Using Multi Criteria Decision Analysis to Identify and Prioritise Key Sanitary and Phytosanitary Capacity Building Options and Needs for Belize

Delilah Cabb

Francisco Gutierrez

Spencer Henson

20 September 2012

Contents

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 advocated as a structured framework for making the costs and benefits of alternative capacity-building investments explicit and for identifying options that offer the greatest return. Because the lack of data can seriously impede such analyses the Standards and Trade Development Facility (STDF) has supported the development of an MCDA-based framework which enables SPS capacity-building options to be prioritised on the basis of a wide range of decision criteria.

This report presents the initial results of a priority-setting exercise for SPS capacity-building in Belize which commenced with a stakeholder workshop on Thursday 3rd May 2012. A total of twenty-one (21) distinct SPS capacity-building options are identified, of which eight (8) are judged to be substantive SPS issues. These eight (8) capacity-building options are prioritised on the basis of a series of twelve (12) decision criteria to which weights are applied. These criteria and weights are again derived through the stakeholder workshop. The end result is a clear ranking of the eight (8) capacity-building options, which appear robust to changes in the weights attached to the decision criteria and to changes in the decision criteria applied. Of the eight (8) options in the analysis the following four (4) are consistently ranked as high priority:

- Food safety controls for papaya exports.
- Plant health controls for pitahaya exports.
- Animal health and hygiene controls for chicken exports.
- Laboratory testing capacity for heavy metals.

Conversely, animal health controls for live cattle exports and plant health controls for citrus pulp exports are consistently ranked bottom of the eight (8) options under consideration.

It is important to recognize that the results of the analysis should represent the starting point in the use of MCDA in the context of SPS capacity-building in Belize. 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 and as new issues arise or investments are made in the identified options.

Using Multi Criteria Decision Analysis to Identify and Prioritise Key Sanitary and Phytosanitary Capacity Building Options and Needs for Belize

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 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).

---

[1] Henson, S.J., and Humphrey, J., (2010). Understanding the Complexities of Private Standards in Global Agri-Food Chains as They Impact Developing Countries. *Journal of Development Studies*, 46 (9), 1628-1646.

[2] World Bank (2005). *Food Safety and Agricultural Health Standards: Challenges and Opportunities for Developing Country Exports*, Report 31207, Poverty Reduction and Economic Management Trade Unit. World Bank, Washington DC.

[3] Henson, S.J., and Masakure, O., (2009). *Guidelines on the Use of Economic Analysis to Inform SPS-related Decision-Making*. Standards and Trade Development Facility, Geneva.

[4] Henson and Masakure (2009). *Op cit.*

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.

This report provides an overview and the results of the application of the MCDA framework in Belize. Despite the fact that some assessments of the SPS situation and capacity-building needs have been conducted in Belize, there remains a lack of coherence in the establishment of priorities. 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, predominantly these assessments have focused on weaknesses in specific elements of capacity, for example plant and animal health, but with limited attention to the benefits that will flow from related capacity-building investments. Therefore, it is not surprising that Belize 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 a short overview of Belize's nature of agri-food trade, highlighting the extent to which this trade is composed of products that might be considered 'SPS sensitive' and examining evidence that this trade is impeded by weaknesses in capacity in the areas of food safety, plant health and/or animal health. The report then proceeds to lay out the process by which SPS capacity-building needs are identified. The results of the analysis are then reported, followed by an assessment of the implications for SPS capacity-building in Belize in the medium term.

2. SPS issues facing agri-food exports from Belize

Belize has established exports in a range of agri-food commodities as detailed in Table 1. Historically, exports were dominated by sugar, bananas and a range of citrus products, notably orange concentrate. In more recent years, however, non-traditional exports have become more important including fish and fishery products, papayas and pulses. There have also been efforts to promote exports of value-added foods, notably pepper sauce. It is noteworthy, however, that exports of fish and fishery products have declined appreciably in recent years, reflecting a collapse in exports of shrimp.

[5] Henson, S.J., and Masakure (2009). *Op cit.*
Henson, S.J., and Masakure, O., (2011). *Establishing Priorities for SPS Capacity Building: A Guide to Multi-Criteria Decision-Making*. Standards and Trade Development Facility, Geneva.

Table 1. Exports of agricultural and food products from Belize, 2002-2011 (BZE$'000)

Commodity	2003	2004	2005	2006	2007	2008	2009	2010	2011P
Sugarcane products									
Sugar	71,227	81,534	69,899	100,065	88,142	71,384	89,062	58,721	90,131
Molasses	2,476	1,766	2,821	4,203	5,504	2,821	3,327	6,197	4,236
Sub-total	*73,703*	*83,300*	*72,720*	*104,268*	*93,646*	*74,204*	*92,389*	*64,918*	*94,367*
Bananas									
Bananas	52,579	52,991	51,081	50,592	41,464	65,648	66,692	82,565	63,355
Citrus fruit and products									
Orange Concentrate	65,538	55,489	87,547	86,176	101,169	99,927	84,999	66,125	92,491
Orange Squash	1,479	1,996	542	107	93	582	253	1,997	1,036
Orange Oil	566	2,050	1,919	2,810	2,213	3,005	3,088	3,242	5,838
Oranges	2,406	1,973	3,248	2,881	2,685	1,689	2,479	1,613	2,843
Grapefruit Concentrate	12,516	23,817	19,424	22,810	16,271	12,673	12,395	14,933	10,572
Grapefruit Squash	381	1,792	298	27	8	258	436	717	352
Grapefruit Oil	24	1,573	6,600	2,852	681	755	1,508	1,003	705
Sub-total	*82,909*	*88,690*	*119,579*	*117,663*	*123,121*	*118,889*	*105,158*	*89,630*	*113,837*
Fish and fisheries products									
Lobster	13,598	15,142	14,499	13,927	16,096	14,809	13,011	12,723	17,771
Conch	3,741	5,810	7,156	8,359	5,389	6,640	7,870	6,325	8,727
Shrimp	92,762	85,153	60,535	62,520	19,749	18,510	28,882	31,142	20,994
Whole Fish	30		0	277	401	3,934	1,892	181	617
Fish Fillet	0		0	933	527	392	240	0	
Crab	26		0	0	20	0	101	0	
Other Fish		1,228	1,681	0	0		1,814	7,075	1,468
Sub-total	*110,157*	*107,334*	*83,871*	*86,016*	*42,182*	*44,285*	*53,810*	*57,446*	*49,576*

Commodity	2003	2004	2005	2006	2007	2008	2009	2010	2011P
Other products									
Pepper Sauce	607	866	1,154	1,607	1,687	1,632	1,935	1,242	2,289
Papayas	16,752	22,818	26,768	31,014	26,074	22,442	20,588	25,274	25,951
Red Kidney Beans	1,659	1,872	5,064	1,912	2,878	3,451	3,466	6,617	5,332
Black Eye Peas	3,410	1,418	3,463	3,372	3,599	4,047	5,294	4,686	6,909
Mangoes	1	0							
Cocoa Beans	94	69					121	4	42
Honey	0	0						2	
Peanuts		12							
Chicle	22	0							13
Sub-total	*22,545*	*27,054*	*36,449*	*37,905*	*34,238*	*31,571*	*31,404*	*37,825*	*40,535*
TOTAL	**341,893**	**359,370**	**363,699**	**396,444**	**334,651**	**334,597**	**349,454**	**332,383**	**361,670**

Source: Central Statistical Office
P= provisional

The stringency of the SPS requirements faced by agri-food exports from Belize reflects the products being exported and the markets these are exported to. Table 2 presents a summary, identifying the stringency of the regulatory food safety, plant health and animal health requirements and private standards that are faced. With the exception of fish and fishery products, Belize does not face particular stringent regulatory requirements for food safety or plant and animal health. Whilst, food safety regulations tend to be more stringent for fish and fishery products, there is variation across export markets, with the strictest requirements in the case of the United States (US). Across many of Belize's agri-food exports, the most stringent requirements, predominantly for food safety, are laid down by private standards. This is especially the case where exports are destined for the United Kingdom (UK) and other parts of Europe, for example bananas and citrus concentrate. Private standards are now having an impact even on products not previously affected such as fish and fishery products and papayas exported to the US, and sugar and molasses destined for European markets.

It is evident that Belize faces fairly stringent food safety and plant and animal health requirements for many of its major agri-food exports. However, given that no comprehensive assessment has been undertaken of the challenges faced by agri-food exporters in Belize, the broad picture has to be built up from the collective of often piecemeal information that does exist. This is summarised briefly below.

The PCE tool of the IPPC, PVS tool of the OIE and PVS framework of IICA have all been applied to Belize.[6] All highlight significant capacity-building needs, both with respect to specific SPS control functions and to the overall strategic management of SPS issues in Belize. The related investments needs are estimated to be significant. Notably, the costs of upgrading animal health controls in Belize are estimated at US$3.0 million, with an initial annual operating budget of US$3.6 million.[7] None of these assessments, however, focus on the specific compliance issues faced in international trade as a result of the identified weaknesses in capacity.

There is a decided lack of systematic evidence more generally on the extent to which weaknesses in SPS capacity actually impede trade, despite the fact that various policy documents highlight the fact that compliance with SPS requirements is a priority issue.[8] Furthermore, analysis of border rejection data does not indicate systematic and widespread compliance issues. Thus, since the late 1990s, Belize has had no border rejections in the case of the EU. Whilst there have been US rejections of agri-food exports from Belize, these have averaged only two consignments annually, with the highest levels of

---

[6] FAO (2004). *IPPC PCE Results: Belize*. Food and Agriculture Organisation, Rome.
Stemshorn, B., Ugarte, R. and Logan, L. (2009).*OIE PVS Tool: Belize*. International Organisation for Animal Health, Paris.
IICA (2008). *Results of Application of PVS Tool to Belize*. Inter-American Institute for Cooperation in Agriculture, San Jose.

[7] Stemshorn, B., Pacer, R., Sotgia, S. (2010). *OIE PVS Gap Analysis: Belize*. International Organisation for Animal Health, Paris.

[8] See for example:
Barnett, C., Catzim-Sanchez, A. and Humes, D. (2010). *Belize: Horizon 2030*. Barnett and Company, Belmopan.
Gomez, D. (2006). National Export Strategy Belize 2007-2012. Belize Trade and Development Services, Belmopan.
Government of Belize (2010). *Belize Medium-Term Development Strategy 2010-2013*. Ministry of Economic Development, Commerce and Industry and Consumer Protection, Belmopan.

rejections only amounting to four (4) consignments, in 2005 and 2004, spread across a range of products including honey, lobster, pepper sauce, spices, etc.

Table 2: Stringency of SPS requirements for agricultural and food product exports from Belize

Commodity	Regulatory Requirements			Private Standards
	Food Safety	Plant Health	Animal Health	
Sugarcane products				
Sugar	X	X	N/A	X
Molasses	X	N/A	N/A	X
Bananas				
Bananas	X	X	N/A	XXX
Citrus fruit and products				
Orange Concentrate	X	X	N/A	X
Orange Squash	X	X	N/A	X
Orange Oil	N/A	N/A	N/A	X
Oranges	N/A	X	N/A	N/A
Grapefruit Concentrate	X	X	N/A	X
Grapefruit Squash	X	X	N/A	X
Grapefruit Oil	N/A	N/A	N/A	X
Citrus pulp	X	XX	N/A	X
Fish and fisheries products[9]				
Lobster	XX to XXX	N/A	X	XX to XXX
Conch	XX to XXX	N/A	XX	XX to XXX
Shrimp	XX to XXX	N/A	X	XX to XXX
Whole Fish	XX to XXX	N/A	X	XX to XXX
Fish Fillet	XX to XXX	N/A	X	XX to XXX
Crab	XX to XXX	N/A	X	XX to XXX
Other Fish	XX to XXX	N/A	X	XX to XXX
Other products				
Pepper Sauce	X	N/A	N/A	XX
Papayas	X	X	N/A	XXX
Red Kidney Beans	X	X	N/A	N/A
Black Eye Peas	X	X	N/A	N/A
Cocoa Beans	X	X	N/A	X

Key: - = Generally not applied or few requirements; X = relatively easy to comply; XX = somewhat difficult to comply; XXX = very difficult to comply requiring significant resources and interactions between several actors; N/A = not applicable.

[9] Requirements for fish and fishery products vary by export destination. Shrimp destined to Mexico must comply with animal health and food safety requirements and the related certification is conducted by BAHA. However if these products are destined to the USA, few buyers request certification from BAHA, with many inspecting and certifying the plants themselves. Regardless, these plants are all registered with BAHA for HACCP. Fishery exports to the Caribbean only require compliance with regulatory food safety requirements, with certification by BAHA.

The broad picture painted by existing information and data is that relatively stringent SPS requirements are faced by agri-food exports from Belize in some cases. Further, there are evidently appreciable weaknesses in capacity across food safety and plant and animal health controls. However, there is a lack of substantive evidence that this situation translates into wide-scale compliance problems. This is not to say that SPS compliance is not an issue, and indeed there is plenty of anecdotal and case-by-case evidence suggesting that problems are indeed faced, but that there is a need for a more systematic assessment of the prevailing situation. This is the focus of the analysis below, which aims to identifying specific instances where weaknesses in SPS capacity actually impedes trade and to establish priorities amongst these in terms of where efforts towards capacity-building should be first focused.

3. 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 Belize 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.

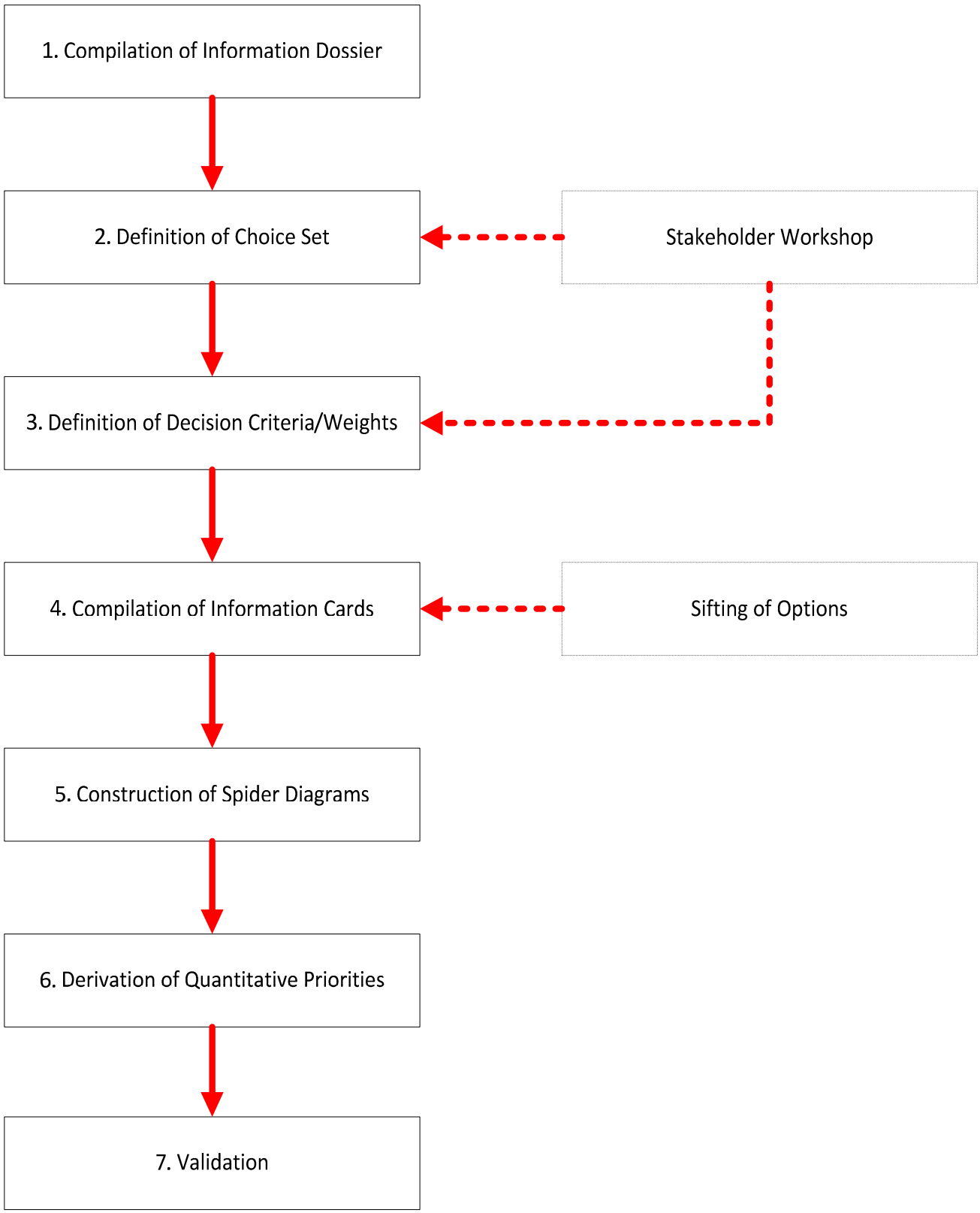
In pursuit of this objective, the framework aims to:

- 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.
- Prioritise 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 user's guide.[10] 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 Belize.

