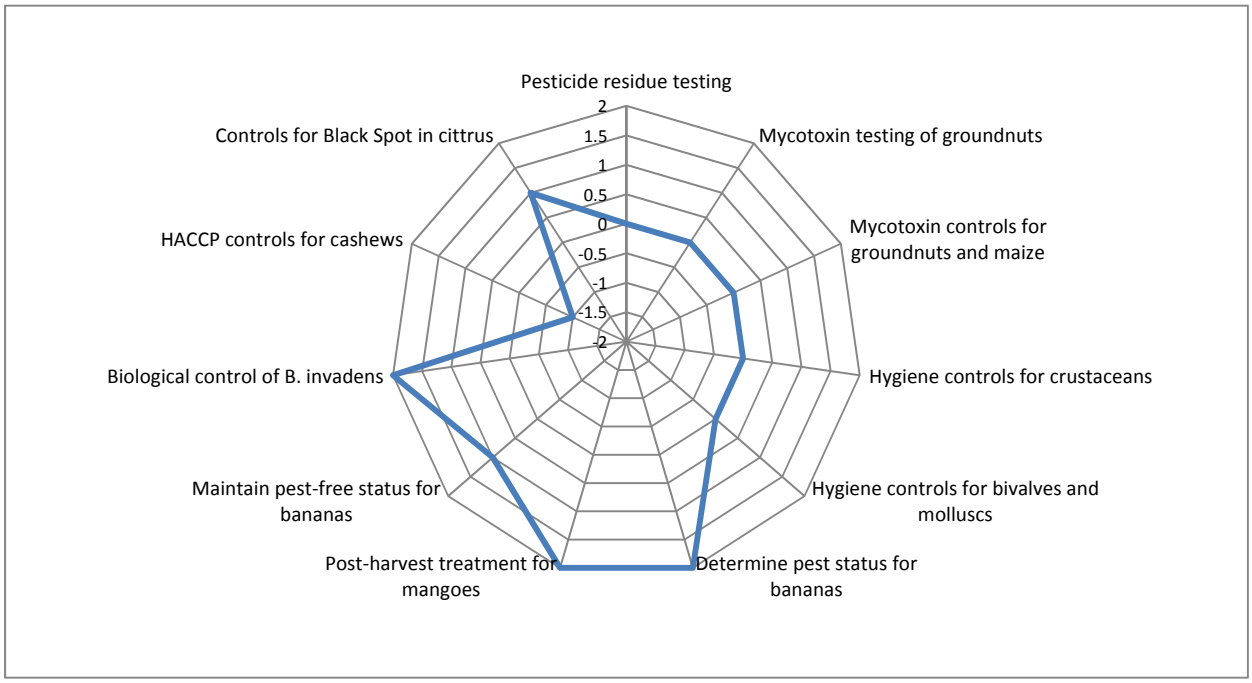


Figure 7; Decision criteria measures scores for SPS capacity-building options – change in domestic public health

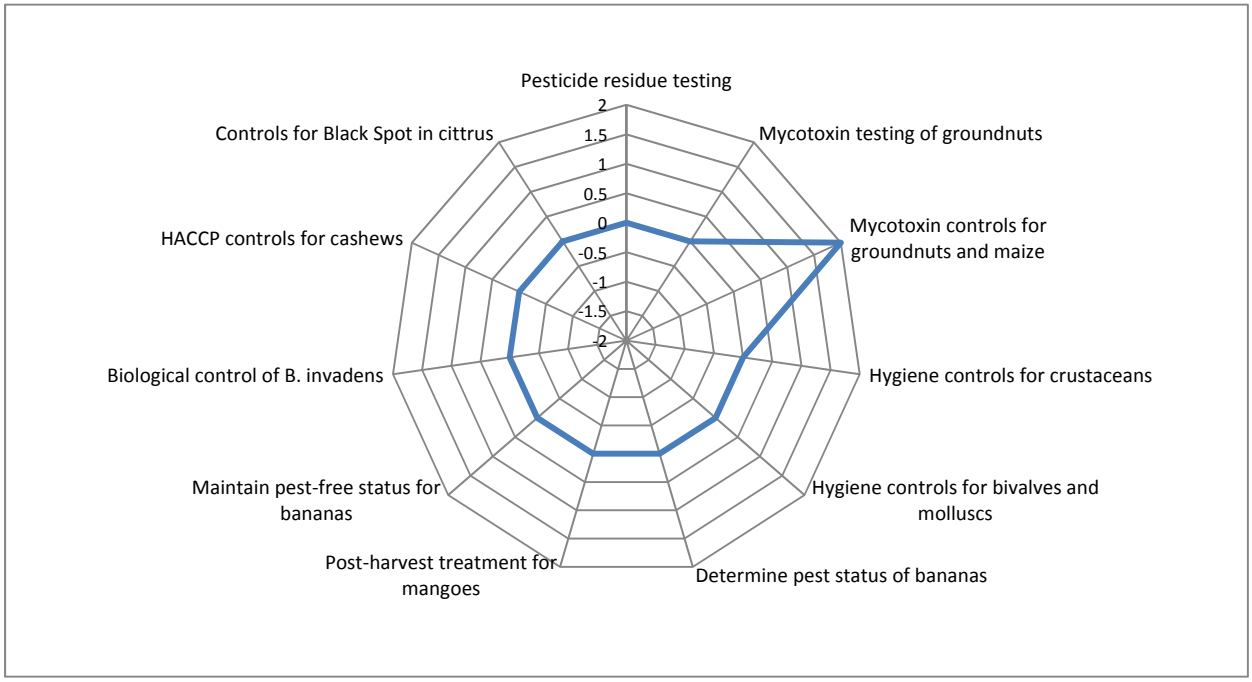


Figure 8; Decision criteria measures scores for SPS capacity-building options – change in local environmental protection

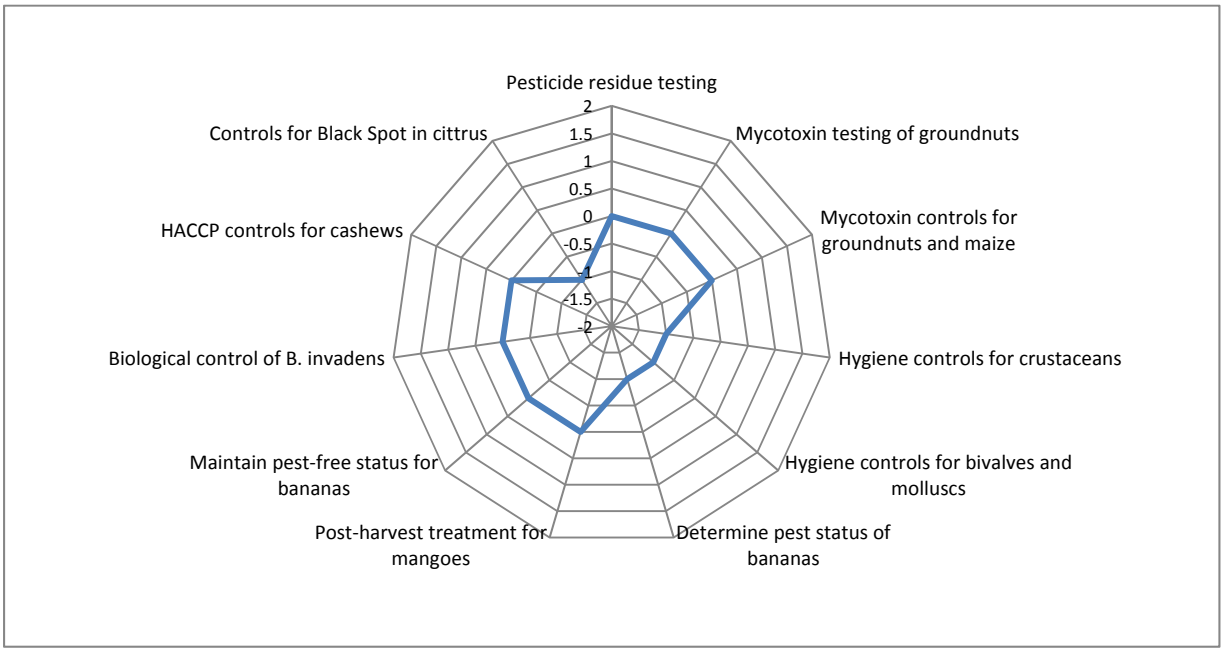
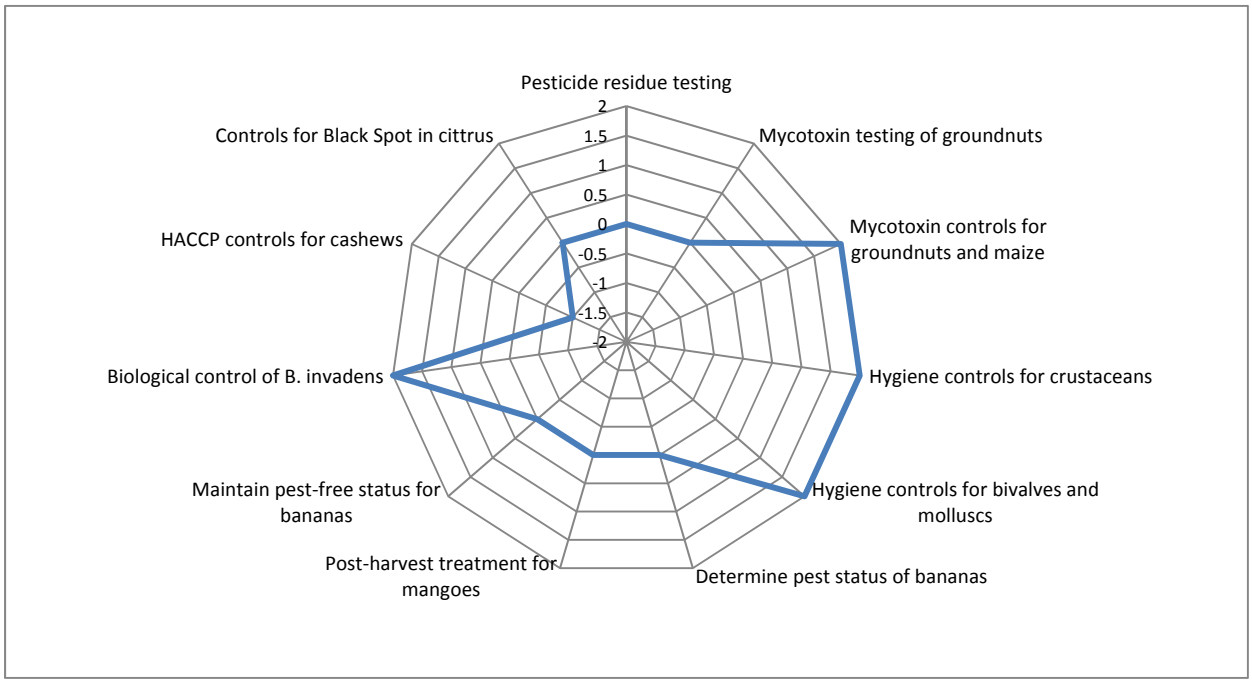


Figure 9; Decision criteria measures scores for SPS capacity-building options – poverty impact



It is apparent that none of the SPS capacity-building options dominates across all or even most of the decision criteria, such that it is not immediately apparent how these options should be prioritised. That is where the outranking analysis comes in; it compares each of the capacity-building options on a pairwise basis with respect to each of the eight decision criteria in turn. Each of these comparisons determines whether one option dominates (or is dominated) by another and by how much. The

aggregate of all of these comparisons, taking account of the defined decision weights, gives an overall measure of preference, what is termed the net flow. Thus, options with a positive and larger (or negative and smaller) net flow are given a higher priority. Options with a positive net flow, dominate the other options with respect to the eight defined decision criteria. Conversely, options with a negative net flow are generally dominated by other capacity-building options.