[10]Henson and Masakure (2011). *Op cit.*

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



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 Belize 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 in Belmopan on Thursday 3rd May 2012. A total of 35 stakeholders (Appendix 2) attended the workshop, drawn from government, private sector and international organisations. Workshop participants were presented with a series of cards and asked to identify the SPS capacity-building needs of Belize. 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 (4) elements defined a distinct capacity-building option. Respondents were free to define as many specific SPS capacity-building needs as they wished.

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 21 SPS capacity-building options were defined through the above process, of which 13 were excluded because they were judged not to be substantive SPS issues (Table 3).

Table 3. SPS capacity-building excluded options

Option		Brief Description
1	Plant health controls for guava exports	This option relates to plant health controls for guava exports to the US and Guatemala. In the case of the US, the only options that would permit exports would be the installation of irradiation facilities or establishment of pest-free areas. The cost of both is judged to be prohibitive. In the case of Guatemala, establishing areas of low pest prevalence might be a feasible option. However, it is not evident that there is a substantive economic incentive to undertake the related investment.
2	Animal health and hygiene controls for pork exports	The costs of establishing the animal health status and associated controls for pigs, and hygiene controls in slaughtering facilities will be high. It is not evident that there is sufficient market demand in Guatemala, the target market, to justify this investment. Indeed, Guatemala has an interest in exporting pork to Belize.
3	Plant disease controls for pineapple exports	There is some concern that *Fusarium gutiforme* might become established in Belize, with significant negative consequences for pineapple production. The concern here, however, is the potential impact on productivity rather than access to export markets.

Option		Brief Description
4	Plant health controls for citrus exports	This option relates to controls on citrus greening on productivity of orange production in Belize and the quality of juice. This is not an SPS issue impacting trade.
5	GMO testing for corn exports	This option relates to the capacity to undertake testing of corn to verify it is GMO-free. This is not an SPS issues impacting trade.
6	Nutritional value analysis for consumer-ready juices	This option relates to the capacity to undertake analysis of nutritional value, notably of consumer-ready juices for export within the region. This is not an SPS issues impacting trade.
7	Plant health controls for citrus production	There are concerns that citrus exports to the US are impeded by plant health issues. However, Belize successfully exports limes into northern states of the US. There is no evident demand for oranges or grapefruit imports from Belize.
8	Plant health for hot pepper exports	Belize has clearance for hot pepper exports to the US under the existing Commodities Certification Programme for Medfly hosts. There have been no returned consignments due to plant health issues. This suggests that there is no problem with exports of hot pepper to the US that relate to SPS issues.
9	Controls on extraneous material in red kidney bean	Recently, consignments of red kidney beans to Jamaica and Trinidad and Tobago have been detained due to the existence of extraneous matter, including rat droppings and a syringe. The procedures employed in these markets are, however, questionable. Further, investigation by BAHA has not identified any problems along the supply chain in Belize, suggesting that the problems lie elsewhere.
10	Microbiological controls for table egg exports	If Belize wishes to establish formal exports of table eggs to Guatemala, a surveillance programme for *Salmonella* and certain other pathogens would need to be established. At the current time, however, the economic feasibility of table egg exports to Guatemala is uncertain.
11	Food safety controls for coconut and soya oil exports	There is no evidence of SPS issues impeding trade in coconut and/or soya oil exports from Belize. Quality and productivity are issues, but these do not relate to SPS controls.
12	Plant health controls for peanut exports	The major constraint is demand for varieties not currently produced in Belize, making economic feasibility of regional exports questionable.
13	Treatment requirements for mahogany exports	Exports of lumber, namely mahogany and tropical cedar have recently faced difficulties due to the implementation of requirements for the fumigation of lumber with methyl bromide or heat treatment. Belize cannot meet these requirements; however, BAHA is seeking to solve this problem with further dialogue with Canadian officials

The eight (8) capacity-building options remaining after this initial sifting process are outlined in Table 4. These options proceeded to the priority-setting stage of the analysis.

Table 4. SPS capacity-building options

Option		Brief Description
1	Animal health controls for live cattle exports	Belize is making efforts to meet the import requirements for live cattle into Mexico. These include production in disease-free areas or areas of low disease prevalence for selected diseases and the implementation of an identification system.
2	Animal health and hygiene controls for beef exports	Potential export markets for beef have been identified. These countries have requirements relating to animal health and food Safety. This option would enhance capacity to achieve compliance with these requirements.
3	Animal health and hygiene controls for chicken exports	Guatemala has expressed interest in importing poultry from Belize, whilst one of the major poultry processing plants has identified a potential market in the Caribbean. This option would achieve compliance with the SPS requirements of these markets including the implementation of HACCP in processing establishment, and testing for certain animal diseases.
4	Plant health controls for pitahaya exports	The US Department of Agriculture (USDA) has recently permitted imports of pitahaya from Central America. Imports are permitted provided the fruit is produced under a systems approach that minimises the risk of infestation with Mexican fruit fly. This option would implement the necessary controls to facilitate access to US markets.
5	Food safety controls for papaya exports	Papaya exports are increasingly facing requirements with respect to food safety controls, including maximum residues limits for approved pesticides and limits for microbiological contaminants. In addition, HACCP certification is required for both packing house and production. This option would achieve compliance with these requirements.
6	Laboratory testing capacity for pesticide residues, veterinary drugs and veterinary pesticide residues	Exports of beef, poultry, aquaculture products and papaya all require testing for pesticides and veterinary drug and pesticide residues. Currently, there is no capacity to undertake such tests in accredited facilities in Belize, such that tests have to be undertaken externally. This option would achieve this capacity in Belize.
7	Laboratory testing capacity for heavy metals	Exports of beef, poultry and aquaculture products require testing for heavy metals. Currently, the required capacity does not exist in Belize, meaning that samples have to be tested externally. This option would establish accredited laboratory capacity for heavy metal testing in Belize.
8	Plant health controls for citrus pulp exports	The citrus juice sector in Belize produces large quantities of citrus pulp as a by-product and has invested in the necessary capacity to process this for export, notably to Japan. Exports to Japan have been impeded, however, by strict requirements of zero tolerance for insect parts in citrus pulp. The only practical way to meet these requirements is to produce citrus fruit in areas of low pest prevalence. This option would implement and maintain the required pest control measures.

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 (4) categories and asked which (if any) should be excluded and whether any potentially important criteria were missing. The final agreed decision criteria are detailed in Table 5.

To define the decision weights, the workshop participants were each asked to assign 100 points amongst the eight (8) 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 5.

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.

Table 5. Decision criteria and weights for setting priorities of SPS capacity-building options

Objectives	Decision Criteria	Minimum	Mean	Maximum
Costs and Difficulty of implementation	Up-front investment	0	10	25
	On-going costs	2	9	20
	Difficulty of implementation	0	9	25
Trade impacts	Change in absolute value of exports	5	15	50
	Trade diversification – new products	3	8	18
	Trade diversification – new markets	2	9	18
Direct agri-food impacts	Impact on agricultural productivity	0	8	25
	Impact on domestic public health	0	8	20
	Impact on environment	0	5	10
Social impacts	Employment impact	0	7	20
	Poverty impact	0	7	20
	Impact on vulnerable groups	0	5	10

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 eight (8) capacity-building options are provided in Section 4 below.

The metrics to be employed for each of the 12 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 6 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 on-going basis and revised as more and/or better data for the decision criteria become available.

Table 6. Decision criteria measurement

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

Information cards for each of the eight (8) SPS capacity-building options were then compiled. These are reported in Appendix 4. Each card presents data for the twelve (12) decision criteria, measured according to the scales outlined in Table 6. 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.

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 on the information cards in a manner that permits easier comparison of the eight (8) capacity-building options. Thus, spider diagrams were derived that plotted the eight (8) SPS capacity-building options against each of the 12 decision criteria. Scrutiny of these diagrams identified the decision criteria against which each of the capacity-building options performed 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 involved 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.[11] 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 (3) 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 with the respective weights form the baseline model applied.

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 are estimated in order to examine the extent to which the derived priorities are sensitive to changes in the decision weights; if the broad ranking of the eight (8) SPS capacity-building options remains broadly the same under the three (3) 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.

Stage 7: Validation

The final stage of the priority-setting analysis involved a process of stakeholder feedback. The draft final report was circulated widely amongst stakeholder across the public and private sectors by email with a request for comments. Further, a second stakeholder workshop was held in Belmopan on Monday 20th August 2012. The workshop had 27 participants from government and the private sector (Appendix 3).

[11] Henson and Masakure (2011). *Op cit.*

At the workshop, the preliminary results were presented and comments invited from participants. Subsequently, a period of almost two weeks was provided for stakeholders, including those who had not attended the workshop, to provide written or oral feedback. No substantive comments that challenged the substantive analysis were received. Any issues of clarification were addressed in the preparation of the final report.

4. Sanitary and Phytosanitary (SPS) capacity-building options

This section provides a more detailed description and rationale for each of the eight (8) SPS capacity-building options considered in the priority-setting analysis.

4.1. Animal health controls for live cattle exports

Belize is currently implementing a capacity-building project aimed at facilitating market access for live cattle into Mexico. In 2009, cattle producers approached potential importers in Mexico to ascertain the possibility of establishing exports. Subsequently, a dialogue was established between the veterinary services of both countries. Mexico has defined the import requirements that Belize needs to meet, including: 1) disease -free areas or areas of low disease prevalence for Bovine Tuberculosis and Bovine Brucellosis; 2) insignificant or controlled risk for Bovine Spongiform Encephalopathy; and 3) animal identification system. To fulfill these requirements, Belize is implementing the Cattle Sweep Project which seeks to determine the country's status for these diseases. Once Belize's health status is determined to be favourable, it will be able to export live cattle to Mexico. To ensure this process is acceptable to Mexico, SENASICA will need to recognise BAHA as the competent authority through an evaluation process of Belize's veterinary services. Key areas to be evaluated include human and financial resources, infrastructure, technical authority and capacity, interaction with stakeholders, and the ability to access markets. A key requirement is the accreditation of veterinary officers and laboratory technicians by SENASICA.

4.2. Animal health and hygiene controls for beef exports

Some beef processing plants in Belize have identified potential export markets for beef in the region. The requirements that need to be complied with fall under two categories. First, animals will need to be sourced from zones or farms that are disease-free or have low disease prevalence, and veterinary inspections undertaken ante and post mortem. An implication is that veterinarians rather than food safety inspectors will need to be stationed at processing facilities. Second, food safety controls will need to be enhanced. This includes the implementation and certification to HACCP in processing establishments, and routine testing for heavy metals, veterinary drugs and pesticides, and microbiological contaminants. This option would implement and maintain the capacity to meet these requirements.

4.3. Animal health and hygiene controls for chicken exports

Guatemala has expressed interest in importing poultry from Belize. Additionally one of the major poultry processing plants in Belize has identified a potential market in the Caribbean. The import requirements with which Belize must comply include that poultry products are exported from HACCP-

Certified processing establishments and that the poultry flock is tested for Newcastle Disease, Avian influenza, Mycoplasma and Salmonella. In addition, poultry products must be tested for microbiological contaminants and veterinary drugs. This option would include implementing HACCP in processing facilities and upgrading animal disease testing capacity from the use of serological to PCR techniques.

4.4. Plant health controls for pitahaya exports

Belize has been pursuing the admissibility of pitahaya (*Hylocerus* spp) into the USA for some time. Pitahayas are high-value fruits mainly geared at US Asian and Latin American ethnic markets. USDA prohibits the importation of pitahaya from the Central American region because the fruit is a host for the Mexican Fruit fly (*Anastrepha ludens*). In 2012, the US Department of Agriculture (USDA) finally published a ruling allowing imports from Central American, including Belize, subject to certain conditions. Notably, fruit has to be produced under a systems approach. The related measures include monitoring of pest populations and applying practices that reduce the pest to extremely low levels, notably spraying, mass trapping and removal of other hosts. Packing must be carried out in approved facilities that further prevent infestation of consignments. These activities have to be coordinated by the national regulatory agency to ensure compliance. Certification of the final exportable products carried out by the national regulatory agency.

4.5. Food safety controls for papaya exports

Papayas have been exported from Belize for many years and only had to comply with phytosanitary requirements. In the past few years, food safety requirements have been implemented in export markets which include maximum residues limits for approved pesticides and limits for microbiological contaminants. The most recent addition to that list is HACCP certification for both packing houses and production. Currently, the largest exporter, accounting for around 85 per cent of exports, complies with these requirements, but the main smaller exporter does not. It is extremely costly to comply with these requirements and as such it is expected that this company, as well as a number of very small producers, could be seriously affected. The livelihood of poor households would be impacted.

4.6. Laboratory testing capacity for pesticide residues and veterinary drug residues

Belize's major trading partners have stringent food safety requirements for products exported to them, including very low limits for pesticides and veterinary drug residues. These analyses also need to be conducted by accredited laboratories using approved methodologies. Currently, testing for pesticide and veterinary drug residues is undertaken by accredited laboratories outside of Belize. BAHA has the capacity to conduct screening for veterinary drugs in animal products, but not to undertake quantitative confirmatory tests. The competent authority in Belize is currently building capacity in the area of pesticide and veterinary drug residue analysis and is working on acquiring accreditation. This option would benefit the papaya and aquaculture sectors that export currently, and the beef and poultry sectors should they be granted export market access.

4.7. Laboratory testing capacity for heavy metals

The same food laboratory in BAHA is responsible for conducting analyses for heavy metals. According to the trade requirements of importing countries, only certain products require to be tested for heavy metals, for example beef to Jamaica. BAHA would need to make some investment in order to be able to conduct this testing at the national level. At this point, BAHA would need to send samples to foreign approved laboratories for testing. This option would benefit the aquaculture sector that exports currently and the beef and poultry sectors should they be granted export market access.

4.8. Plant health controls for citrus pulp exports

Citrus production is a major agricultural sector in Belize, with current production at around forty five thousand (45,000) acres. About 98 per cent of production is processed, mainly into frozen concentrated orange and grapefruit juices for export. On average, the two processing facilities in the country process six million (6,000,000) boxes of fruit annually. This generates many by-products including citrus bagasse, essential oils and pulp. Oil is recovered and exported, whilst bagasse is processed into animal feed. Some years ago these processing facilities invested in equipment to recover citrus pulp for export to lucrative markets, such as Japan. However, this initiative did not materialise because of stringent Japanese market requiring that the pulp is free of fruit fly larvae. Grapefruit, and to a certain extent oranges, are affected by the Mexican fruit Fly (*Anastrepha ludens*), which lay eggs in the fruit (which develop into larvae). The larvae are similar in shape and density to the citrus pulp cells so that they cannot be separated in processing. Thus, the only way to capitalise on this potential export is to produce citrus that is free of fruit fly larvae. This option would implement the necessary controls to establish areas of low pest prevalence. These controls include a combination of phytosanitary measures that reduce the pest population, such as chemical spot spraying, infested fruit removal and monitoring with traps, amongst others. This process requires official controls to ensure a sound and disciplined programme, supported by the industry.

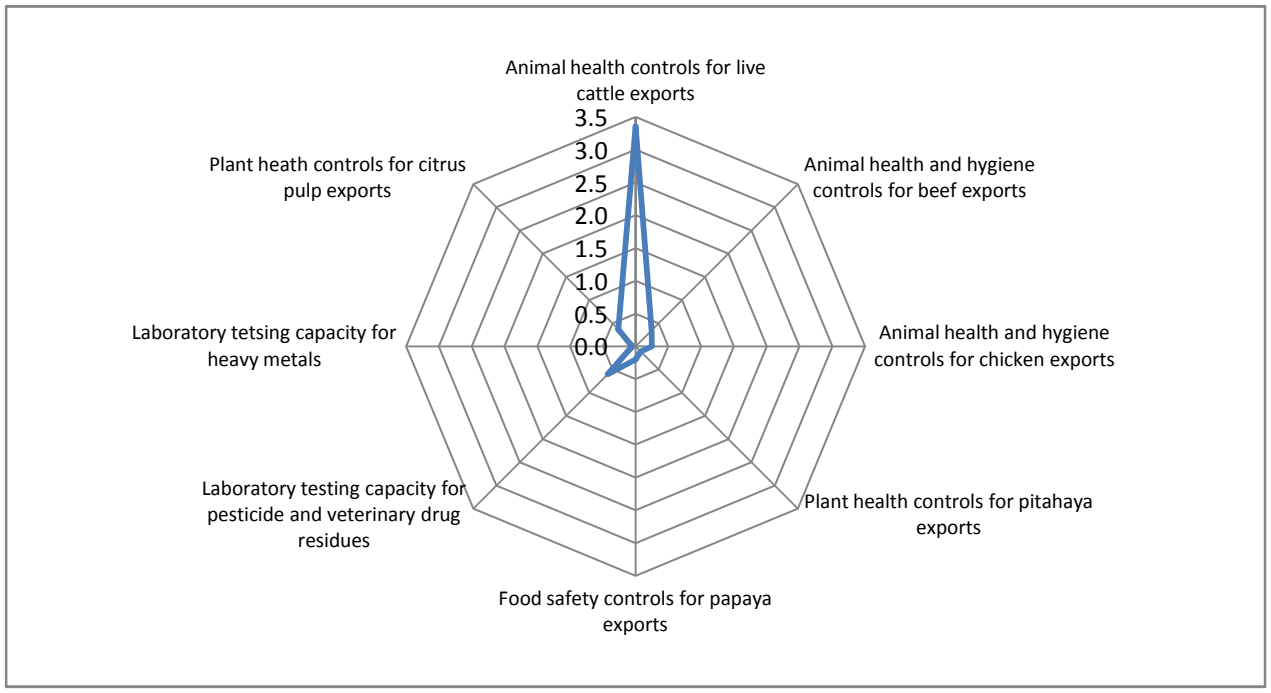
5. Results

The descriptions presented above, and the results of the stakeholder workshop, suggest all eight (8) 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 the results of the prioritisation exercise are presented. These are derived using outranking analysis through the software package D-Sight.

To provide a first scan of the relative strengths and weaknesses of the eight (8) capacity-building options, spider diagrams were constructed (Figures 2 to 13). Because of the relatively large number of options, a separate diagram is presented for each of the 12 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 general (less technical) decision-makers.

Figures 2 and 3 present the up-front investment and on-going costs profiles of the eight (8) SPS capacity-building options. It is immediately obvious that the most expensive capacity-building option in terms of up-front investment is animal health controls for live cattle exports (US$3.36 million). With the exception of laboratory testing capacity of pesticide and veterinary drug residues, all of the other options have an up-front investment of less than US$500,000. All of the options have on-going costs of less than US$250,000 per annum. Options with the highest on-going costs are plant health controls for citrus pulp exports (US$231,036) and animal health and hygiene controls for chicken exports (US$222,950). Conversely, options with very low on-going costs are plant health controls for pitahaya exports and laboratory testing capacity for heavy metals.

Figure 2. Decision criteria measures scores for SPS capacity-building options – up-front investment (US$ million)



The majority of the eight (8) capacity-building options are judged to be 'somewhat' or 'very' easy to implement (Figure 4). Exceptions are animal health controls for live cattle exports and plant health controls for citrus pulp exports, which are considered 'very difficult', and animal health and hygiene controls for beef exports that are judged to be 'somewhat difficult'. The major factor determining the difficult of implementation is the scale of area over which controls are needed.

Figure 3. Decision criteria measures scores for SPS capacity-building options – on-going costs (US$'000)

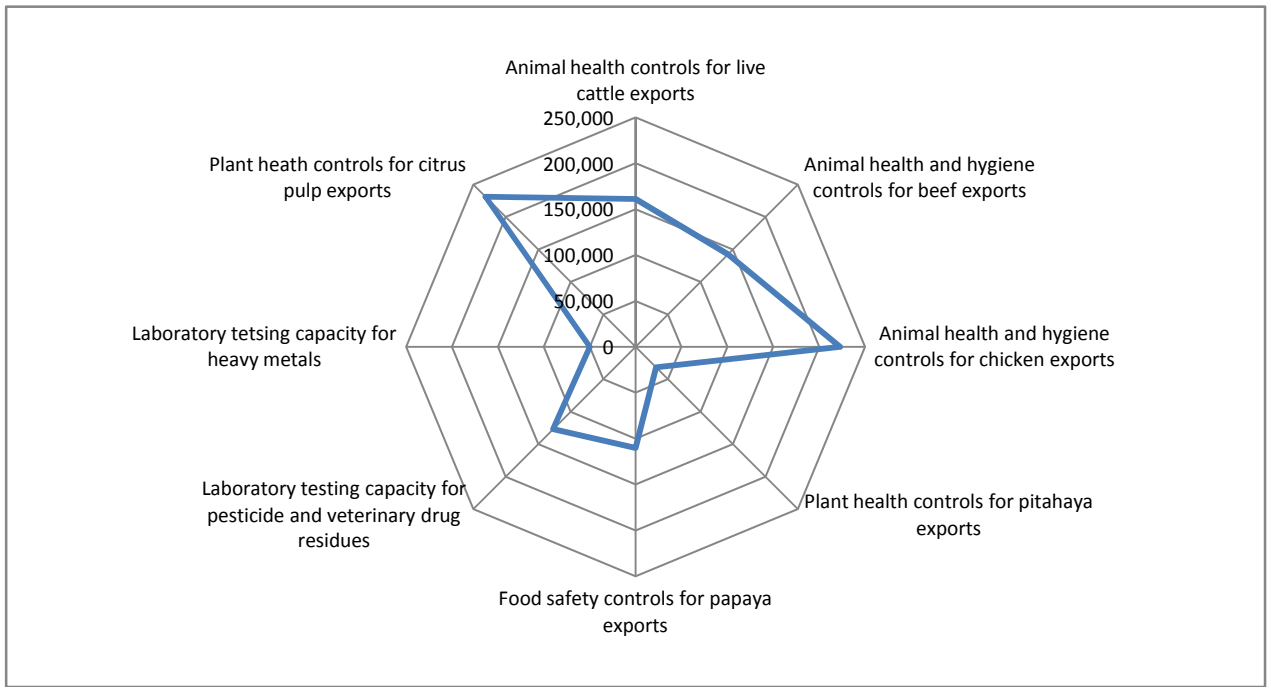
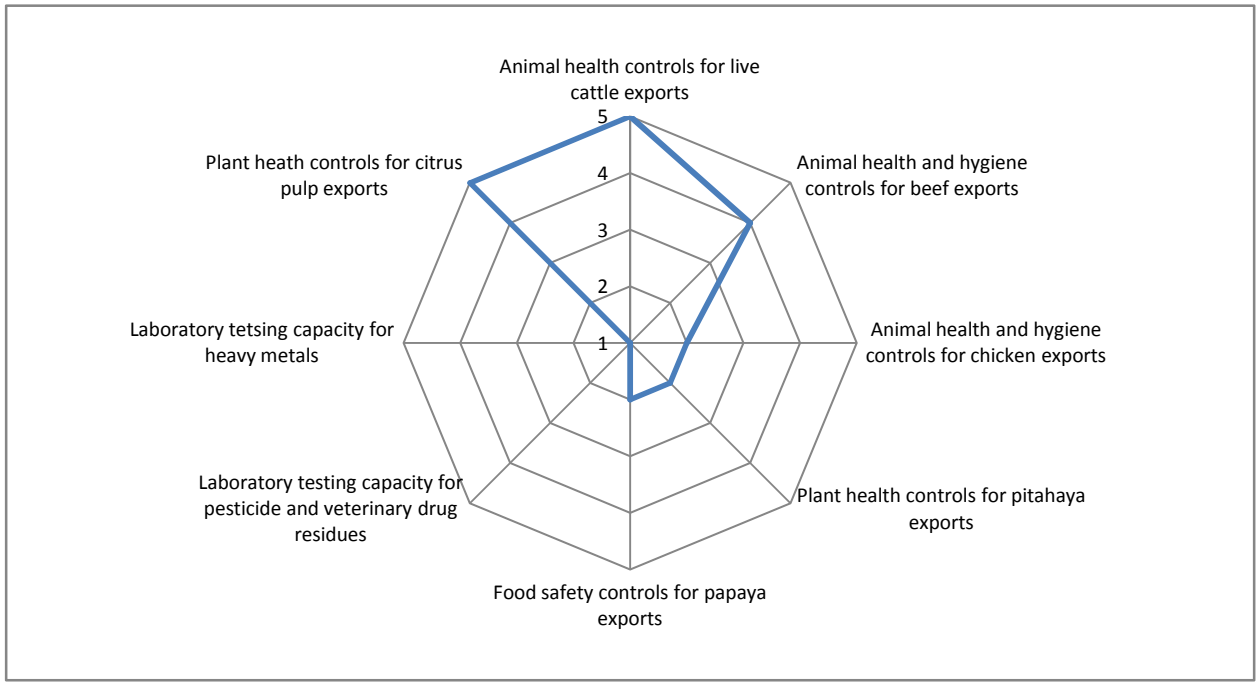


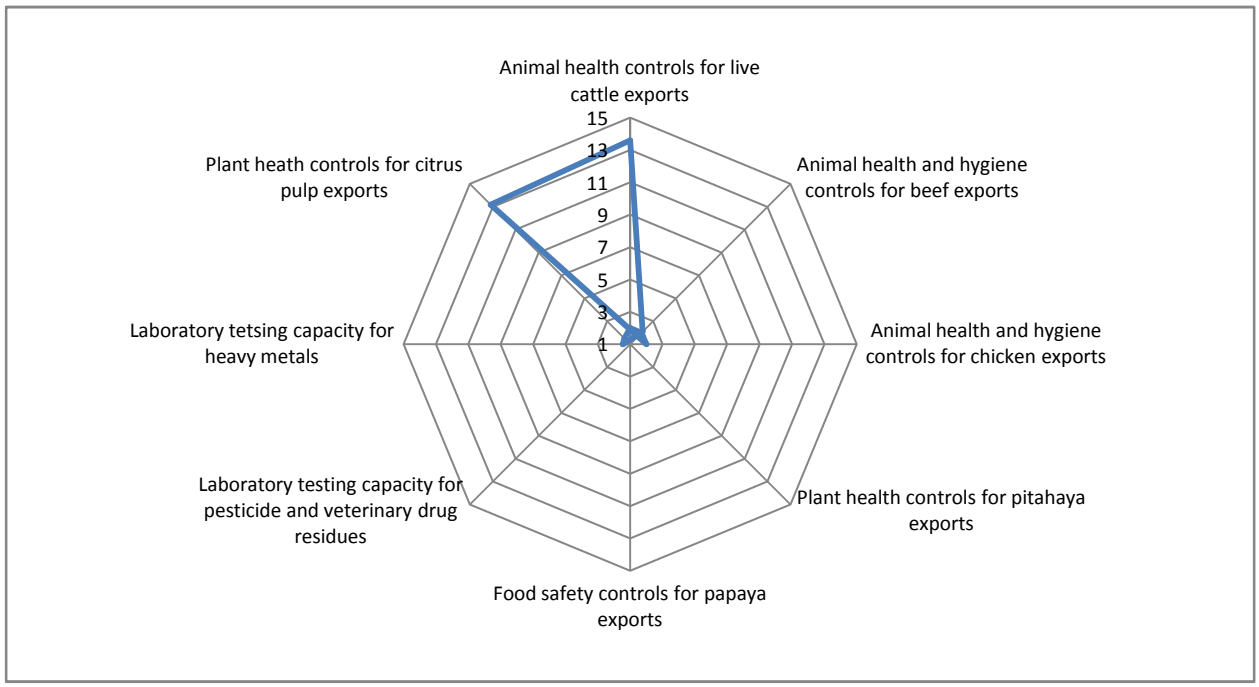
Figure 4. Decision criteria measures scores for SPS capacity-building options - difficulty of implementation



Most of the eight (8) capacity-building options are predicted to have modest impacts in terms of growth in agri-food exports or avoided losses in exports (Figure 5). The notable exceptions are animal health

controls for live cattle exports and plant health controls for citrus pulp exports; it is estimated that these will result in additional exports in 2017 of US$13.6 million and US$13.2 million, respectively.

Figure 5. Decision criteria measures scores for SPS capacity-building options- change in absolute export (US$ million)



Only three (3) of the capacity-building options are predicted to enhance appreciably the diversity of exports across products and/or markets, namely animal health and hygiene controls for beef exports, animal health and hygiene controls for chicken exports, and plant health controls for pitahaya exports (Figures 6 and 7). It is anticipated that plant heath controls for citrus pulp exports would diversify exports across markets but not products.

Figures 8 to 10 report the impacts of the eight (8) options through the domestic agri-food sector. Six of the eight (8) capacity-building options are judged to have positive impacts on agricultural productivity, with the exceptions being laboratory testing capacity for pesticide and veterinary drug residues, and laboratory testing capacity for heavy metals (Figure 8).

It is anticipated that five (5) of the options will have positive impacts on domestic public health, with animal health and hygiene controls for beef exports and animal health and hygiene controls for chicken exports expected to have 'very positive' spill-overs through enhanced food safety (Figure 9). The options judged to have no impacts on domestic public health are animal health controls for live cattle exports, plant health controls for pitahaya exports and plant heath controls for citrus pulp exports.