Figure 10; Decision criteria measures scores for SPS capacity-building options – poverty impact

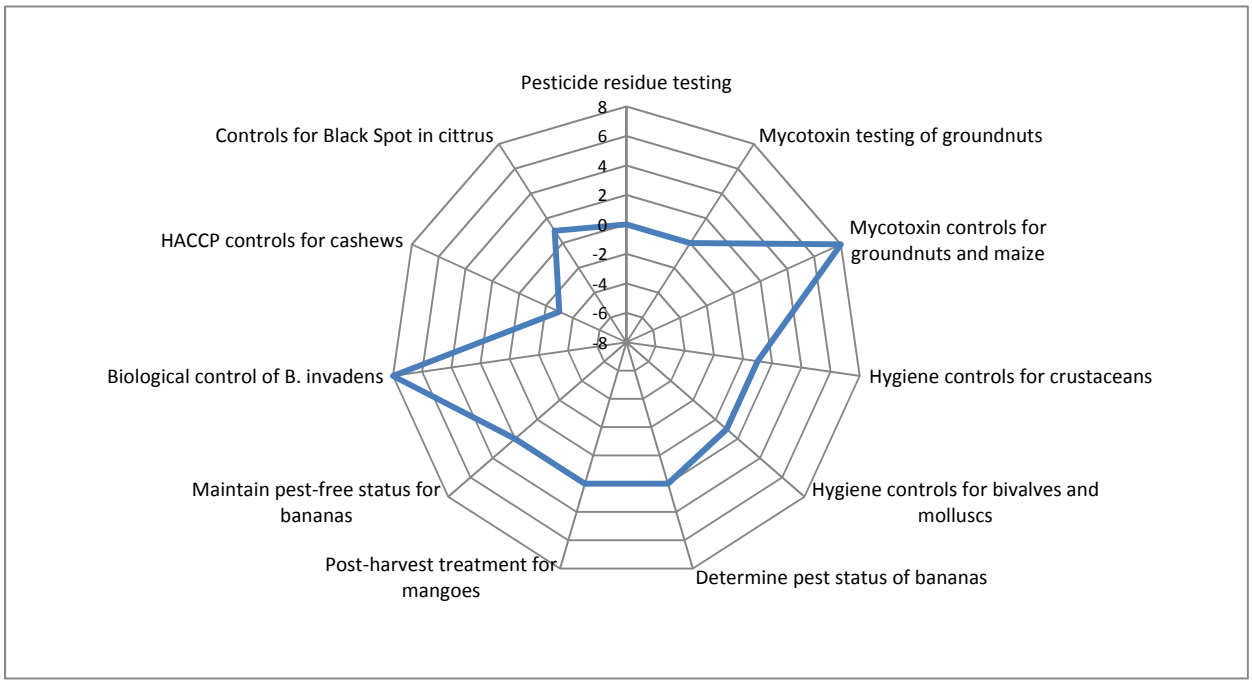
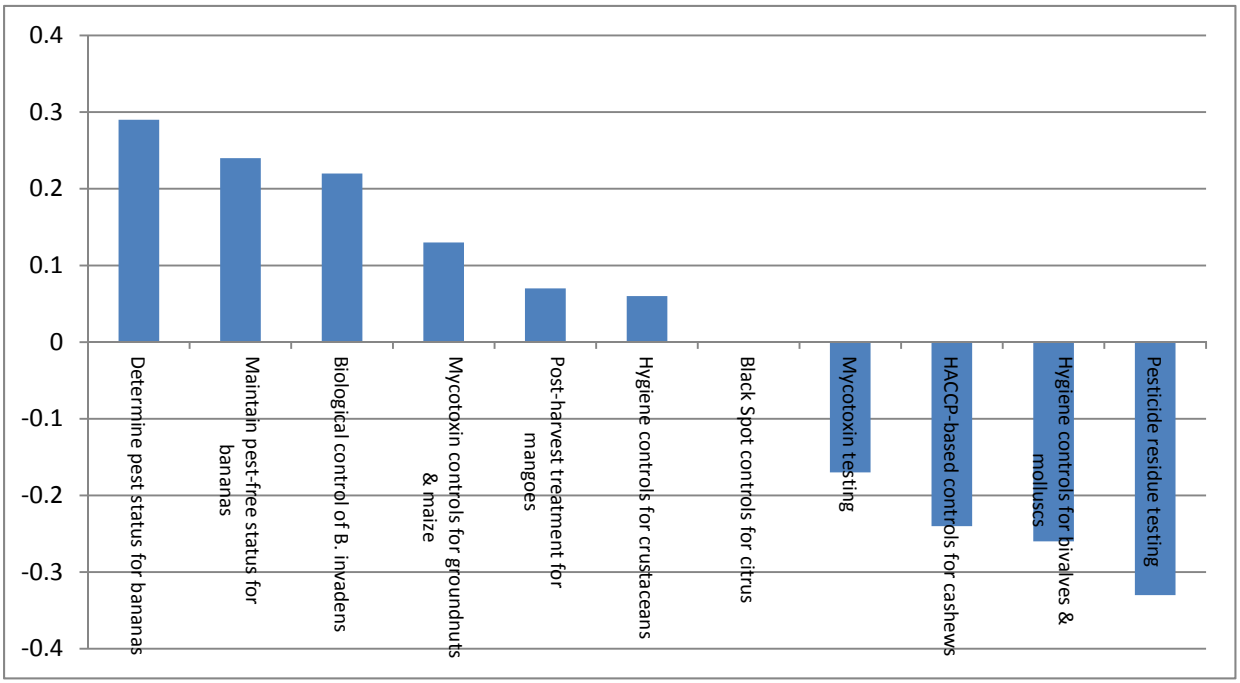


Figure 11 reports the net flows for the 11 SPS capacity-building options for the baseline model; that is the prioritisation derived using the decision weights defined in the stakeholder workshop. The options are prioritised from left to right. Thus, the analysis suggests the top priority options are determine pest status of bananas, maintain pest-free status for bananas, biological control of *B. invadens* and mycotoxin controls for groundnuts and maize. Other options with positive net flows are post-harvest treatment for mangoes and hygiene controls for crustaceans. All other options have negative net flows, indicating that they are dominated overall on the basis of the chosen decision criteria and weights.

The prioritisation of the 11 SPS capacity-building options reflects a trade-off or compromise between the eight decision criteria. As discussed above, none of the options dominates all others with respect to every one of the decision criteria. Thus, in choosing an option that is given a high priority, meaning it generally performs well with respect to the chosen decision criteria, there is an inevitable compromise in terms of under-performance with respect to certain of these criteria, relative to other capacity-building options.

Figure 11; Net flows for baseline model



It is possible to examine the performance of each of the SPS capacity-building options through their scores for each of the eight decision criteria, as reported in Figures 12 to 22. For example, whilst the scores for five of the decision criteria are strongly positive, this option has (weakly) negative scores for change in domestic public health, change in local environmental protection and poverty impact. Conversely, hygiene controls for crustaceans which is ranked sixth in the overall analysis, performs well with respect to the predicted impact on poverty and the change in absolute value of exports (Figure 17), but has negative scores for most other decision criteria. Whilst biological control of *B. invadens* (Figure 14) that is ranked third overall has very strong impacts on poverty and vulnerable groups, it is not predicted to bring about appreciable improvements in export performance.

The foregoing discussions presents the core results of the analysis, and application of the prioritisation framework. Thus, the rankings in Figure 11 are in many ways the key results of the analysis; they represent the recommended priorities between the 11 SPS capacity-building options included in the analysis. It is important to recognise, however, that these results, and the established priorities amongst the capacity-building options, reflect the chosen decision criteria and the respective measures derived for each of the 11 options, and the weights attached to the criteria. This begs the question, how does the ranking of the capacity-building options change if any of these key inputs changes? To answer this question, sensitivity analysis was applied to the baseline model, the results of which are reported below.

Figure 12; Decision criteria scores from baseline model – determine pest status of bananas

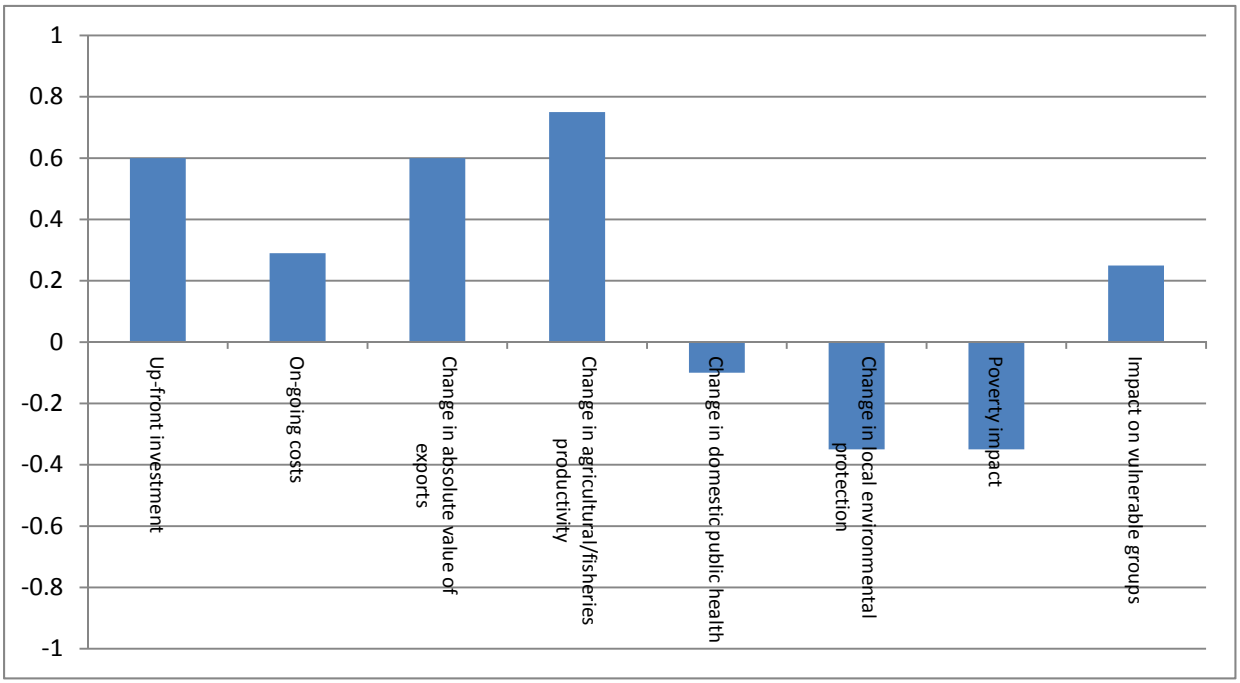


Figure 13; Decision criteria scores from baseline model – maintain pest-free area for banana exports

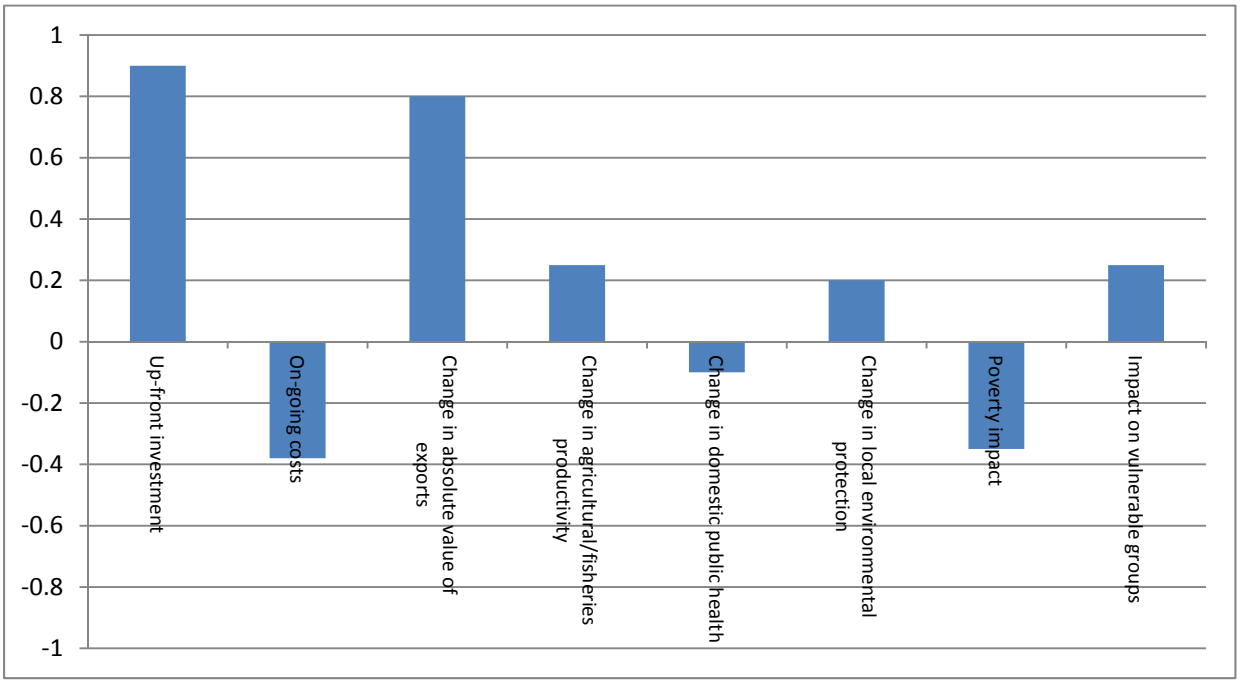


Figure 14; Decision criteria scores from baseline model – biological control of *B. invadens*

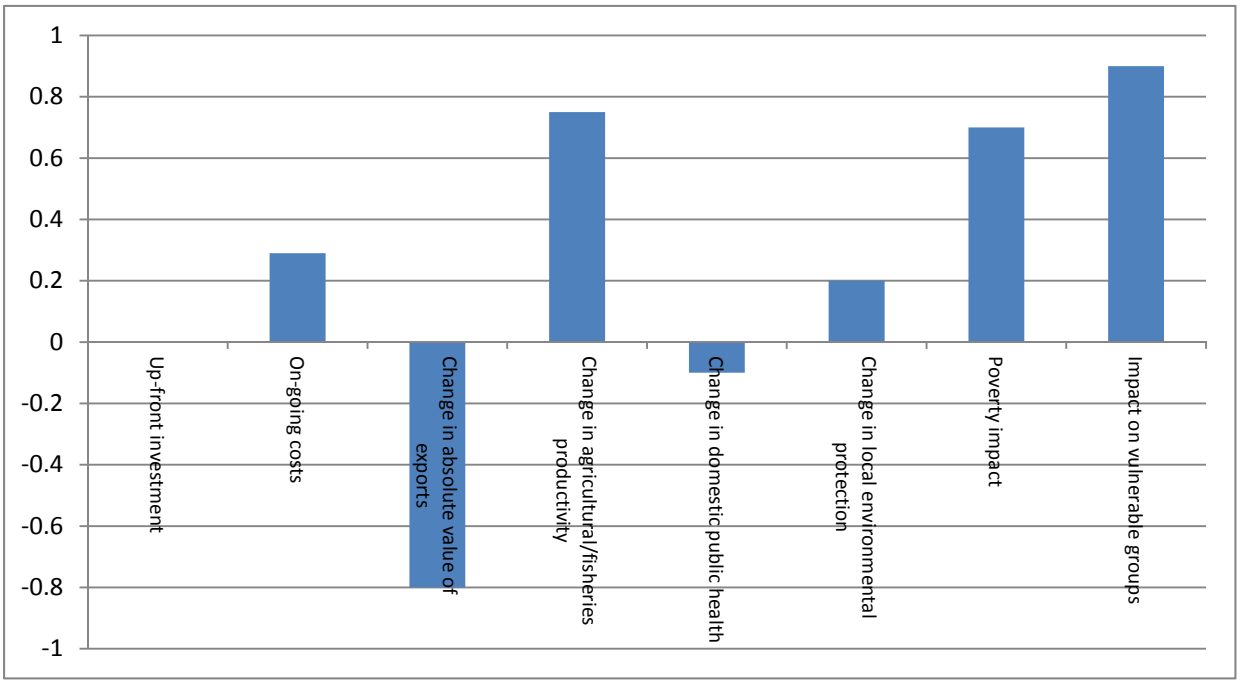


Figure 15; Decision criteria scores from baseline model – mycotoxin controls for groundnuts and maize

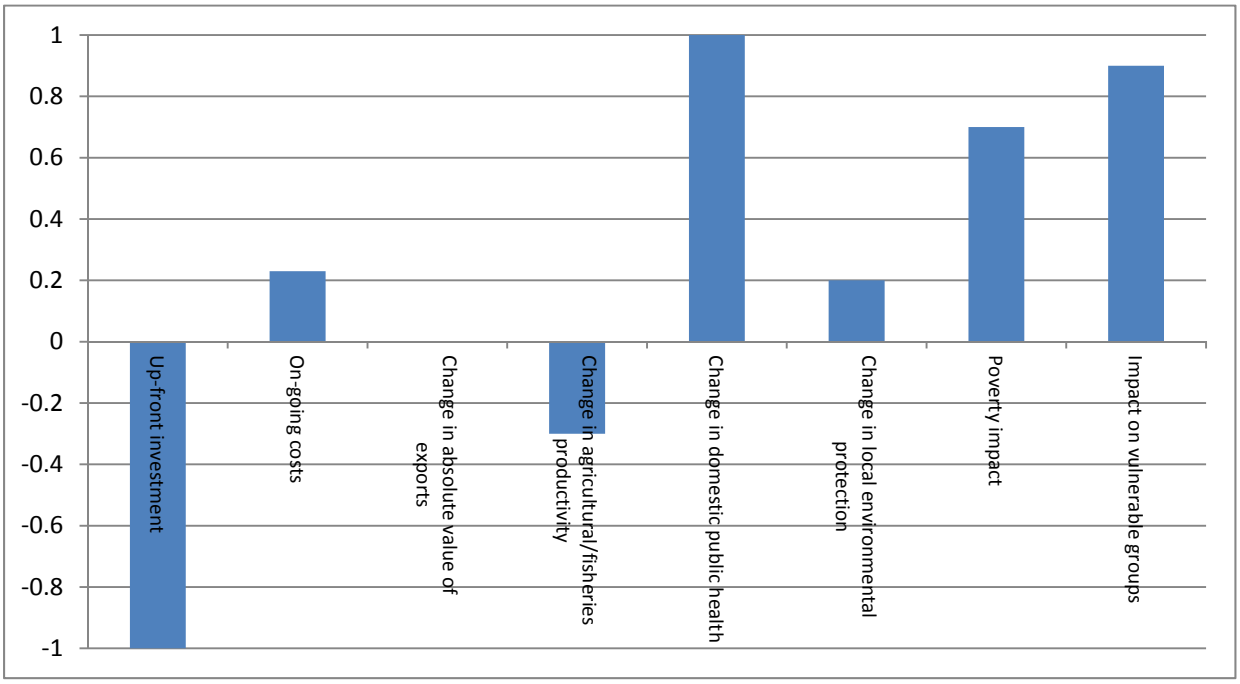


Figure 16; Decision criteria scores from baseline model – post-harvest treatment for mangoes

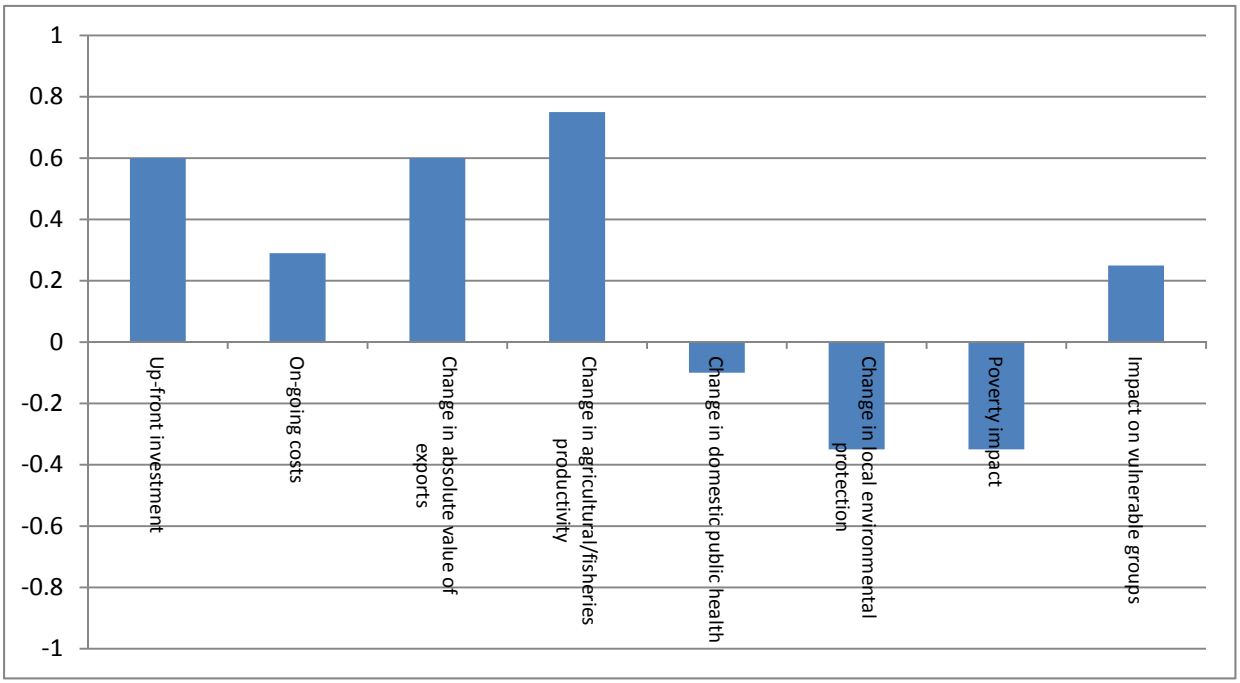


Figure 17; Decision criteria scores from baseline model – hygiene controls for crustaceans