Figure 6. Decision criteria measures scores for SPS capacity-building options - trade diversification – new products

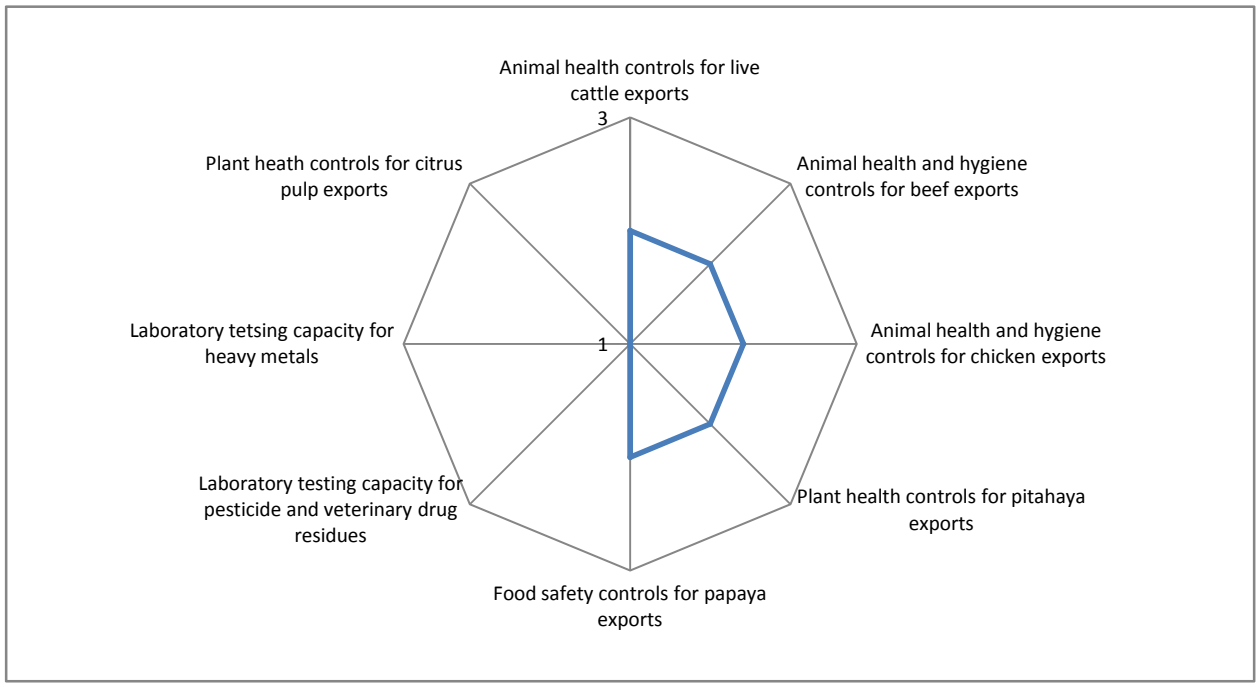


Figure 7. Decision criteria measures scores for SPS capacity-building options - trade diversification – new markets

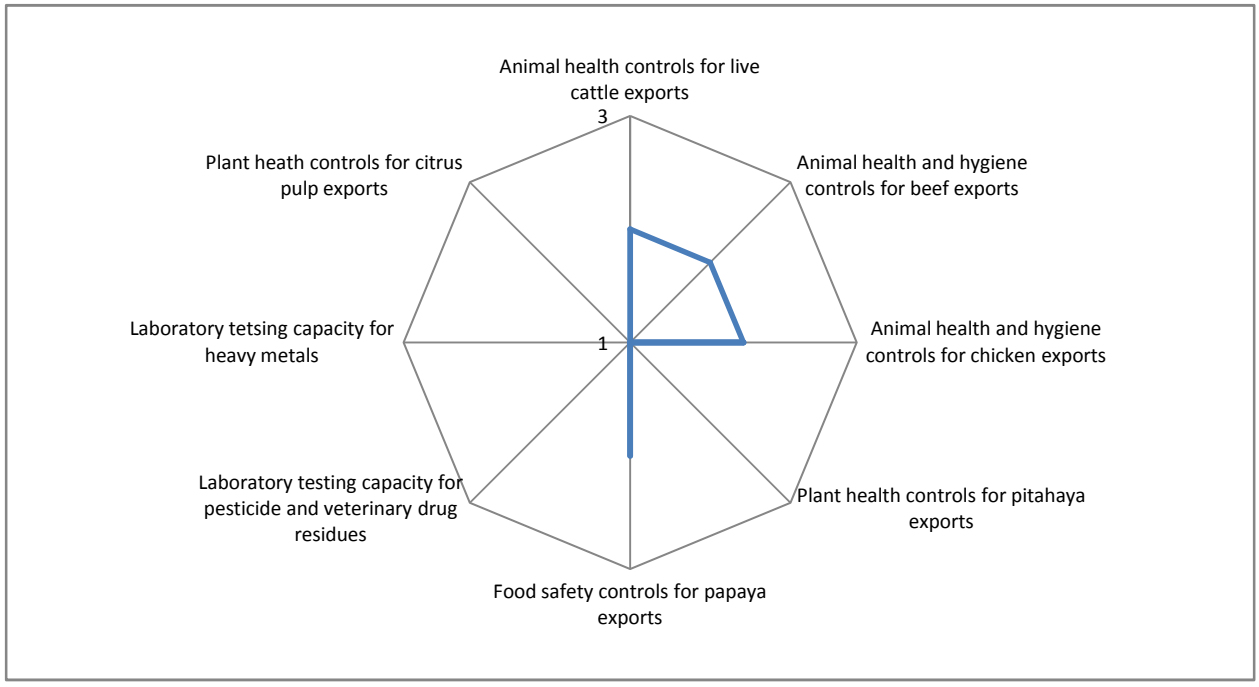


Figure 8. Decision criteria measures scores for SPS capacity-building options - agricultural productivity

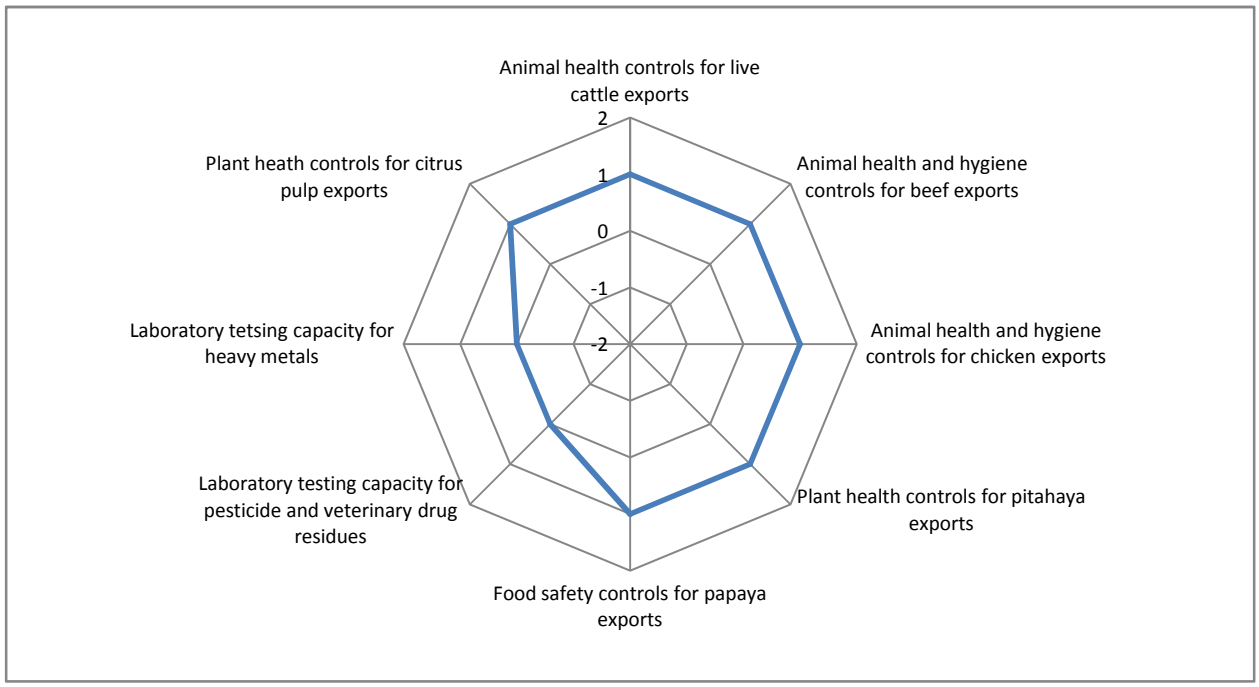
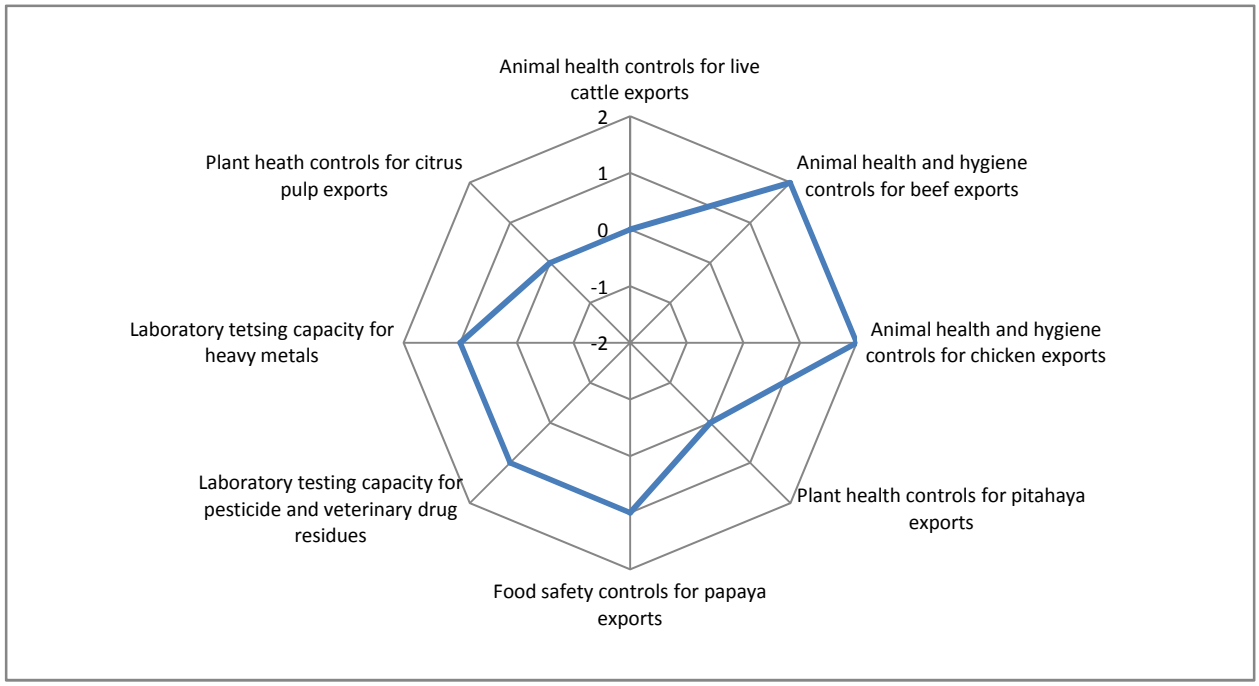


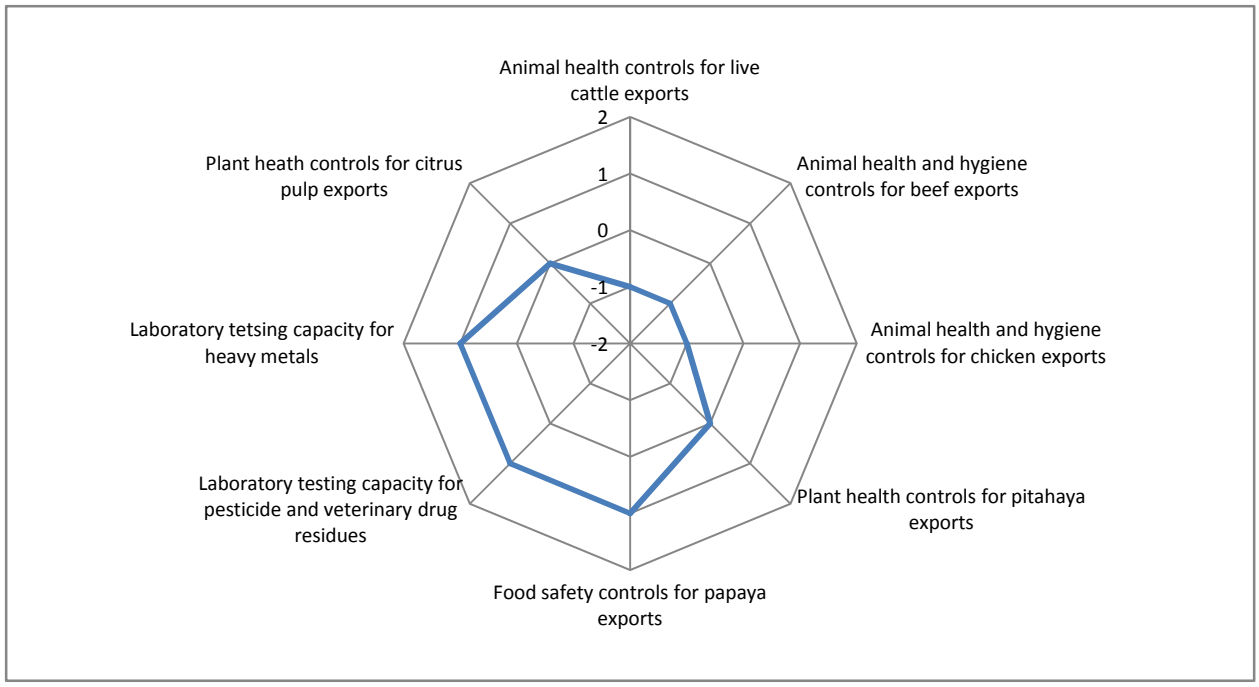
Figure 9. Decision criteria measures scores for SPS capacity-building options -domestic public health



Finally, three (3) of the capacity-building options could conceivably have negative impacts on the natural environment, namely animal health controls for live cattle exports, animal health and hygiene controls for beef exports, and animal health and hygiene controls for chicken exports (Figure 10). These impacts would be through expansion of production areas (leading for example to deforestation) and/or

increased levels of animal waste. Conversely, three (3) options are predicted to have positive environmental impacts, predominantly through reduced residues of pesticides, veterinary drugs and/or heavy metals.

Figure 10. Decision criteria measures scores for SPS capacity-building options -environmental protection



Only one of the capacity-building options is predicted to have a positive social impact in terms of employment and/or poverty, namely food safety controls for papaya exports (Figures 11 and 12). It is anticipated that five (5) of the eight (8) options will impact positively on vulnerable groups, predominantly small farmers and women in more marginal areas, with the exceptions being plant heath controls for citrus pulp exports, animal health controls for live cattle exports, and animal health and hygiene controls for beef exports (Figure 13).

It is apparent that none of the eight (8) 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 pair-wise basis with respect to each of the 12 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'. The maximum score an option can have is +1, in which case it dominates all other options for all 12 of the decision criteria. The minimum score an option can have is -1, in which case it is dominated by all other options for every one of the 12 decision criteria. Thus, options with a positive and larger net flow are given a higher priority. Conversely, options with a negative and larger net flow are given a lower priority.