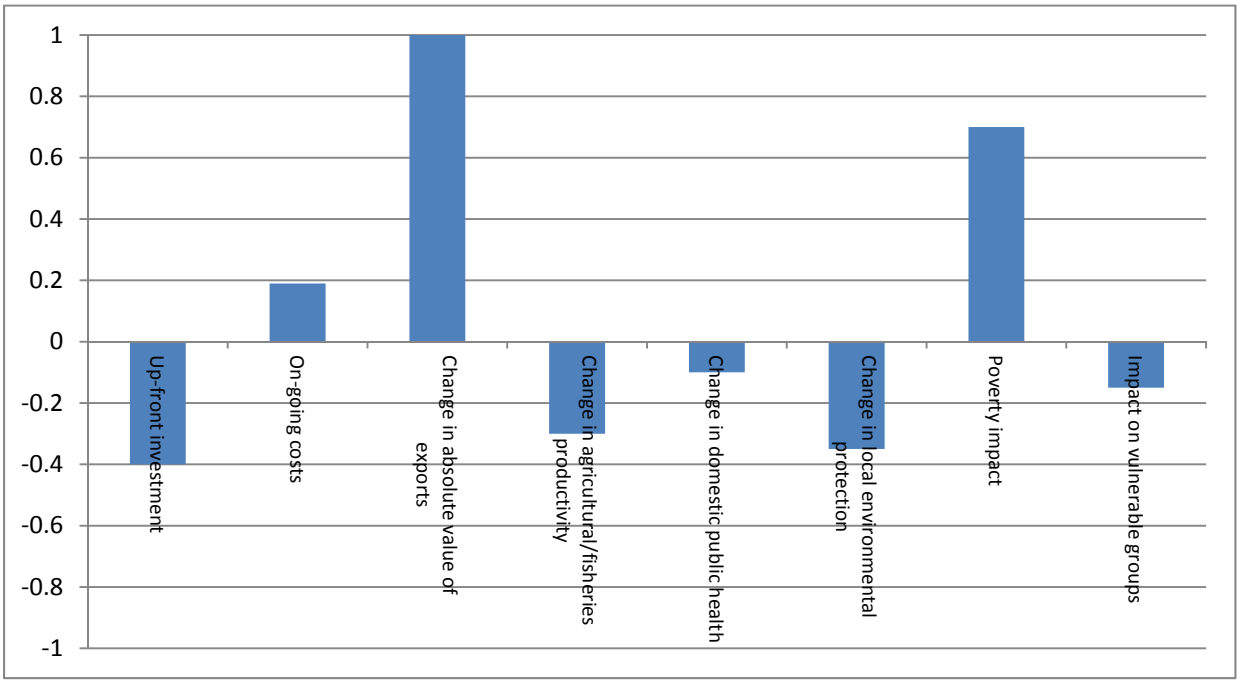


Figure 18; Decision criteria scores from baseline model – Black Spot controls for citrus

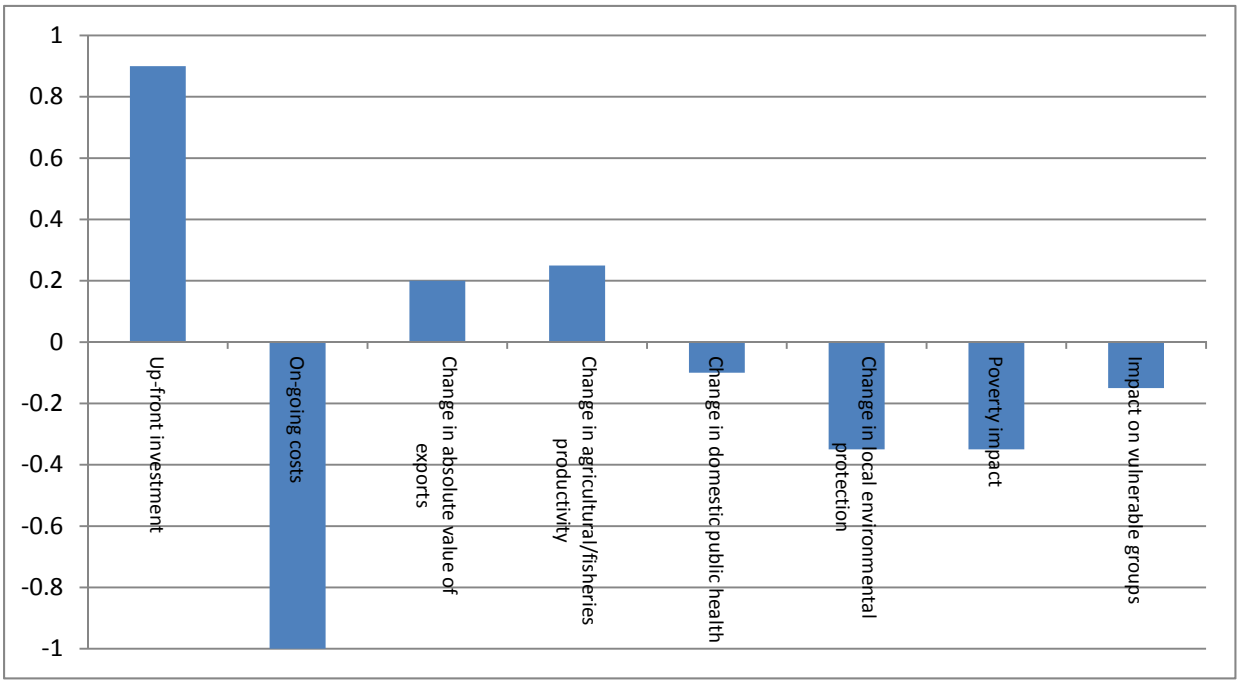


Figure 19; Decision criteria scores from baseline model – mycotoxin testing for groundnuts

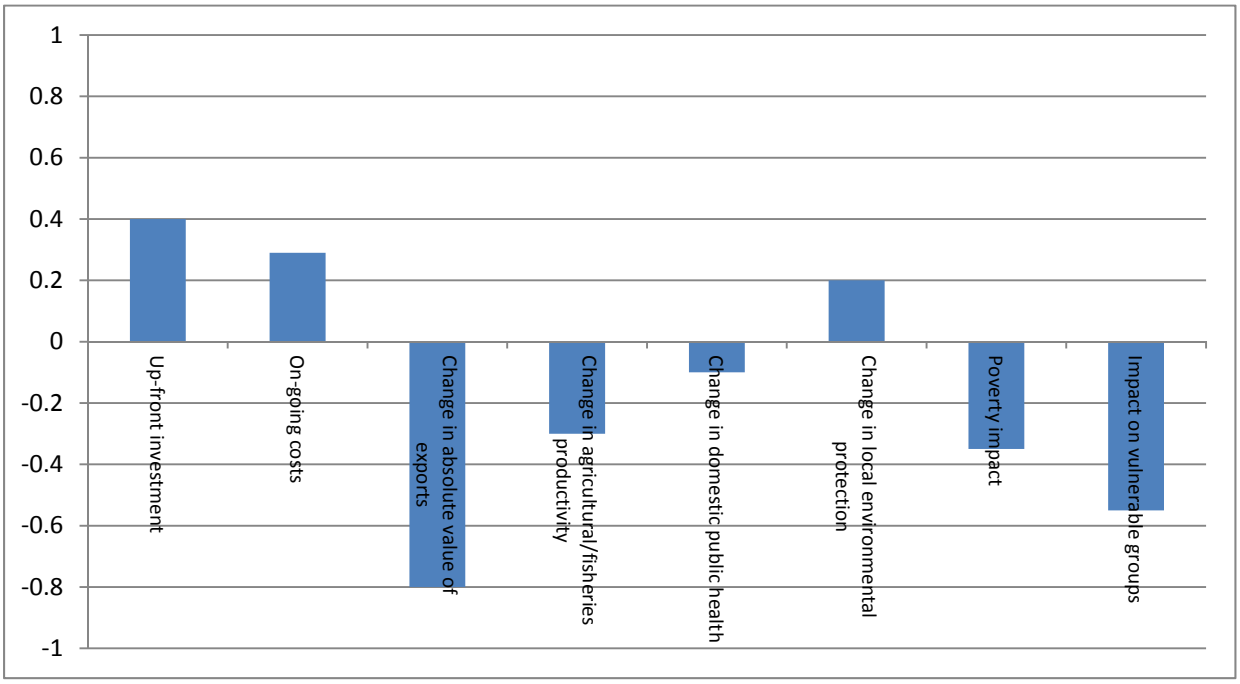


Figure 20; Decision criteria scores from baseline model – HACCP-based controls for cashews

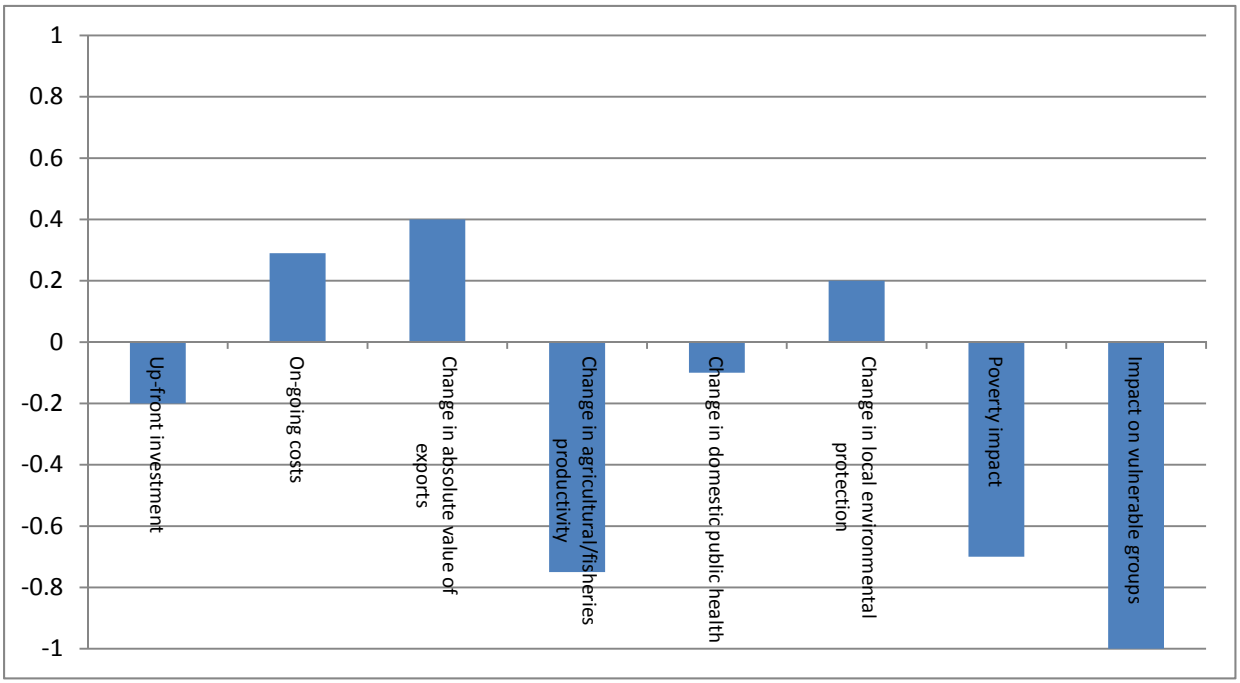


Figure 21; Decision criteria scores from baseline model – hygiene controls for bivalves and molluscs

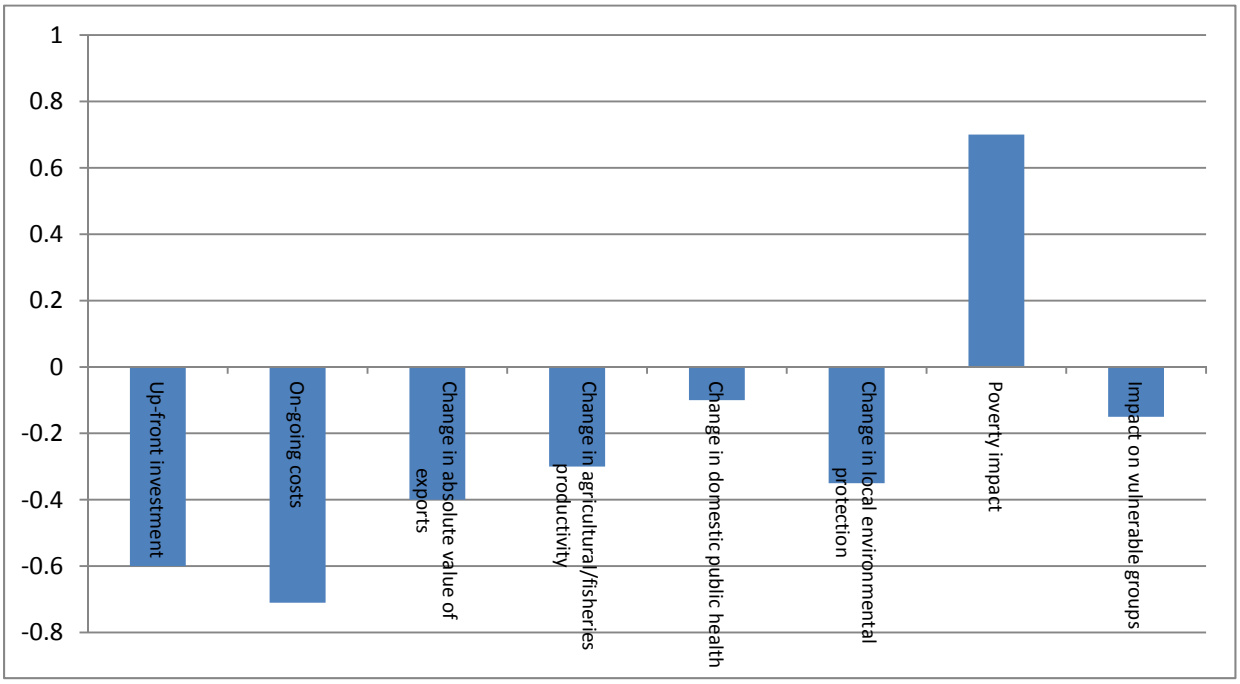
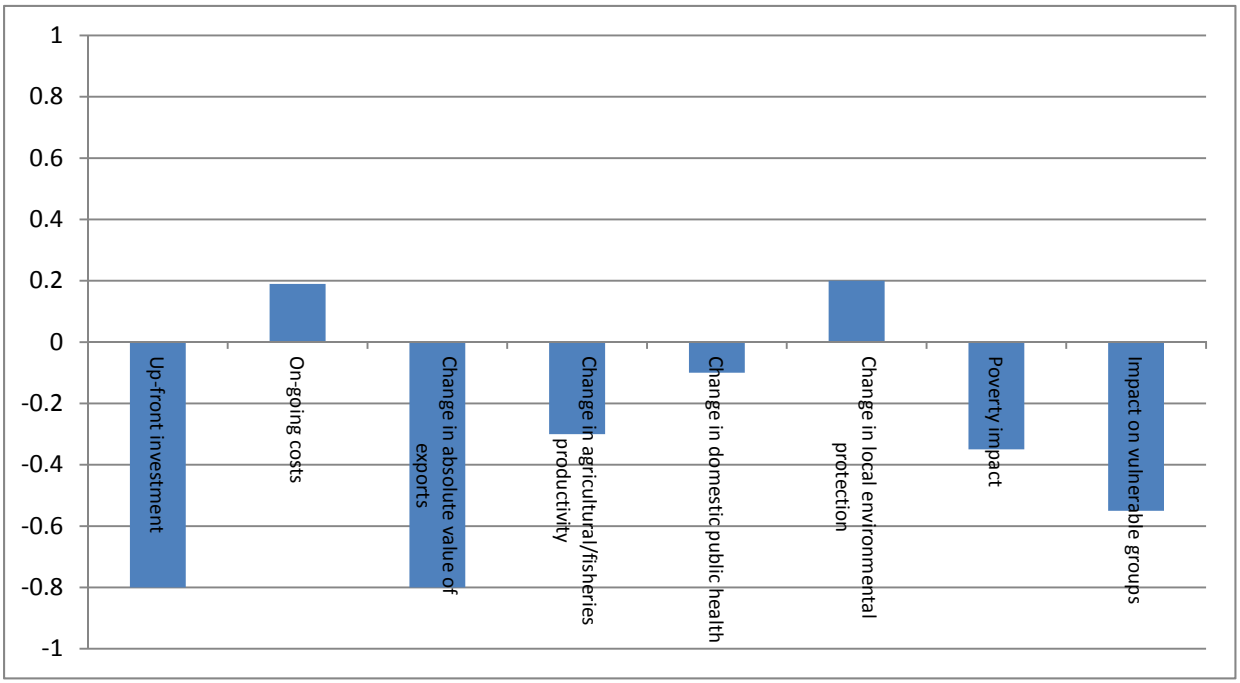


Figure 22; Decision criteria scores from baseline model – pesticide residue testing



To explore the impact of changing the weights attached to the eight decision criteria, an alternative equal weights model was estimated. This model abandons the weights derived in the stakeholder workshop and assumes all criteria are weighted equally. The results of this model (Figure 23) do not differ appreciably from those of the baseline model, in that the same capacity-building options are ranked as the top six priorities. Indeed, the only change in the ordering of options within this group is between maintaining the pest-free status of bananas and biological control of *B. invadens*; in the baseline model biological control of *B. invadens* is ranked third, but second in the equal weights model. Amongst the options with negative net flows, the main difference between the baseline model and equal weights model is that hygiene controls for bivalves and molluscs is ranked higher in the equal weights model (8th as opposed to 10th). These results suggest that the derived priorities are relatively robust to changes in the decision weights.

To further explore the sensitivity of the prioritisation of SPS capacity-building options to changes in the decision weights, a cost and trade only model was estimated; this assumes that the only criteria driving the ranking of options is costs (up-front investment and on-going costs) and the impact on trade (absolute change in value of exports). In this model, all three decision criteria are weighted equally. The prioritisation of options presented by this model is somewhat different (Figure 24). For example, hygiene controls for crustaceans is ranked third and biological controls for *B. invadens* eighth. The chief factor driving this change in the ranking of capacity-building options is the discounting of impacts on agricultural/fisheries productivity. Clearly, if a quite different pattern of decision criteria is applied, a distinct prioritisation of capacity-building options emerges. That being said, even in the cost and trade impact model, maintaining the pest-free status of bananas and determining the pest status of bananas are ranked as the top two options; these two options are ranked highly regardless of the model applied.

Figure 23; Net flows for equal weights model

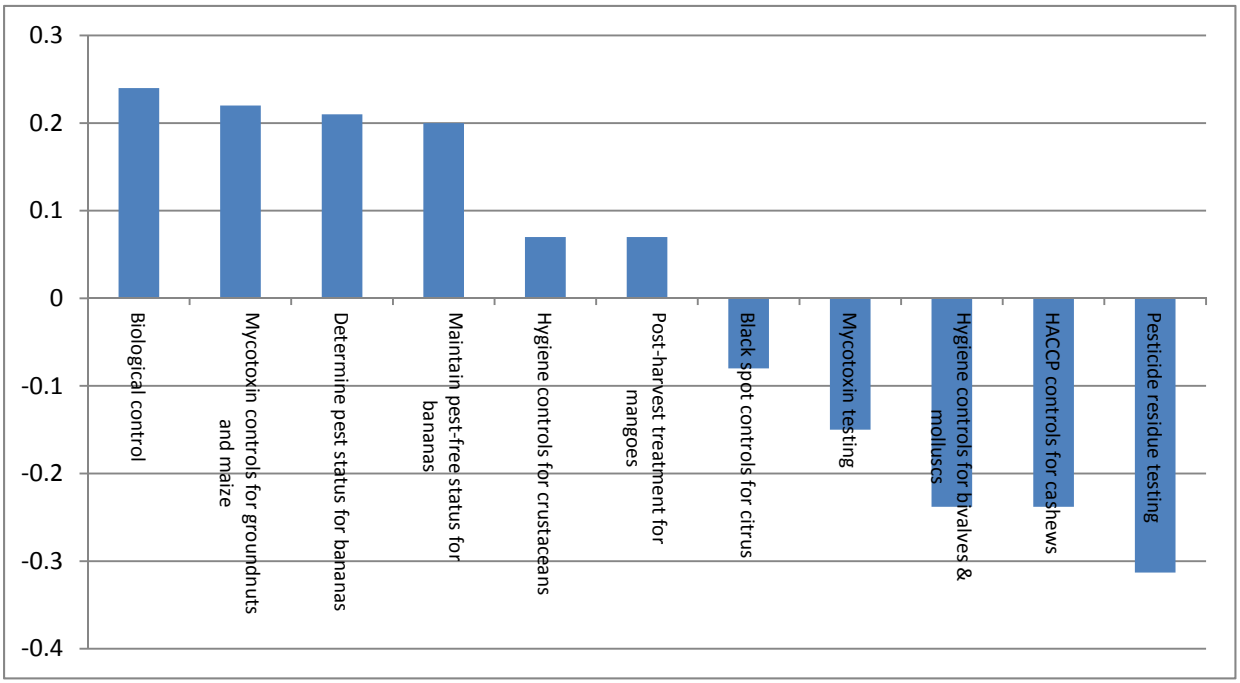
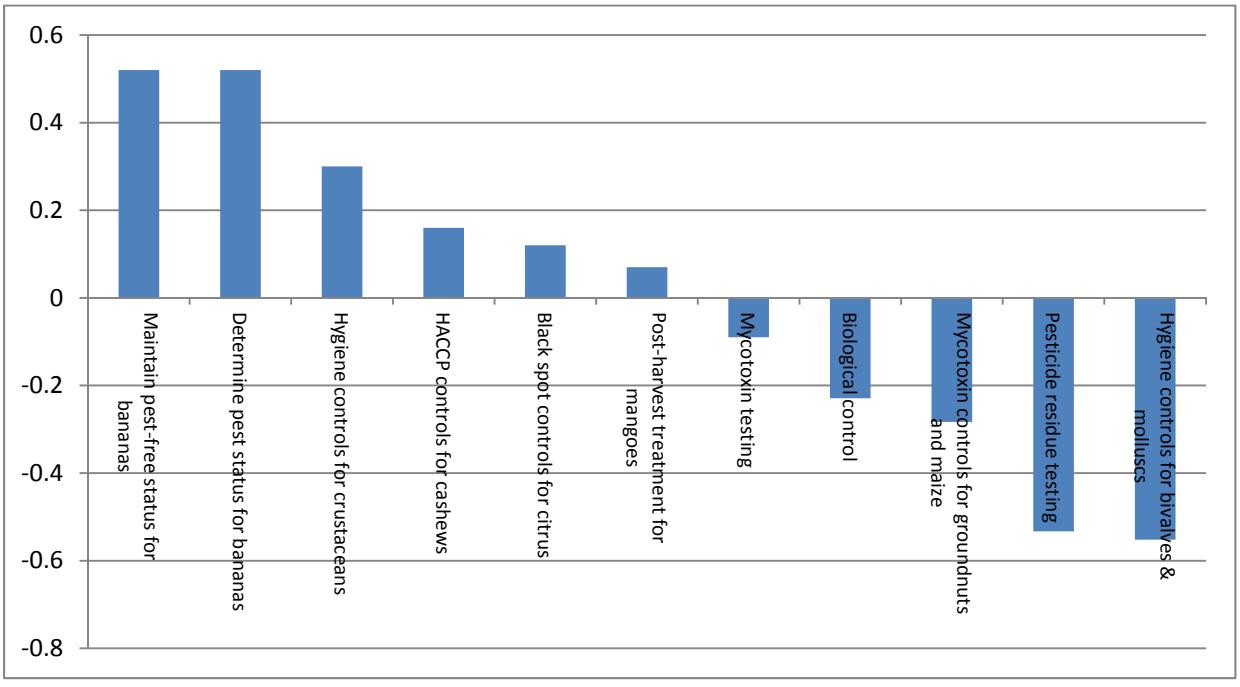