Figure 11. Decision criteria measures scores for SPS capacity-building options -impact on employment

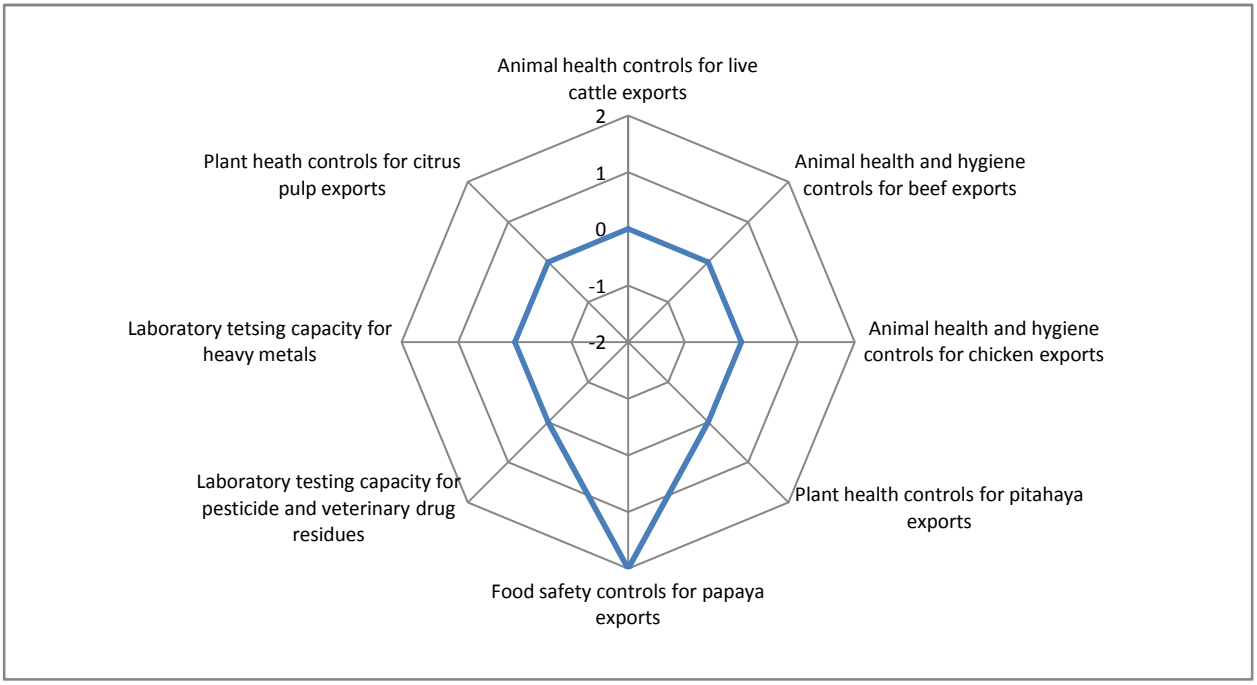


Figure 12. Decision criteria measures scores for SPS capacity-building options - impact on poverty

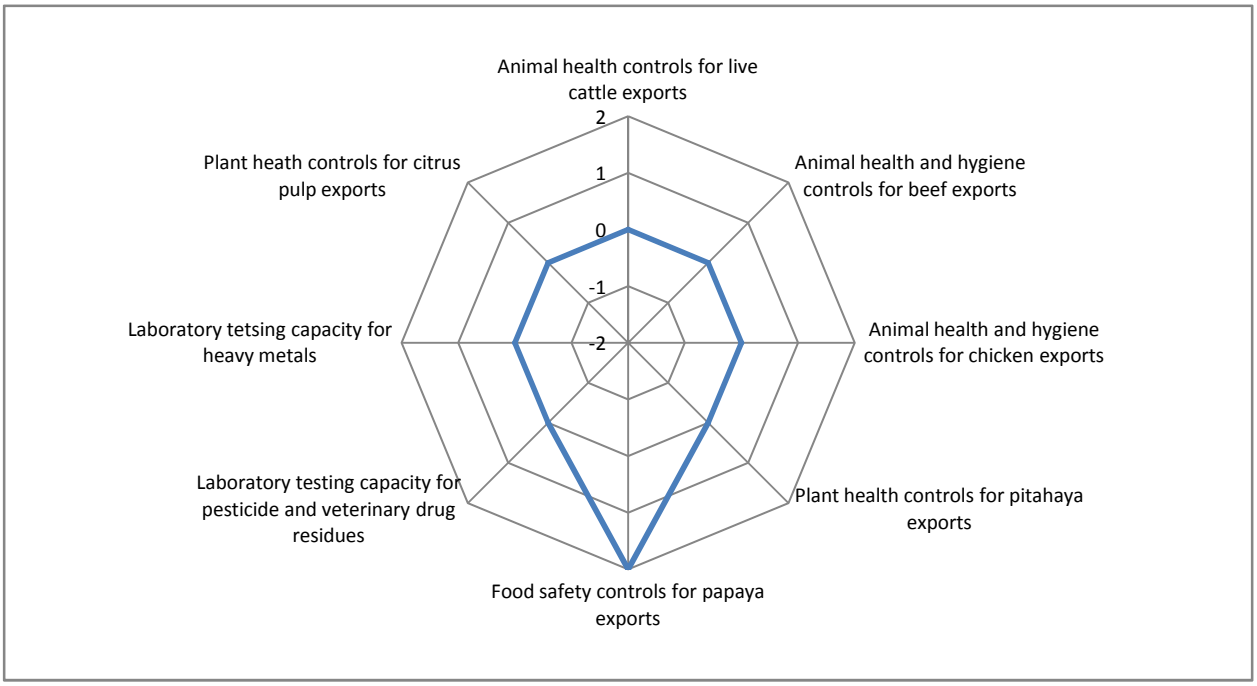


Figure 13. Decision criteria measures scores for SPS capacity-building options -impact on vulnerable groups

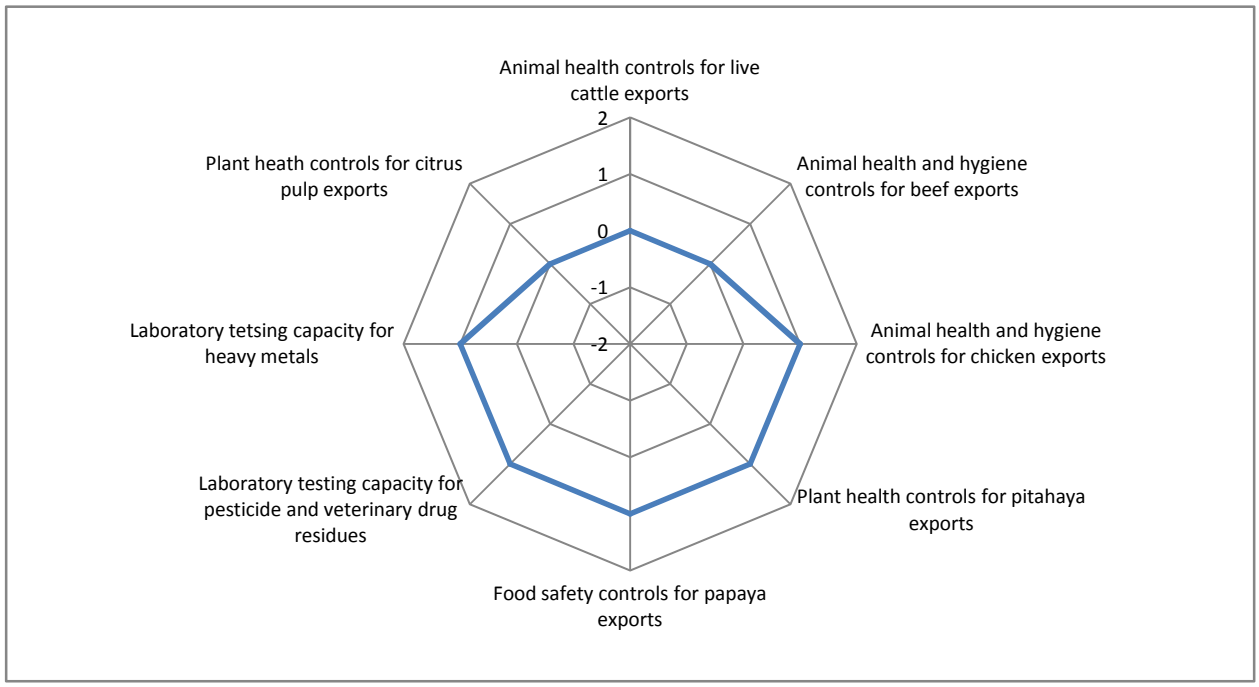


Figure 14 reports the net flows for the eight (8) SPS capacity-building options for the baseline model; that is the prioritisation derived using the decision weights defined in the stakeholder workshop. The options are prioritised from left to right. The option judged to be top priority on the basis of the 12 decision criteria is food safety controls for papaya exports. Other high-ranked options are plant health controls for pitahaya exports, animal health and hygiene controls for chicken exports, and laboratory testing capacity for heavy metals. The remaining four (4) capacity-building options all have negative net flows. The option ranked bottom, and with a net flow significantly below all other options is animal health controls for live cattle exports.

The prioritisation of the eight (8) SPS capacity-building options reflects a trade-off or compromise between all twelve (12) decision criteria. As discussed above, none of the options dominates all others with respect to every one of the 12 decision criteria; if it did it would have a score of +1 (see above). 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 still a degree of compromise in terms of under-performance with respect to certain of these criteria, relative to the other capacity-building options being considered.

The performance of each of the eight (8) capacity-building options with respect to each of the 12 decision criteria is shown in Figures 15 to 22. These figures present the performance of each capacity-building option with respect to each criterion relative to all of the options. The capacity-building option ranked first, food safety controls for papaya exports, has a positive score for all of the decision criteria, with the exception of trade diversification with respect to both new products and new markets. This option performs especially well with respect to its impacts on poverty, employment and environmental protection. Conversely, the option ranked bottom, animal health controls for live cattle exports, has

negative scores for all of the decision criteria with the exception of agricultural/fisheries and trade impact. It is noteworthy that this option scores best of the eight (8) options on trade impact.

Figure 14. Net flows for baseline model

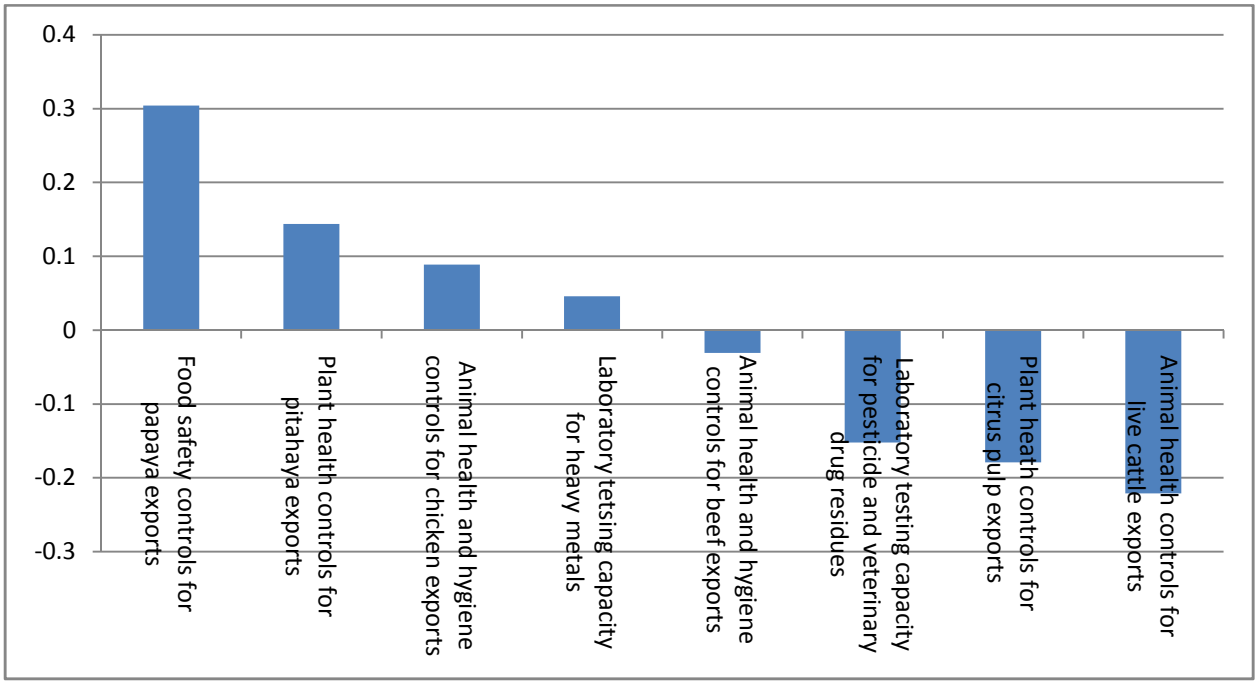


Figure 15. Decision criteria scores from baseline model – animal health controls for live cattle exports

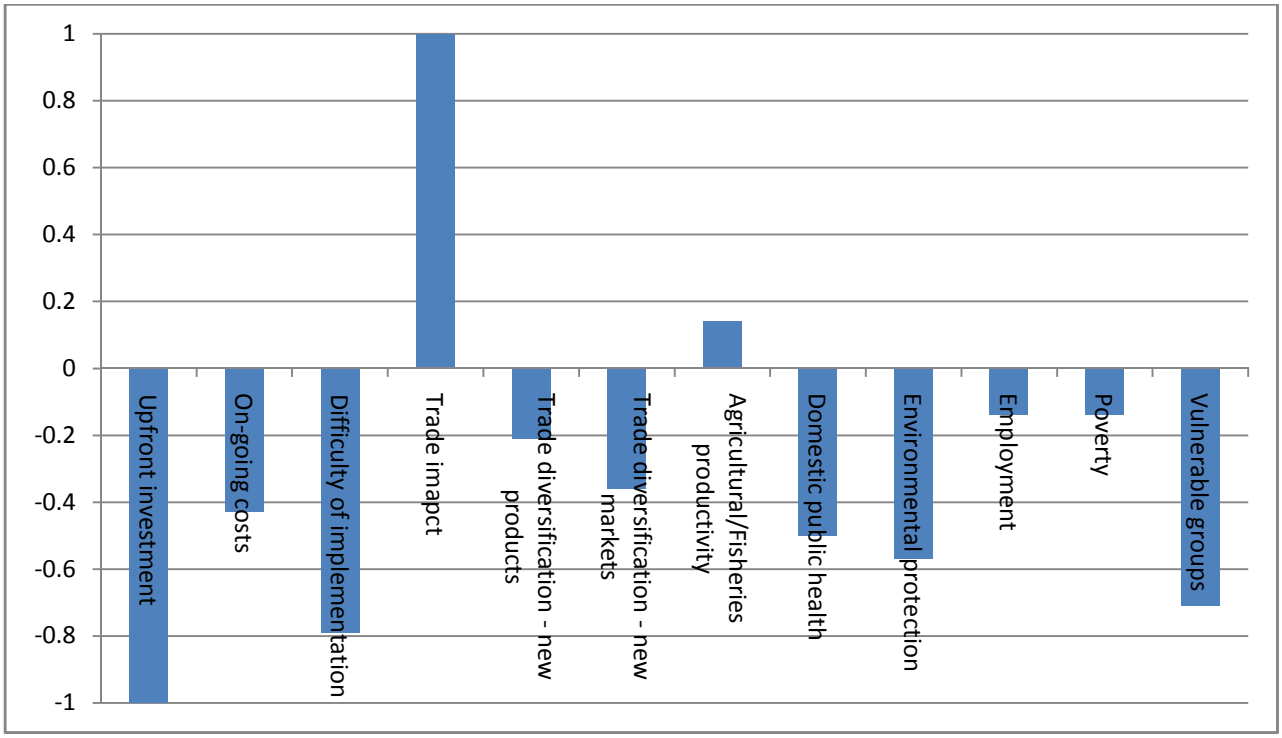


Figure 16. Decision criteria scores from baseline model – animal health hygiene controls for beef exports

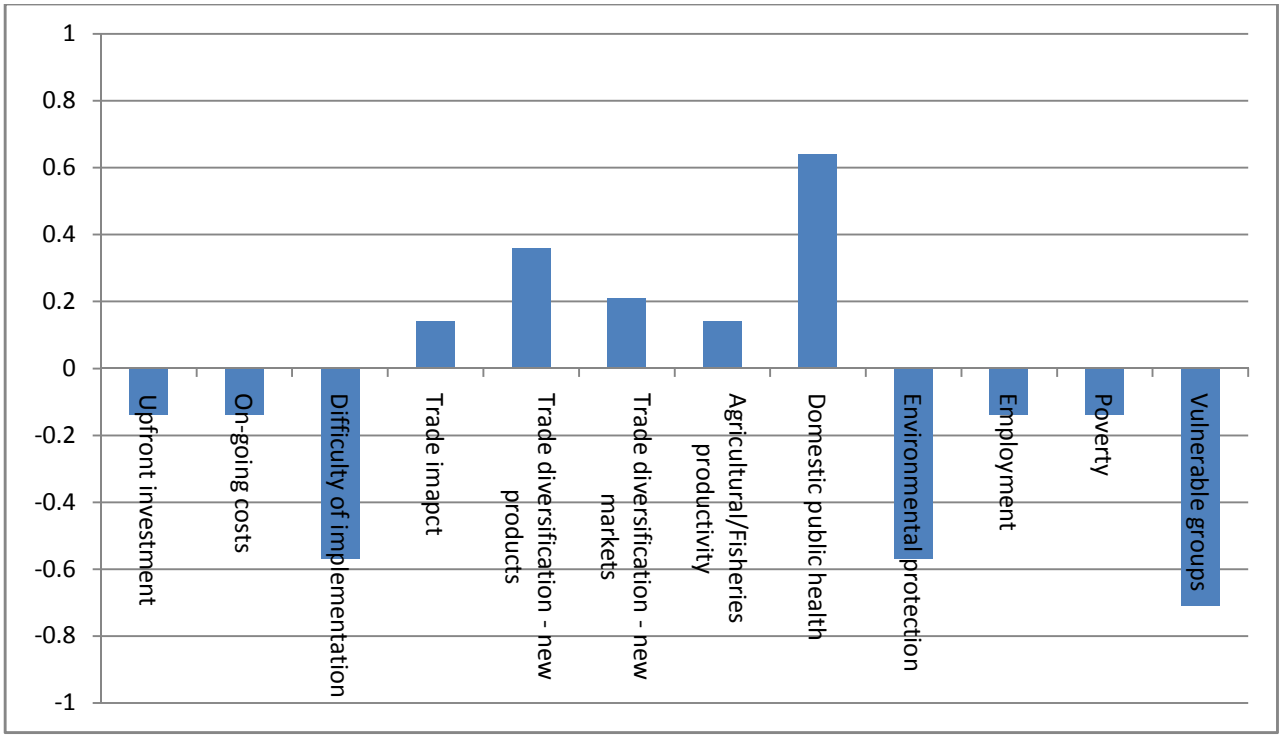


Figure 17. Decision criteria scores from baseline model – animal health and hygiene controls for chicken exports

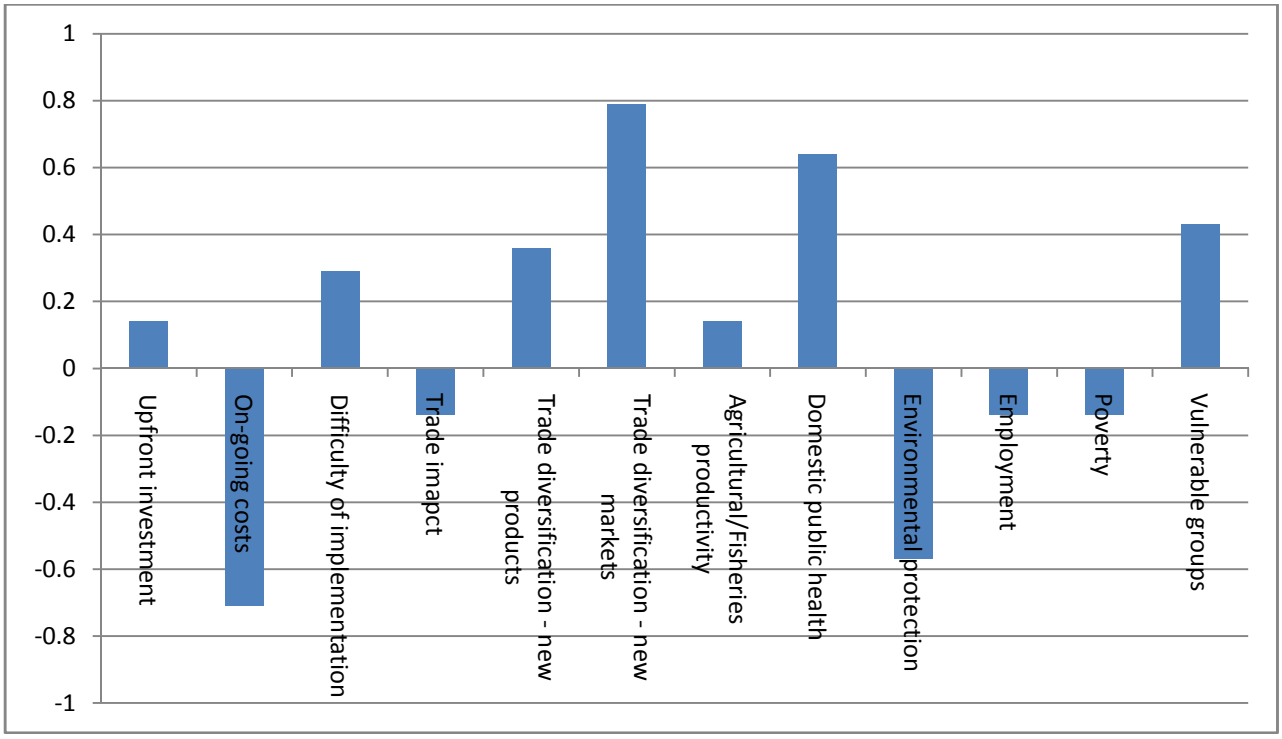


Figure 18. Decision criteria scores from baseline model – plant health controls for pitahaya exports

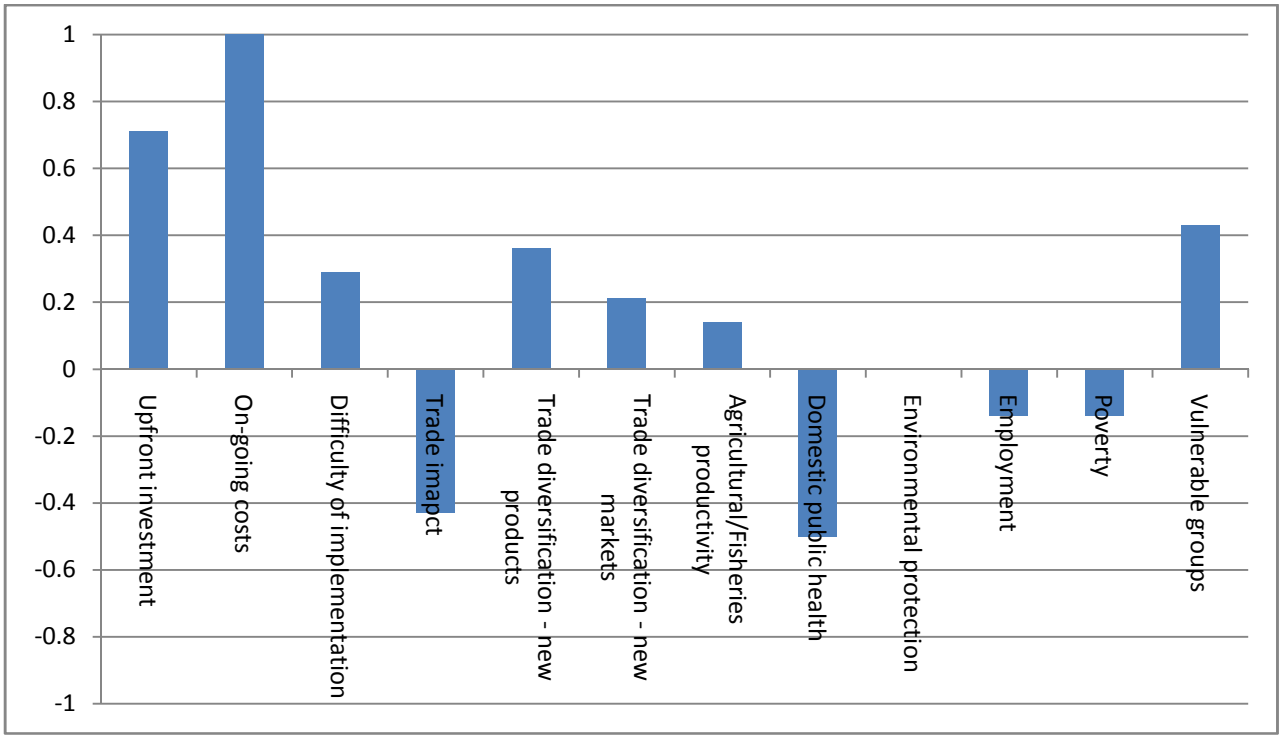


Figure 19. Decision criteria scores from baseline model – food safety controls for papaya exports

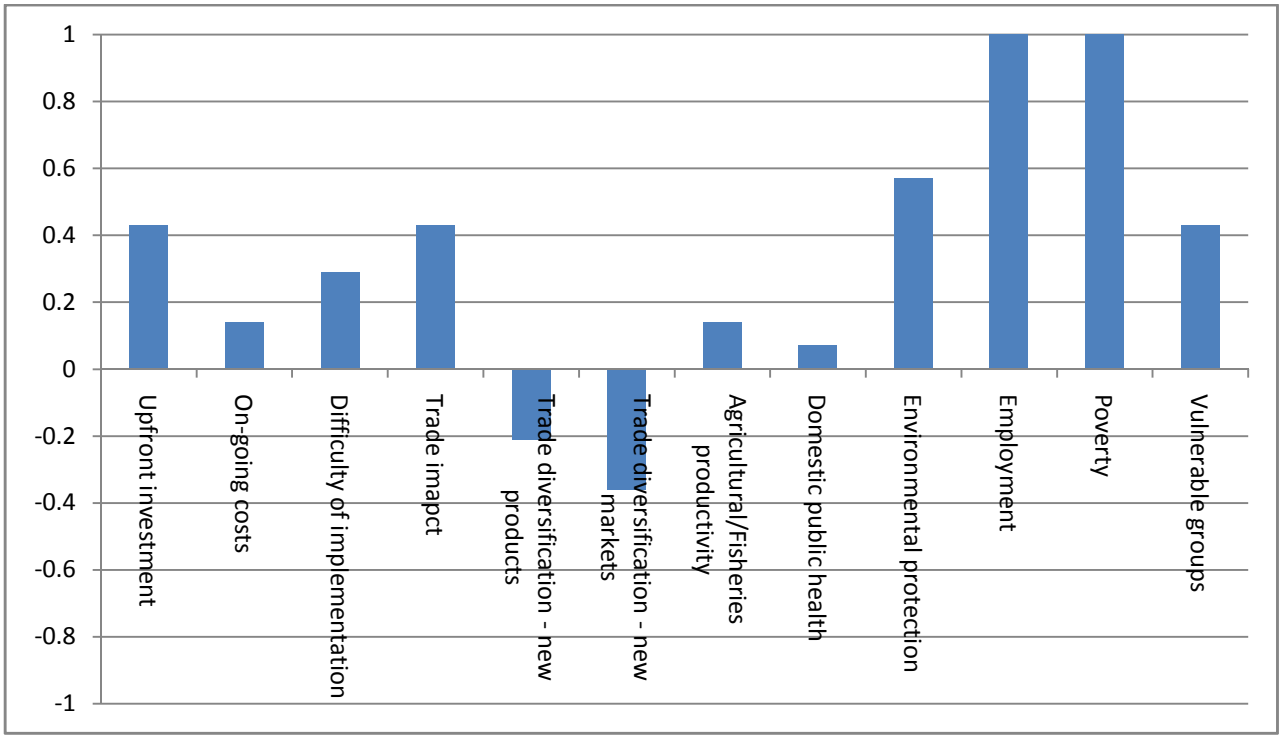


Figure 20. Decision criteria scores from baseline model – laboratory testing capacity for pesticide and veterinary drug residues

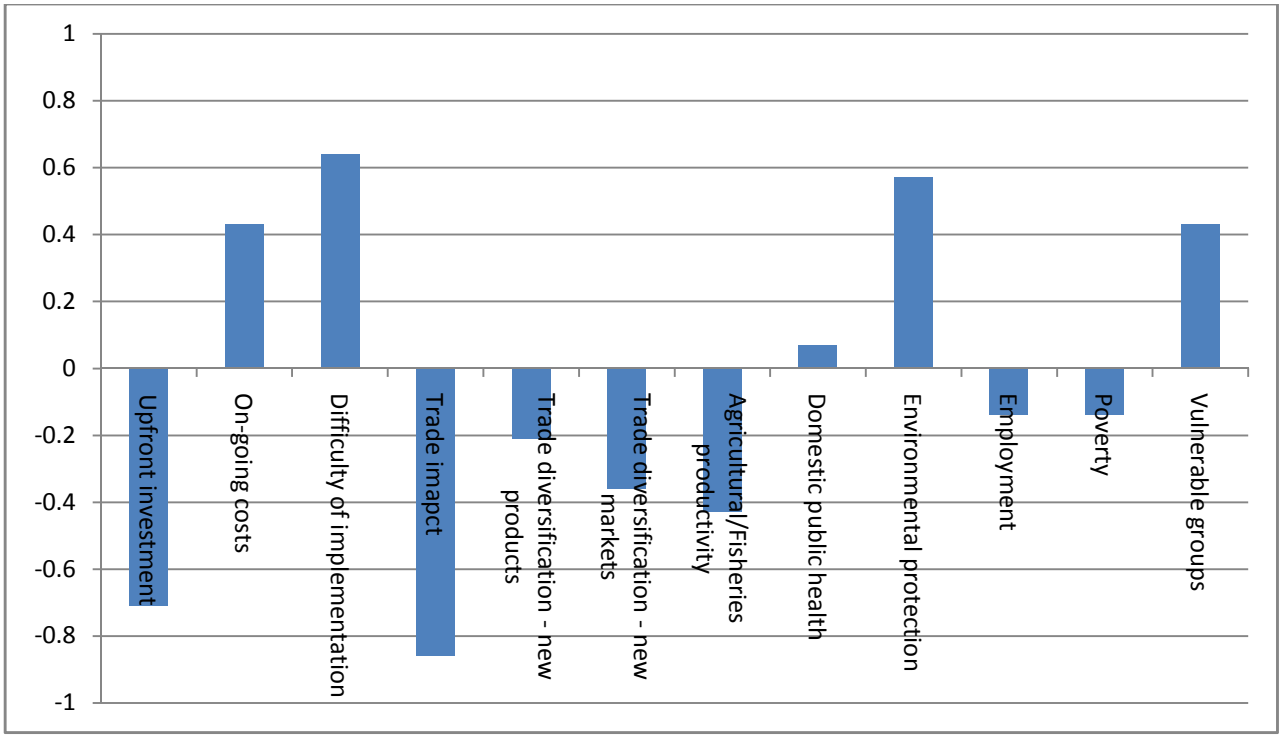


Figure 21. Decision criteria scores from baseline model – laboratory testing capacity for heavy metals