Figure 24; Net flows for cost and trade impact model



Examination of the sensitivity of the prioritisation to changes in measures of the decision criteria is more complex, in that 88 individual measures (8 decision criteria x 11 capacity-building options) enter the analysis and conceivably changes in any one might influence the results. Thus, focus was placed on measures for which there was a low level of confidence and that were considered to be of potential importance to the analysis. In particular, there was little prior knowledge on which to base the

predicted trade impact of hygiene controls for bivalves and molluscs. The profile adopted in the baseline model assumes quite conservative increases in the absolute value of exports. Alternatively, it could be that the value of exports grows significantly should access to EU markets be achieved. To assess the impact of this, a model assuming exports increase by $50 million per annum was estimated; this presumably represents the most optimistic scenario for bivalve and mollusc exports from Mozambique. The results in Figure 25, however, suggest that the results of the baseline model are insensitive to changes in this parameter; hygiene controls for bivalves and molluscs is only ranked eight even assuming exports increase by $50 million per annum. Evidently, this capacity-building option is not given a high priority regardless of the assumptions made.

7. Conclusions

This report has presented the initial results of a priority-setting exercise for SPS capacity-building in Mozambique. The priorities are defined using a new prioritisation framework based on MCDA, which provides a structured and transparent approach to ranking capacity-building options on the basis of predefined and agreed criteria. Thus, the options to be considered are identified through a process of stakeholder consultation that is informed by a review of prior assessments of SPS capacity. In this case, 11 distinct SPS capacity-building options were identified. These options are then prioritised on the basis of a series of decision criteria to which weights are applied, that are again derived by consulting stakeholders. The end result is a clear ranking of the 11 capacity-building options, which appears robust to changes in the weights attached to the decision criteria.

Of 11 capacity-building options identified, the following six are consistently ranked as top priority:

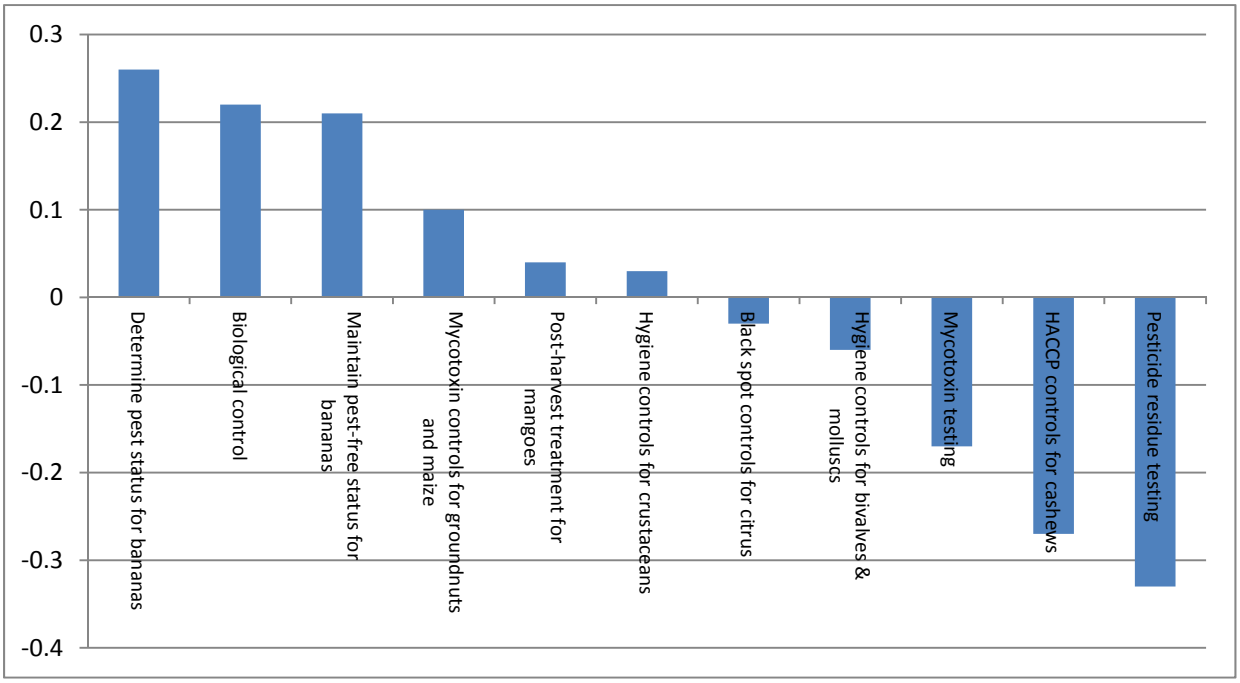
- Determine the pest status of bananas.
- Maintain the pest-free status of bananas.
- Biological control of *B. invadens*.
- Mycotoxin controls for groundnuts and maize
- Post-harvest treatment for mangoes
- Hygiene controls for crustaceans.

This prioritisation is based not only on the respective costs and predicted trade impacts, but also on the basis of impacts on agricultural/fisheries productivity, domestic public health, local environmental protection, poverty and vulnerable groups. Given the robustness of the results, this basic ranking would appear to present a coherent basis on which to start defining a national action plan for SPS capacity-building in Mozambique.

It is important to recognise, however, that the results of the analysis presented above represent just the starting point in the use of the priority-setting framework in the context of SPS capacity-building in Mozambique. Indeed, the results should be revisited and revised on an ongoing basis in the light of improvements in the availability and/or quality of data, changes in policy priorities that imply shifts in the decision weights and/or the introduction of new decision criteria, etc. Further, if new capacity-building needs arise, these can be added to the analysis. Likewise, as investments are made in the options included in the analysis above, these can be excluded and the priorities estimated accordingly.

The intention is that the prioritisation framework will become a routine element of SPS capacity-building planning in countries such as Mozambique.

Figure 25; Net flows for baseline model with enhanced trade impacts of hygiene controls for bivalves and molluscs



It is possible that some stakeholders will be concerned about the priorities presented above. It is important to recognise that the aim of the framework is not to make decisions over investments in SPS capacity-building, but to provide an input into established systems of decision-making. Indeed, the framework aims to facilitate a coherent and transparent debate over priorities between capacity-building options. Thus, if a particular stakeholder is unhappy about the priority given to a particular option, they should be invited to present new evidence (in the form of revised data to support measures of particular decision criteria in the capacity-building option information cards/profiles) and/or to suggest how and why distinct decision criteria or differing decision weights should be employed. Such changes can then be employed and the model re-estimated accordingly.

Further initial applications of the prioritisation framework are planned in coming months. The framework will be revised in the light of the experiences gained during this process. At the same time, the user's guide will be redrafted to ensure the framework is easy to apply and accessible to decision analysts and/or makers with little or no prior knowledge of MCDA. Whilst it is not expected that substantive changes will be made to the basic mechanics of the framework, the preliminary prioritisation reported above could be revisited at that time.

Appendix 1; Contents of Information Dossier

1. STDF (2008). *Overview of SPS Needs and Assistance in Mozambique*. Background Paper, LDC Ministerial Conference, Siem Reap, Cambodia. Standards and Trade Development Facility, Geneva.
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7. Mangana, S., Timana, A., Benjamin, C. and Rodrigues, P. (2004). *SPS in Mozambique: Development, Challenges and Propsects*. Workshop on Business Implications for the Private Sector in Africa of the WTO Agreement on SPS, Cairo, Egypt.
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13. Details of border rejections of food and feed products from Mozambique over the period 1998 to 2011. Downloaded from Rapid Alert System for Food and Feed on 22 February 2011.
14. Data on exports of agri-food products from Mozambique downloaded from International Trade Centre on 22 February 2011.

Appendix 2; Participants at Stakeholder Workshop, April 13 2011

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Appendix 3. Participants at Stakeholder Workshop, 17 January 2012

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Appendix 4; Capacity-Building Option Information cards

Table A4-1; Decision criteria values for pesticide residue testing

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$300,000	Estimated cost of pesticide laboratory in 2005 is $200,000. Updated to 2010 at 8% gives approximately $300,000.	Medium
On-going cost	0.1%	Estimated cost of maintaining laboratory accreditation $17,000. Estimated value of exports of bananas and mangoes in 2015 is $15,167,000, on basis of trend over period 2001 to 2010. Thus, on-going costs are around 0.1% of the value of exports. No significant difference in unit costs of test between South Africa and new facility in Mozambique.	Medium
Trade impacts			
Change in absolute value of exports	$0	Exporters already have samples tested in South Africa. No additional exports created.	High
Domestic agri-food impacts			
Change in agricultural/fisheries productivity	0	No change – pesticide testing already undertaken using laboratories in South Africa.	High
Change in domestic public health	0	No change – pesticide testing already undertaken using laboratories in South Africa.	High
Change in local environmental protection	0	No change – pesticide testing already undertaken using laboratories in South Africa.	Medium
Social impacts			
Poverty impact	0	Small number of producers. Mainly medium-sized farms.	High
Impact on vulnerable groups	0	Little or no involvement of women (0); Little or no impact on children (0); Production largely in less vulnerable areas (0); Little or no involvement of smallholders/artisanal fishers (0).	High