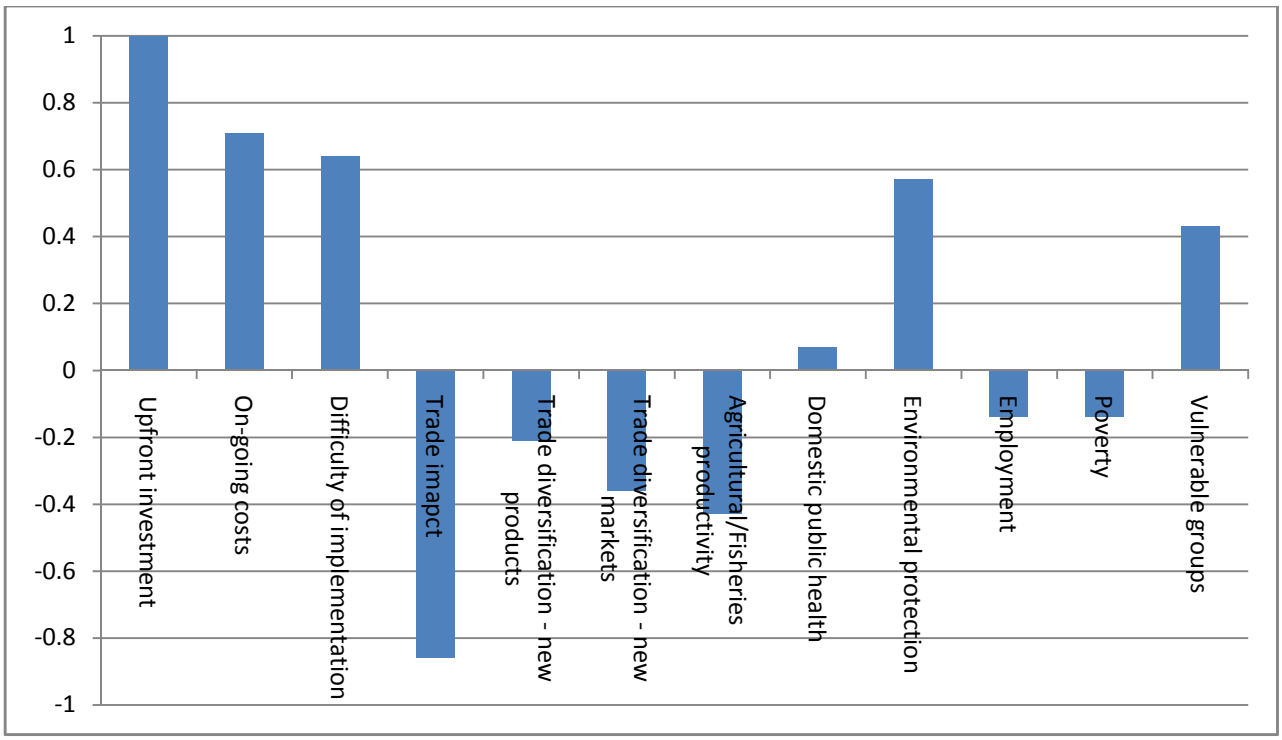
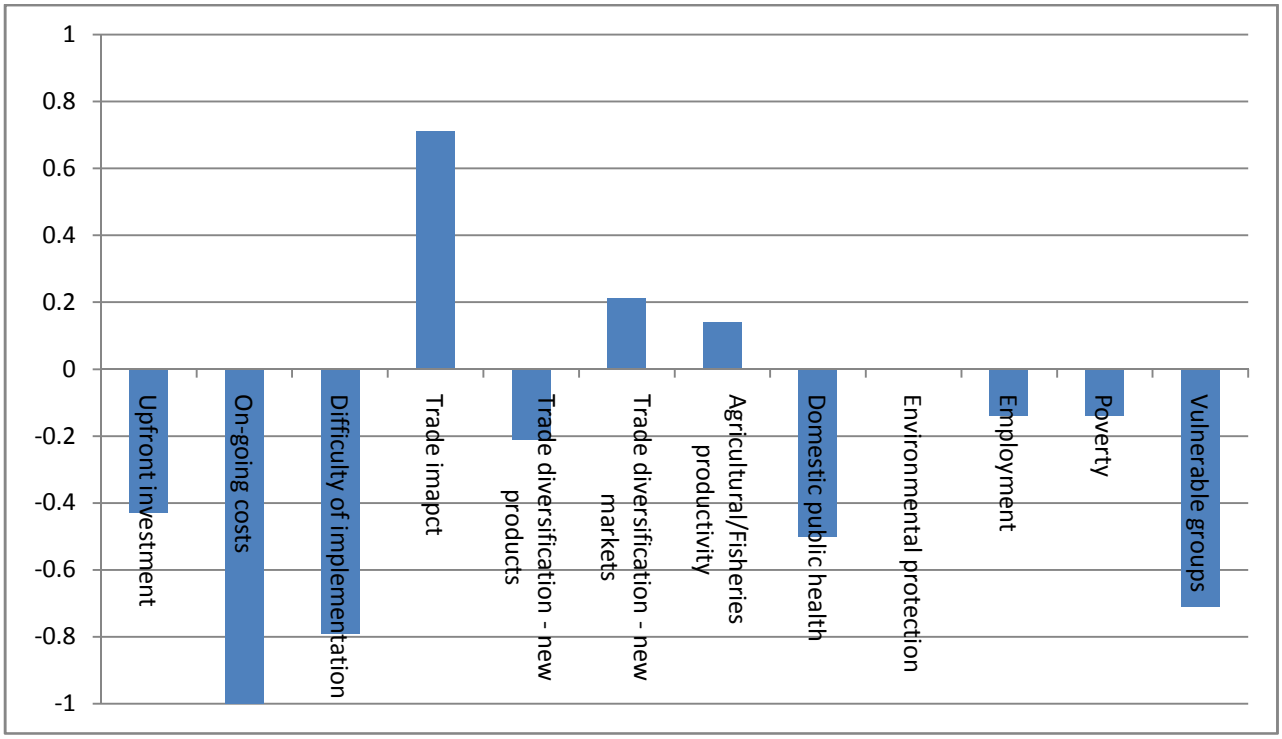


Figure 22. Decision criteria scores from baseline model – plant health controls for citrus pulp exports

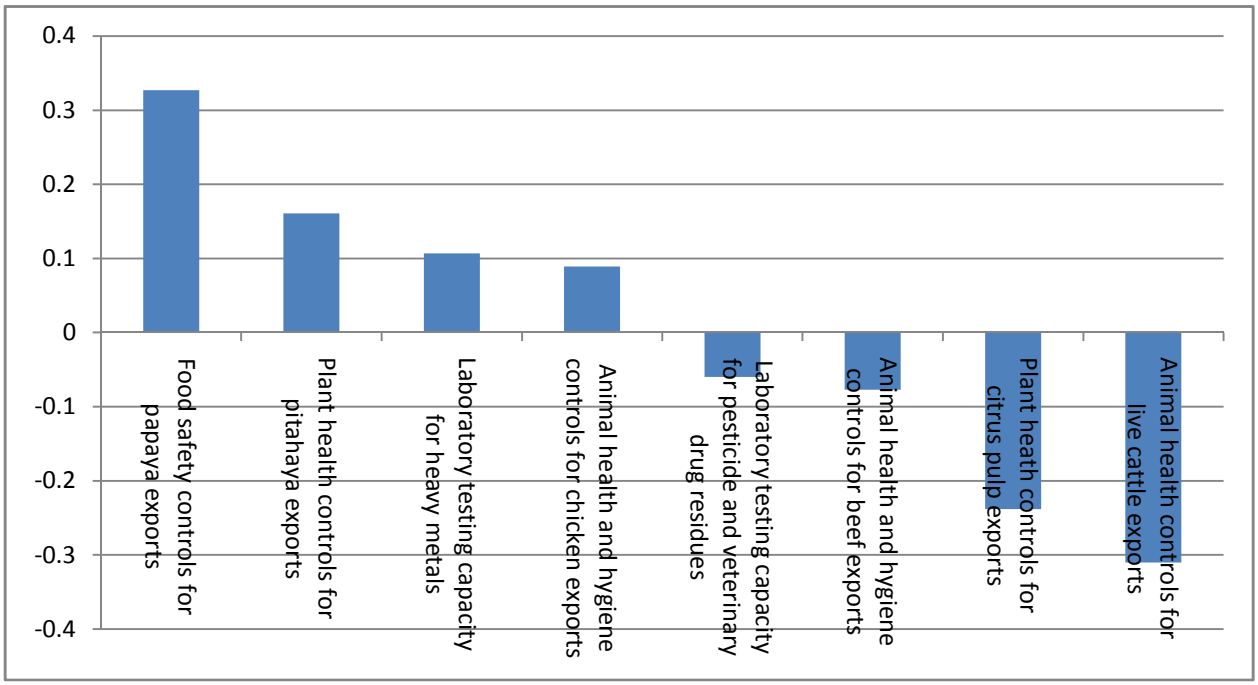


So far the core results of the analysis have been presented. These are based on the decision criteria and weights derived from the stakeholder workshop, and as such they arguably represent the most valid prioritisation. It is important to recognise, however, that different stakeholder groups might have distinct perspectives on the criteria that should drive the prioritisation of the capacity-building options and/or the weights that should be assigned to particular criteria. Such differences can lead to conflict in decision-making processes, such that it is important to ascertain where distinct perspectives on the decision criteria have an appreciable impact on the prioritisation and where they do not. In cases where the prioritisation is insensitive to changes in the decision criteria, it should be relatively easy to come to collective agreement on which options should be prioritised. Where changes to the decision criteria have appreciable impacts on the prioritisation it may be necessary to enter into a more extensive process of consultation or to explore the reasons why different stakeholder groups put more or less weight on particular criteria.

Figures 23 and 24 present alternative scenarios, the aim of which is to ascertain the sensitivity of the results of the baseline model to changes in the decision criteria. The first of these alternative models assumes that all 12 of the decision criteria are weighted equally. Implicitly this negates the weightings derived in the stakeholder workshop. For example, it might be viewed that the workshop was not representative of stakeholders more generally, or was biased towards particular interests. It will be seen, however, that the same four (4) capacity-building options as in the baseline model are ranked top. There are, however, some slight changes in the ordering of certain capacity-building options. Thus, animal health and hygiene controls for chicken exports (shifting from third to fourth) and laboratory testing capacity for heavy metals (shifting from fourth to third) swap positions in the ranking. Likewise,

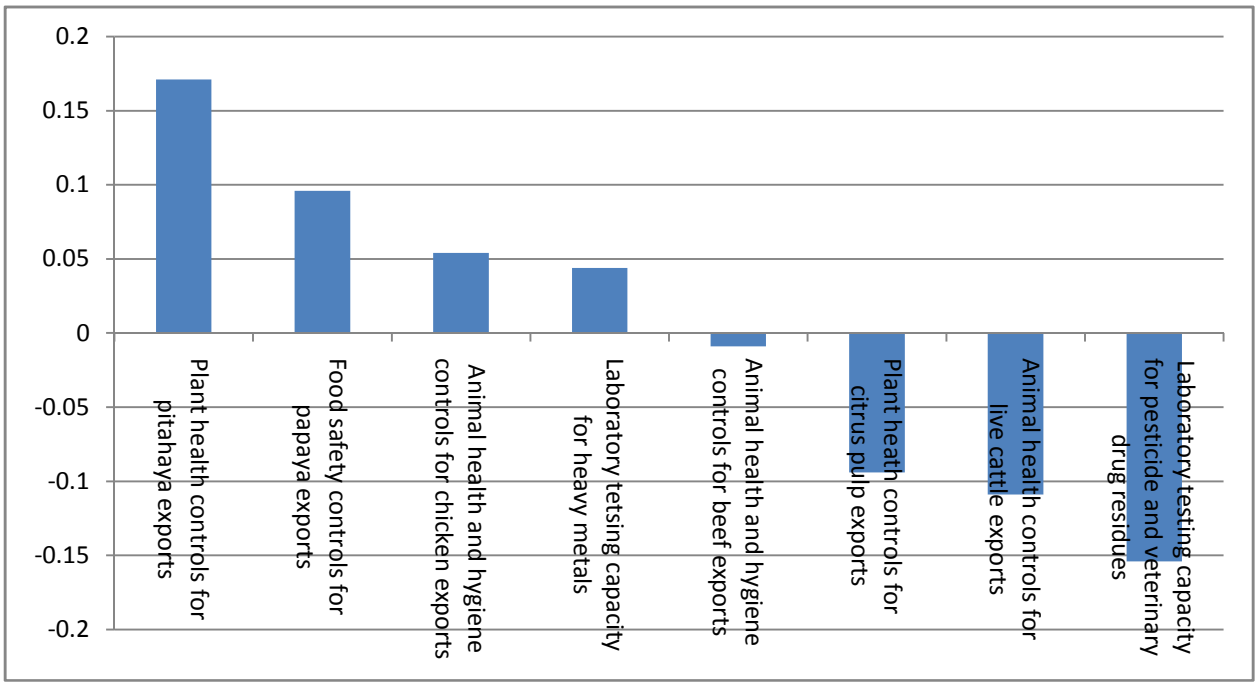
animal health and hygiene controls for beef (shifting from fifth to sixth) and laboratory testing capacity for pesticide and veterinary drug residues (shifting from sixth to fifth) swap positions. These results suggest that the derived priorities are relatively robust to changes in the decision weights.

Figure 23. Net flows for equal weights model



An alternative scenario, which might for example be the perspective of the Ministry of Trade**,** Investment Promotion, Private Sector Development and Consumer Protection, assumes that the prioritisation of SPS capacity-building should be driven by cost-effectiveness in terms of impacts trade alone. Thus, the model in Figure 24 only includes the following decision criteria: upfront investment, on-going costs, difficulty of implementation, trade impact, trade diversification – new products, and trade diversification – new markets. The respective weightings from the baseline models are preserved. Again, the same four (4) capacity-building options as in the baseline model are ranked top, although plant health controls for pitahaya exports (shifts from second to first) and food safety controls for papaya exports (shifts from first to second) swap positions. It is noteworthy that, despite its dominant impact on trade (see Figure 15), animal health controls for live cattle exports only moves from eighth to seventh in the ranking.

Figure 24. Net flows for cost/difficulty of implementation and trade impact model



6. Lessons and challenges for the future application of the framework in Belize

Through experiences in applying the MCDA framework in Belize, as well as other countries, a number of lessons and challenges can be identified for the future application of the framework in Belize. Below a number of the key lessons and challenges are discussed in turn, focusing on those that are most likely to be issues in the on-going application of the MCDA framework in Belize. In each case, there is some discussion of the nature of the issue and, where appropriate how this can be addressed.

A key component of the MCDA framework is the stakeholder workshop. It is through the workshop that the portfolio of SPS capacity-building needs that enter the prioritisation are identified, and the decision criteria and weights that drive the analysis are defined. A concern, therefore, is the degree to which the participants at the workshop reflect the full range of stakeholder interests and concerns, for example across the public and private sectors, food safety and plant and animal health, agri-food commodities, etc. Clearly, the composition of participants at the workshop is important; if any key constituencies are excluded their voice will not be heard. It is important to recognise, however, that the numbers of participants representing a particular stakeholder groups is less important. Thus, the capacity-building options and decision criteria are defined in a way that each individual has an equal voice. No effort is made to prioritise these elements of the process on the basis of the number of participants raising an issue.

The application of the MCDA framework *per se*, does not require any technical knowledge of food safety, plant health and/or animal health capacities. Indeed, in many ways it is important that the person driving the application of the framework has a broader perspective, including on trade and socio-economic issues, and is certainly not seen as having a particular interest in the outcome of the analysis.

At the same time, however, technical expertise in the various elements of SPS capacity is needed amongst the team involved in applying the framework. Thus, for each of the identified capacity-building needs an information card has to be completed. Estimation of the up-front investment and on-going costs, for example, may require detailed technical knowledge of the prevailing weaknesses in capacity and the actions needed to address these. The implication is that the MCDA framework should optimally be implemented by a multi-disciplinary team of SPS technical experts and social scientists.