Table A4-2; Decision criteria values for mycotoxin testing of groundnuts

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$100,000	Estimated costs of laboratory equipment ($50,000), training ($25,000) and certification to ISO 17025 ($25,000).	High
On-going cost	0%	Costs of maintaining laboratory accreditation approximately $10,000/year. Costs of retesting in EU avoided. On balance, will be little or no additional on-going costs.	High
Trade impacts			
Change in absolute value of exports	$0	Samples already tested in non-accredited laboratory in Mozambique, then retested in EU. No additional exports created.	High
Domestic agri-food impacts			
Change in agricultural/fisheries productivity	0	Samples already tested in non-accredited laboratory in Mozambique, then retested in EU. No change.	High
Change in domestic public health	0	Samples already tested in non-accredited laboratory in Mozambique, then retested in EU. No change.	High
Change in local environmental protection	0	Samples already tested in non-accredited laboratory in Mozambique, then retested in EU. No change.	High
Social impacts			
Poverty impact	0	No change in exports.	High
Impact on vulnerable groups	0	Little or no change and so minimal or no impact on women (0), children (0), vulnerable areas (0) and smallholders/artisanal fishers (0).	High

Table A4-3; Decision criteria values for mycotoxin controls for groundnuts and maize

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$2,700,000	Estimated costs of $2,700,000 over four years including personnel, training, equipment, vehicles, travel and indirect costs.	High
On-going cost	0.06%	Estimated cost of $6/tonne. Unit price of exports over period 2001 to 2010 approximately $1/kg. Thus, on-going costs equal to 0.06% of the value of exports.	High
Trade impacts			
Change in absolute value of exports	$1,583,500	Predicted exports in 2015 of groundnuts without mycotoxin controls on basis of trend over period 2001 to 2010 equal to $15,835,000. 10% increase in exports by 2015.	Medium
Domestic agri-food impacts			
Change in agricultural/fisheries productivity	0	Costs of production enhanced because of higher seed costs. Mycotoxin levels diminished significantly and so lower rejection rates. Net effect is probably neutral.	Low
Change in domestic public health	+2	Significant reductions in levels of mycotoxins in food on domestic markets.	High
Change in local environmental protection	0	Little or no impact on environmental protection.	High
Social impacts			
Poverty impact	+2	Decline in level of mycotoxins in animal feed and products consumed by farm households.	High
Impact on vulnerable groups	+8	Improved controls will reduce mycotoxin exposure amongst women (+2), children (+2), people in vulnerable areas (+2) and by smallholders/artisanal fishers (+2). Also moderate increase in returns for smallholders.	Medium

Table A4-4; Decision criteria values for hygiene controls for crustacean exports

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$200,000	Estimated laboratory accreditation costs of $45,000 for Maputo facility and $40,000 for three remaining laboratories. Fisher training costs of $35,000.	Medium
On-going cost	0.1%	Annual costs of maintaining accreditation of $17,000 per laboratory. Gives annual cost of $68,000. Estimated exports in 2015 of $65,925,479 on basis of average exports over period 2008 to 2010. Gives on-going costs of 0.1% of value of exports.	Medium
Trade impacts			
Change in absolute value of exports	$30,020,373	Eventually lose access to EU market if do not address remaining weaknesses in hygiene controls and achieve laboratory accreditation. As a result, would divert exports to China at price discount of $3.35/kg based on average crustacean prices over period 2008 to 2009. Predicted exports in 2015 of 8,952 tonnes on basis of average exports over period 2008 to 2010. Cannot access US markets as an alternative due to non-use of TEDs.	Medium
Domestic agri-food impacts			
Change in agricultural/fisheries productivity	0	Marginal impact	Medium
Change in domestic public health	0	No impact – focus is on export value chain	High
Change in local environmental protection	-1	Likely to contribute to depletion of fishery resource	Low
Social impacts			
Poverty impact	+2	Relatively few artisanal fishers involved in supply of crustaceans into export sector. Large numbers of employed fishers in commercial vessels.	High
Impact on vulnerable groups	+1	Little or no involvement of women (0) or children (0) in crustacean value chain. Coastal areas less vulnerable (0) than many areas of Mozambique. Some involvement of artisanal fishers (+1).	Medium

Table A4-5; Decision criteria values for hygiene controls for bivalves/molluscs

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$280,000	Estimated costs of $280,000 including upgrading of Maputo laboratory ($20,000), upgrading of three other laboratories ($40,000 per laboratory), consultant to guide drafting of legislation ($10,000), classification of production areas ($30,000) and upgrading of 2 production facilities ($50,000 per plant)	Medium
On-going cost	1.0%	On-going costs of $17,000 to maintain Maputo laboratory and $5,000 per laboratory for three other facilities. Annual monitoring costs of $30,000. Gives on-going costs of $62,000. Estimated exports in 2015 of $367,994 assuming export volumes double based on average exports over period 2008 to 2010 and all exports are to the European Union at the average unit price over the period 2008 to 2010 of $4.56/kg.	Low
Trade impacts			
Change in absolute value of exports	$359,777	Exports in 2015 without access to EU markets for bivalve and molluscs predicted at 73,574kg on basis of average exports over period 2008 to 2010. With approval export volume would double. All exports would be directed at the EU with a price of $4.56/kg based on the average EU unit import price over the period 2008 to 2010. This implies that existing export volumes would attract a price premium of $0.33/kg on basis of average prices over period 2008 to 2010.	Low
Domestic agri-food impacts			
Change in agricultural/fisheries productivity	0	Marginal impact	Medium
Change in domestic public health	0	No impact – focus is on export value chain	High
Change in local environmental protection	-1	Likely to contribute to depletion of fishery resource	Low
Social impacts			
Poverty impact	+2	Relatively few artisanal fishers involved in supply of crustaceans into export sector. Large numbers of employed fishers in commercial vessels.	High

Impact on vulnerable groups	+1	Little or no involvement of women (0) or children (0) in bivalve/mollusc value chain. Coastal areas less vulnerable (0) than many areas of Mozambique. Some involvement of artisanal fishers (+1).	Medium

Table A4-6; Decision criteria values for determine pest status of bananas

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$75,000	Estimated one-off research costs of $75,000	High
On-going cost	0%	No on-going costs	High
Trade impacts			
Change in absolute value of exports	$7,500,000	Current banana exports continue. Additional exports of 50% from Nampula province.	Medium
Domestic agri-food impacts			
Change in agricultural/fisheries productivity	+2	Greater returns to producers in Nampula.	High
Change in domestic public health	0	Involves controls on plant pest – no public health impacts	High
Change in local environmental protection	-1	Virgin areas being cleared for banana production	High
Social impacts			
Poverty impact	0	Few smallholders and relatively low levels of employed labour	High
Impact on vulnerable groups	+2	Banana value chain employs substantial numbers of women (+1), little or no impact on children (0), banana production in marginally vulnerable areas (+1), no involvement of smallholders/artisanal fishers (0).	Medium

Table A4-7; Decision criteria values for post-harvest treatment of mangoes

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$120,000	Cost of high temperature forced air equipment	High
On-going cost	0%	Estimated additional cost of $0.32/kg. However, offset by increase in price, such that overall cost is around zero.	Medium
Trade impacts			
Change in absolute value of exports	$664,000	Predicted exports in 2015 of $107,000 on basis of trend over period 2001 to 2010. Plans exist for production to be increased from 40 ha to 160ha, suggesting further 400% increase in exports.	Medium
Domestic agri-food impacts			
Change in agricultural/fisheries productivity	+2	Greater returns to producers	High
Change in domestic public health	0	Involves controls on plant pest – no public health impacts	High
Change in local environmental protection	0	No impact	High
Social impacts			
Poverty impact	0	Few smallholders and relatively low levels of employed labour	High
Impact on vulnerable groups	+2	Banana value chain employs substantial numbers of women (+1), little or no impact on children (0), mango production in marginally vulnerable areas (+1), no involvement of smallholders/artisanal fishers (0).	Medium

Table A4-8; Decision criteria values for maintaining pest-free status of bananas

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$0	No upfront costs	High
On-going cost	0.67%	Estimated annual cost of $100,000. Predicted exports in 2015 of $15,000,000 on basis of trend over period 2004 to 2010. Thus on-going costs of 0.67%.	High
Trade impacts			
Change in absolute value of exports	$15,000,000	Lose exports to South Africa if pest status not confirmed. Predicted exports in 2015 of $15,000,000 on basis of trend over period 2004 to 2010.	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Loss of pest-free status will bring about a decline in returns to banana producers.	High
Domestic public health	0	Involves controls on plant pest – no public health impacts	High
Environmental protection	0	No impact	High
Social impacts			
Poverty impact	0	Few smallholders and relatively low levels of employed labour	High
Impact on vulnerable groups	+2	Banana value chain employs substantial numbers of women (+1), little or no impact on children (0), mango production in marginally vulnerable areas (+1), no involvement of smallholders/artisanal fishers (0).	Medium

Table A4-9; Decision criteria values for biological control of *B. invadens*

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$157,085	Cost of importing insects, rearing and release.	High
On-going cost	0%	No on-going costs	High
Trade impacts			
Change in absolute value of exports	0	No impact on exports	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+2	Reduction in levels of fruit fly will diminish pre- and post-harvest losses in all susceptible fruit crops.	High
Domestic public health	0	Involves controls on plant pest – no public health impacts	High
Environmental protection	0	No impact, although are debates about whether would have negative (due to potential impacts on indigenous fruit fly) or positive (due to eradication of exotic species of fruit fly).	Medium
Social impacts			
Poverty impact	+2	Widespread reductions in fruit fly in fruits grown by smallholders for local markets and domestic consumption	High
Impact on vulnerable groups	+8	Women (+2) are responsible for cultivation of fruits and vegetables, consumption of fruit by children likely to be maintained or increased (especially mango) (+2), highly remote/vulnerable area (+2), most production by smallholders (+2).	Medium

Table A4-10; Decision criteria values for HACCP controls for cashews

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$168,000	Estimated costs of $11,000 building costs and $10,000 HACCP implementation costs per firm. Around 8 firms currently export. Gives $168,000 total up-front investment.	Medium
On-going cost	0%	Any costs associated with record keeping, maintaining traceability systems, etc. are offset by efficiency savings associated with reduced post-harvest losses and out-grading of cashews. Thus, net on-going costs are zero	Medium
Trade impacts			
Change in absolute value of exports	$5,829,720	Lose all exports of shelled cashew, predicted to be 3,737,000kg in 2015 on basis of trend over period 2001 to 2010. Instead exported unshelled at price discount of $1.56/kg on basis of average prices over period 2001 to 2010. No impact on existing exports of unshelled cashews.	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	-1	Agricultural productivity could decline as a result of higher rejection rates due to more effective screening.	Medium
Domestic public health	0	Exported commodity. Little or no impact on domestic food safety.	Medium
Environmental protection	0	No impact	High
Social impacts			
Poverty impact	-1	Expect rationalisation of supply chains for cashew as traceability systems implemented, reducing numbers of smallholder producers.	High
Impact on vulnerable groups	-3	Women active in production of cashews (-1), little or no direct impact on children (0), production in vulnerable areas (-1), production all by smallholders (-1)	Medium

Table A4-11; Decision criteria values for controls for Black Spot in citrus

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	0	Investment already been made	
On-going cost	6.5%	On basis of cost estimates from South Africa, annual costs of $1,261,440. Estimated exports of $19,440,000 in 2015 assuming current estimated current production area of 1,000ha fully rehabilitated. Assuming 27,000kg/ha estimated exports are 27,000,000kg in 2015, valued at average unit price over period 2008 to 2010 of $0.72/kg. Gives on-going costs of 6.5% of value of exports.	Medium
Trade impacts			
Change in absolute value of exports	$2,970,000	Estimated current production area of 1,000ha. Assume will be fully rehabilitated. Assuming 27,000kg/ha estimated exports are 27,000,000kg in 2015. Exports will be diverted from the Middle East to EU, giving a price premium of $0.11/kg on basis of average over 2008 to 2010.	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	1	Reduces pre- and post-harvest losses	High
Domestic public health	0	Little or no impact on domestic food safety – involves control of a plant pest	High
Environmental protection	-1	Involves use/greater use of pesticides	High
Social impacts			
Poverty impact	0	Small change in exports. Medium/large farms engaged in citrus production for export.	High
Impact on vulnerable groups	1	Women engaged in citrus production (+1), little or no direct impact on children (0), production in least vulnerable areas (0), no smallholders involved (0).	

Appendix 5; Endnotes

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[4] Henson, S.J. and Masakure, O. (2009).

[5] Henson, S.J. and Masakure, O. (2009).

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[6] See for example:

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Rebello da Silva, G. and da Silva Carrilho, L. (2003). Bridging the Standards Divide: A Case Study and Action Plan for Mozambique. In: Wilson, J.S. and Abiola, V.O. (eds). Standards and Global Trade: A Voice for Africa. World Bank, Washington DC.

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Pillar 1: Land & water management
Pillar 2: Market access
Pillar 3: Food supply and hunger
Pillar 4: Agricultural research
Pillar 4: Agricultural research
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[9] Republic of Mozambique (2010). Ministry of Agriculture Strategic Plan for Agricultural Development (PEDSA) 2010-2019. Government of Mozambique, Maputo.

[10]UNDAF (2009). National Action Plan for the Reduction of Absolute Poverty (PARPA II) 2007-2009. United Nations Development Assistance Framework, Maputo.

[11] Republic of Mozambique (2001). Agenda 2025: The Nation's Vision and Strategies. Committee of Counsellors (CoC) of Agenda 2025, Strategies, Registry No.: 4209/RLINLD/2004. Government of Mozambique, Maputo.

[12] IF (2004).

[13] World Trade Organization, 2008, Trade Policy Review, Structural problems are inhibiting development, Report by the Secretariat, Trade Policy Review Body, WT/TPR/S/209, 1 December 2008

[14] Quoted from; World Trade Organization, 2008, Trade Policy Review, Structural problems are inhibiting development, Report by the Secretariat, Trade Policy Review Body, WT/TPR/S/209, 1 December 2008

[15] http://www.minicom.gov.rw

[16] http://spsims.wto.org/ (Accessed 22/12/2011).

[17] Data on the WTO SPS Agreement notification, focal and contact points for Mozambique as held in the WTO Database. SPSIMS Website accessed December 26, 2011.

[18] Source, World Trade Organization, WT/CTE/W/160/Rev.1, 14 June 2001, (01-2956)

[19] COMTRADE data.

[20]For example, in January 1998 the EU imposed a ban on fishery products (Commission Decision 98/84/EC) because of a Cholera outbreak in Mozambique. At the time, Mozambique argued that there should be a derogation provided for fishery products which are caught, frozen and packed in their final packaging at sea and landed directly on Community territory.

[21] Shows a year on year increasing trend of y=.3714x -1.714.

[22]Henson and Masakure (2011).

[23] Initially, a list of 15 decision criteria was employed, but this was slimmed down to eight in order to avoid overlaps/correlations between decision criteria.

[24] Henson and Masakure (2011).

[25] In this case, there was considerable uncertainty over the extent to which exports of bivalves and mollusks would expand as a result of compliance with EU hygiene controls, and subsequent entry to EU markets. The information card applies a highly conservative assumption, and as a result this capacity-building option is ranked relatively low. The analysis here aimed to assess whether relaxing this conservative assumption had an appreciable impact on the ranking.

[26] Exports of groundnuts from Mozambique, predominantly to the EU, increased appreciably over the period 2000 to 2009. Further, there is considered to be significant potential for foreign investment in this sector that could contribute to future export growth. The sector, however, has been troubled with problems due to excess levels of aflatoxins. Thus, from 2007 to 2009 there were six EU border rejections of groundnuts from Mozambique, with levels of contamination far in excess of EU limits. Consignments failing EU standards are either diverted to South Africa where tolerances are 10 times those of the EU or to the local market. At the same time, there are concerns about the local public health impacts of high levels of aflatoxins and fumonisins in groundnuts and other locally-consumed foods such as maize and cassava flour.

[27] Food Standards Agency (2011). Imports of fishery products from Mozambique, 24 June 2008. http://www.food.gov.uk/multimedia/pdfs/fin102008.pdf (Accessed 29 /4/2011).

[28] These requirements also apply to tunicates, echinoderms and marine gastropods.

[29] Food Standards Agency (2011). Importing fishery products or bivalve molluscs. http://www.food.gov.uk/foodindustry/imports/want_to_import/fisheryproducts/#h_1. Website accessed 29 April, 2011

[30] The invasive fruit fly *Bactrocera invadens* (Diptera: Tephritidae) was first detected in Mozambique in Cuamba District (Niassa Province) in 2007, since when it has spread to large parts of the northern and central regions, as far south as the areas near the Save River. The occurrence of *B. invadens* led to a temporary closure of exports to Mozambique's main export markets for fresh fruit, in particular South Africa. It is estimated that this resulted in the loss of about $2.5 million in exports in the course of one month alone. Whilst exports to South Africa are now permitted from the southern region, exports of all fresh fruit from the central and northern regions remain prohibited. Whilst the southern region (south of the Save River) remains free of *B. invadens*, climate and the diversity of host plants provide ideal conditions for its southward migration thus posing a continuing long term threat.

The major fruit exported from Mozambique is bananas and exports of mango have now almost ceased leaving citrus to be the second largest fresh fruit export. The key factor behind the collapse of mango exports was the prohibition on exports from the Dombe area in central Mozambique due to the fruit fly. However, both citrus and mango are vulnerable as preferred hosts of *B. invadens.* The status of green bananas as a fruit fly host is contested and requires urgent clarification. Despite a number of setbacks in recent years there remains considerable scope for foreign direct investment in fresh fruit production in Mozambique, which could lead to significant expansion of exports, not only to South Africa but also Middle Eastern and European markets which, in turn, could generate considerable rural employment. The major SPS issue constraining these investments is *B. invadens*. Appreciating this fact, Mozambique has become one of the more proactive of the SADC countries in addressing the fruit fly issue, with the *Departamento Sanidade Vegetal* (DSV) forming a strong partnership with the Eduardo Mondlane University and the private sector.[30]

A workshop organized by the Department of Plant Health with funding by USAID/Agrifuturo was held in March 2011 in Pemba to assess progress on the surveillance and management of *B. invadens* in Mozambique and elsewhere in SADC, and to plan the way forward for these activities in Mozambique. The country has now been divided into three Regions or Zones: 1) Area A, the northern region (north of the Zambezi River) where infestation by B. *invadens* is very high; 2) Area B, the central region (between the Save and Zambezi Rivers) where infestation is still low; and 3) Area C, the pest free area (south of the Save River) from which trade is permitted. Trade to neighboring countries is not permitted from the first two regions. Participants at this workshop proposed different strategies for these three regions. In addition both the suitability of green bananas as a host for *B. invadens,* as well as the scope for post-harvest mitigation treatment, were identified as priority issues.

[31] Indeed, a sole paper:

Ekesi S., Nderitu, P. W., and Rwomushana, I. (2006). Field Infestation, Life History and Demographic Parameters of the Fruit Fly Bactrocera invadens (Diptera: Tephritidae). Africa Bulletin of Entomological Research, 96, 379–386.

[32] see footnote 30.

[33] Armstrong, J. W. (2001). Quarantine Security of Bananas at Harvest Maturity against Mediterranean and Oriental Fruit Flies (Diptera: Tephritidae). Hawaiian Journal of Economics and Entomology, 94 (1), 302 – 314.

[34] Anonymous (2011). *Ministry of Agriculture and Mozambique Agricultural Research Institute (IIAM) Mozambique Fruit Fly Surveillance and Research Project*. May 17, 2011 Mimeo.

[35] see footnote 30.

[36] Sharp J. L., Ouye M. T., Ingle S. J. and Hart W. (1989). Hot Water Quarantine Treatment for Mangoes from Mexico Infested with Mexican Fruit Fly and West Indian Fruit Fly (Diptera: Tephritidae). *Journal of Economic Entomology*, 82, 1657–1662.

Sharp J. L., Ouye M. T., Ingle S. J., Hart W. G., Enkerlin W. R., Celedonio H., Toledo J., Stevens L., Quintero E., Reyes J., and Schwarz A. (1989). Hot-Water Quarantine Treatment for Mangoes from the State of Chiapas, Mexico, Infested with Mediterranean Fruit Fly and *Anastrepha serpentine* (Wiedemann) (Diptera: Tephritidae). *Journal of Economic Entomology*, 82, 1663–1666.

Armstrong J. W., Silva S. T. and Shishido V. M. (1995). Quarantine Cold Treatment for Hawaiian Carambola Fruit Infested with Mediterranean Fruit Fly, Melon Fly or Oriental Fruit Fly (Diptera: Tephritidae) Eggs and Larvae. *Journal of Economic Entomology,* 88, 683–687.

[37] see footnote 30.

[38] see footnote 30.

[39] see footnote 30.

[40] Mohamed S.A., Ekesi S. and Hanna R. (2008). Evaluation of the Impact of *Diachasmimorpha longicaudata* on *Bactrocera invadens* and Five African Fruit Fly Species. *Journal of Applied Entomology*, 132, 789–797.

Mohamed, S.A., Ekesi, S., and Hanna, R. (2010). Old and New Host-Parasitoid Associations: Parasitization of the Invasive Fruit Fly *Bactrocera invadens* (Diptera: Tephritidae) and Five Other African Fruit Fly Species by *Fopius arisanus*, an Asian Opine Parasitoid. *Biocontrol Science and Technology,* 10, 183-196.

[41] Ekesi, S (undated), Fruit Fly Management Activities in East Africa: State of the Art; Powerpoint presentation available on http://www.standardsfacility.org/files/Fruit_fly/ICIPE%20final%20presentation.pdf (Accessed 27/4/2010).

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[42] Anonymous (2009). Participatory Validation and Dissemination of Management Technologies for *Bactrocera* invadens and other Major Pests that Constrain Production and Export of Fruits and Vegetables in East and Southern Africa. A project proposal submitted to the Common Fund for Commodities (CFC) by Ministry of Agriculture Food Security (MAFSC) of the Republic of Tanzania.

[43] SECO (2011). *Strengthening the Competitiveness of Export Oriented Agro Value Chains Cashew Nut Value Chain in Mozambique*. Swiss State Secretariat for Economic Affairs, Maputo.

[44] Cassidy, D. S. (2006). *Visit to Mozambique Cashew Processing Factories: Review of Progress Towards HACCP Accreditation*. Report prepared for Technoserve, Maputo.

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[47] Chadwick, J. (2009). *From the desk of the CEO, Citrus Growers Association (CGA).* www.cga.co.za (Accessed 27/5/2011).