Given that the aim is for the MCDA framework to be used on an on-going basis to establish and then to update priorities for SPS capacity-building, it is important to recognise the complementarities with other assessment frameworks, notably the PCE and PVS tools of the IPPC and OIE, respectively. From the outset, it must be recognised that the MCDA framework addresses a very different set of questions to the PCE and PVS tools. Thus, its focus is on determining priorities amongst established capacity-building needs, with a focus on the portfolio of associated costs and benefits. The PCE and PVS tools instead are aimed at identifying weaknesses in plant and animal health capacity, respectively, relative to international benchmarks. The results of the applications of these tools, therefore, can be seen as important prior information for the identifying of the capacity-building needs that enter the MCDA framework. Indeed, as explained in the user guide[12], the starting point for the MCDA framework is the synthesis of prior assessments of SPS capacity. In the case of Belize, results from the application of the PCE and PVS tools, as well as IICA's PVS analysis, were important elements of the information dossier that was compiled.

The focus of the MCDA framework is on weaknesses in SPS capacity that result in impediments to trade. The focus of national efforts to build SPS capacity in Belize, however, extends to weaknesses in capacity that have little or no relevance to trade but that can have significant impacts on public health, agricultural productivity and/or the natural environment. The MCDA framework does permit such considerations to enter as decision criteria, as was the case in Belize, although as externalities of SPS capacity-weaknesses that do have trade implications. In order to extend the framework to SPS capacity-building needs more generally, some relatively minor adjustments would be needed to certain procedures, namely:

- The composition of participants at the stakeholder workshop would need to be extended to include public and private organisations and institutions focused on domestic SPS issues.
- The question addressed by the framework and posed in the stakeholder workshops would need reframing to cover SPS capacity-building needs that are focused on both trade and domestic needs.
- The criteria employed to rank the identified priority-setting needs would need to be extended and reframed; this will be facilitated by the re-composition of the stakeholder workshop as described above.

Beyond these, the analysis is undertaken is exactly the same way as described in the user guide.

[12]Henson and Masakure (2009) *op cit*.

One concern with the framework is that it can be taken to imply that weaknesses in SPS capacity are the primary constraint to trade, when in fact SPS capacity is but one of a number of impediments to trade, and indeed may not even be the primary factor impeding export performance. Thus, at the stakeholder workshop in Belize a number of seemingly SPS-related trade issues were identified where in fact other competitiveness factors were the major issue. It is important to recognise, however, that this issue is substantially dealt with by the process of sifting the SPS capacity-building options identified at the stakeholder workshop. Thus, in the case of the current analysis, a total of 13 of the 21 options identified at the workshop were excluded through this sifting process. The importance of this sifting process is that it enables stakeholders to be free to put forward their own views and perspectives on SPS capacity-building needs, even if some of these are ultimately not SPS-related trade issues.

7. Conclusions

This report has presented the initial results of a priority-setting exercise for SPS capacity-building in Belize. The priorities were defined using a prioritisation framework based on MCDA, which provides a structured and transparent approach to ranking capacity-building options on the basis of predefined and agreed decision criteria. The options to be considered were identified through a process of stakeholder consultation that was informed by a review of prior assessments of SPS capacity. In this case, 21 distinct SPS capacity-building options were identified, of which 13 were subsequently excluded as not representing substantive SPS issues. The eight (8) remaining capacity-building options were then prioritised on the basis of a series of twelve (12) decision criteria to which weights were applied, both of which were derived through a similar process of stakeholder consultation. These criteria cover the upfront and on-going costs and difficulty of implementing the capacity-building options and the pay-off from these investments in terms of impacts on trade, spill-overs on agricultural/fisheries productivity, public health and the environment, and the degree to which they bring about broader socio-economic benefits in terms of employment, poverty and impacts on vulnerable groups.

The result of the application of the MCDA framework is a clear ranking of the eight (8) capacity-building options that are identified, which is apparently robust to changes in the decision criteria that are applied and to the weights attached to these criteria. Thus, of the eight (8) options in the analysis the following four (4) are consistently ranked as high priority:

- Food safety controls for papaya exports.
- Plant health controls for pitahaya exports.
- Animal health and hygiene controls for chicken exports.
- Laboratory testing capacity for heavy metals.

Conversely, animal health controls for live cattle exports and plant health controls for citrus pulp exports are consistently ranked bottom of the eight (8) options under consideration.

Given the robustness of the results, the ranking provided by the MCDA framework provides a coherent basis on which to define a national action plan for SPS capacity-building in Belize, and to support efforts to secure the necessary resources, both nationally and internationally. However, importantly, the results presented above should be only the starting point in the use of MCDA to prioritise SPS capacity-

building in Belize. Thus, these results should be revisited and revised on an on-going 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. If new capacity-building needs arise, these need to be added to the analysis. Conversely, as investments are made in the options included above, these need to be excluded and the priorities re-estimated.

It is possible that some stakeholders will be concerned about the prioritisation of the eight (8) capacity-building options; they may feel that a particular option has been treated harshly, or that too much weight has been attached to a particular criterion. They might also be concerned about some of the estimates in the information sheets. The rankings are based on the results of the stakeholder consultation process and the collection and collation of data directed at the compilation of the information sheets. It is almost always possible to improve on this process, for example by encompassing the perspectives of a larger number and wider range of stakeholders. It is important to recognize that a key function of the MCDA analysis is to facilitate debate over the prioritisation of the capacity-building options; the output of the framework should not be seen as 'final' but instead the basis on which differences in opinion can be explored and consensus over which options should be given priority is moved towards. Thus, if a particular group of stakeholders is unhappy about the results of the prioritisation they should be invited to present new data that can be used to revise the information sheets. Such changes can then be employed and the model re-estimated accordingly.

.

Appendix 1.Contents of Information Dossier

AFC Consultants (2009).*Enhancement of National Sanitary and Phytosanitary Capacity*.AFC Consultants, Bonn.

Barnett, C., Catzim-Sanchez, A. and Humes, D. (2010).*Belize: Horizon 2030*. Barnett and Company, Belmopan.

BELTRAIDE (2008). *National Export Strategy: Belize*. Belize Trade and Development Services, Belmopan.

Ellis, G. and Marsden, W. (2009). *Report on Inspection Visit to the Belize Agricultural Health Authority (BAHA) and Beef Cattle Farms and Slaughtering Establishment in Belize CA.* Ministry of Agriculture and Fisheries, Jamaica.

FAO (2004). *IPPC PCE Results: Belize*. Food and Agriculture Organisation, Rome.

Gomez, D. (2006). National Export Strategy Belize 2007-2012. Belize Trade and Development Services, Belmopan.

Government of Belize (2003). *National Food and Agriculture Policy 2002-2020*. Ministry of Agriculture and Fisheries, Belmopan.

Government of Belize (2009). *Bridging the Gap in Development Assistance: Belize's Aid For Trade Strategy.* Ministry of Foreign Affairs and Foreign Trade, Belmopan.

Government of Belize (2010). *Belize Medium-Term Development Strategy 2010-2013*. Ministry of Economic Development, Commerce and Industry and Consumer Protection, Belmopan.

IICA (2008). *Results of Application of PVS Tool to Belize*.Inter-American Institute for Cooperation in Agriculture, San Jose.

OIE (2010). *OIE PVS Gap Analysis: Belize*. International Organisation for Animal Health, Paris.

Scanagri (2007). *Belize Marketing Study*. Scanagri, Copenhagen.

Stemshorn, B., Pacer, R., Sotgia, S. (2010).*OIE PVS Gap Analysis: Belize*. International Organisation for Animal Health, Paris.

Stemshorn, B., Ugarte, R. and Logan, L. (2009). *OIE PVS Tool: Belize*. International Organisation for Animal Health, Paris.

Appendix 2.Participants at Stakeholder Workshop, Thursday 3rd May 2012

Name	Organisation	E-mail
Delilah Cabb	Belize Agricultural Health Authority	bahasps@btl.net
Margarito Garcia	Belize Agricultural Health Authority	margargarciabzkind@gmail.com
Miguel Figueroa	Belize Agricultural Health Authority	Miguel.Figueroa@baha.bz
Natalie Gibson	Belize Agricultural Health Authority	natalie.gibson@baha.bz
HernanZetina	Belize Agricultural Health Authority	ernzetina69@hotmail.com
Kenrick Witty	Belize Agricultural Health Authority	khwitty@yahoo.com
OrlaKantun Coleman	Ministry of Foreign Affairs	-
Nancy Namis	Directorate of Foreign Trade	nancynamis@yahoo.com
Roberto Harrison	Ministry of Natural Resources & Agriculture	roberto.harrison@agriculture.gov.bz
Philip Tate	Ministry of Natural Resources & Agriculture	tate@agriculture.gov.bz
Denise Swan	Directorate of Foreign Trade	daswan024@gmail.com
John Rivero	Ministry of Economic Development & Trade	john.rivero@mft.gov.bz
Mark Hazeldine	BELTRAIDE	mark@belizeinvest.org.bz
Mark Noralez	BELTRAIDE	markn@belizeinvest.org.bz
Jose Novelo	Ministry of Natural Resources & Agriculture	jenovel@yahoo.com
Harold Parham	Belize Livestock Producers Association	hparhambze@yahoo.com
Fermin Blanco	OIRSA	oirsarep1@btl.net
Wilfred Pascascio	Citrus Products of Belize	wilfred@citrusproductsbelize.com
Victoriano Pascual	Ministry of Natural Resources & Agriculture	victorianopascual@hotmail.com
Orlando Habet	Belize Poultry Association	belizepoultry@yahoo.com
Yamili Cano Vasquez	Belize Agricultural Health Authority	hrdirector.baha@gmail.com
Roberto Manzanero	Belize Agricultural Health Authority	roberto.manzanero@baha.bz
Jaime Monroy	BEL-CAR Imports & Exports Ltd	bel-car@btl.net
Francisco Gutierrez	Belize Agricultural Health Authority	frankpest@yahoo.com
Joe Myers	Belize Agricultural Health Authority	joe_my2003@yahoo.com
Otto Friessen	BEL-CAR Imports & Exports Ltd	-
Maximiliano Ortega	IICA	maximiliano.ortega@iica.int
Dr. Caroline Herron	University of Belize	cherron@ub.edu.bz
Ary Sosa	Ministry of Health	ary.sosa@chr.health.gov.bz
Rosie Rivero	Ministry of Economic Development/NAO	fc.officer@nao.gov.bz
Thomas Young	Customs & Excise Department	cusnet@btl.net
Alexandra Bedran	Running W	alexandrabedran@gmail.com
Florencio Esquivel	Fruta Bomba	lencho@frutabomba.com
Miguel Depaz	Belize Agricultural Health Authority	depaz_2004@yahoo.com
Ervin Plett	Country Foods	bzeggs@gmail.com

Appendix 3.Participants at Stakeholder Workshop, Monday 20th August 2012

Name	Organisation	E-mail
Delilah Cabb	Belize Agricultural Health Authority	bahasps@btl.net
Margarito Garcia	Belize Agricultural Health Authority	margargarciabzkind@gmail.com
Miguel Figueroa	Belize Agricultural Health Authority	Miguel.Figueroa@baha.bz
Endhir Sosa	Belize Agricultural Health Authority	endhir.sosa@baha.bz
Hernan Zetina	Belize Agricultural Health Authority	ernzetina69@hotmail.com
Kenrick Witty	Belize Agricultural Health Authority	khwitty@yahoo.com
Orla Kantun Coleman	Ministry of Foreign Affairs	okc26@hotmail.com,
Philip Tate	Ministry of Natural Resources & Agriculture	tate@agriculture.gov.bz
Denise Swan	Ministry of Trade and Investment Promotion	denise.swan@mft.gov.bz
John Rivero	Directorate of Foreign Trade	john.rivero@mft.gov.bz
Mark Noralez	BELTRAIDE	markn@belizeinvest.org.bz
Fermin Blanco	OIRSA	oirsarep1@btl.net
Victoriano Pascual	Ministry of Natural Resources & Agriculture	victorianopascual@hotmail.com
Victor Gongora	Belize Poultry Association	belizepoultry@gmail.com
Yamili Cano Vasquez	Belize Agricultural Health Authority	hrdirector.baha@gmail.com
Roberto Manzanero	Belize Agricultural Health Authority	roberto.manzanero@baha.bz
Francisco Gutierrez	Belize Agricultural Health Authority	frankpest@yahoo.com
Joe Myers	Belize Agricultural Health Authority	joe_my2003@yahoo.com
Florencio Esquivel	Fruta Bomba Ltd.	lencho@frutabomba.com
Miguel Depaz	Belize Agricultural Health Authority	depaz_miguel2004@yahoo.com
Crispin Blanco	USDA/APHIS IS	blancocj@state.gov
Darrell Thompson	Fruta Bomba Ltd. & Belize Food Packers	darrell@frutabomba.com
Rondine Twist	Ministry of Natural Resources & Agriculture	legal@mnrei.gov.bz
Maritza Aguilar	BELTRAIDE	maritza@belizeinvest.org
Emir Cruz	Belize Agricultural Health Authority	emir.cruz@baha.bz
Nilda Riverol	BELTRAIDE	nilda@belizeinvest.org.bz
Carlos A. Itza	Project Execution Unit, MNRA	minagricpubelize@gmail.com

Appendix 4.Capacity-Building Option Information cards

Table 4-1a.Animal health controls for live cattle exports

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$3.36 million	Estimates from EU project proposal. See Table 4-1b.	High
On-going cost	US$161,225	Estimates from EU Project proposal. See Table 4-1c.	High
Difficulty of implementation	5	Very difficult. Identification system needs to cover entire cattle population in Belize. Surveillance system needs to be maintained. Needs cooperation of Mexican government.	High
Trade impact			
Change in absolute value of exports	US$13.6 million	Currently the informal trade with Mexico and Guatemala is estimated at US$500,000 and US$6,935,000 per annum but is estimated to increase to US$20,997,500 per annum across the two countries once trade is formalised	Medium
Trade diversification – products	0	Currently, exports occur to Mexico and Guatemala, but all informal	High
Trade diversification – markets	0	Currently, exports occur to Mexico and Guatemala, but all informal	High
Domestic agri-food impact			
Agricultural/fisheries productivity	+1	Bovine Tuberculosis and Brucellosis are not known to be major problem in cattle production in Belize. Returns to cattle production likely to increase	Medium
Domestic public health	0	No impact	High
Environmental protection	-1	Could lead to deforestation. Likely to be shift to semi-intensive or intensive systems of production.	Medium
Socio-economic impact			
Impact on employment	0	Negligible. Likely to be increased production, but not very labour intensive	Medium
Poverty impact	0	Even small cattle producers are not poor.	Medium
Impact on vulnerable groups/areas	0	Cattle producers predominantly men. North not a marginal area.	Medium

Table 4-1b. Estimated up-front investment

Item	Estimated Cost (US$) Total cost
Hiring of personnel	5,716,080
Equipment & Supplies	1,333,198
Consumables (fuel, insurance of vehicles etc.)	604,997
OTHERS (public awareness, training, audit	245,100
Recognition of free farms/certification/compensation/rehabilitation	410,925
International Travel	7,200
Administration (7%)	620,339
Contingency (5 %)	544,686
Less existing project funds already allocated under existing three years project	6,119,546
Grand total	**3,362,977**

Table 4-1c. Estimated on-going costs

Item	Estimated Cost (US$)
Hiring of personnel	30,000
Equipment & Supplies	40,000
Consumables (fuel, insurance of vehicles etc.)	20,000
OTHERS (public awareness, training, audit	10,000
Farm Certification	21,625
International Travel	1500
Animal identification (26,400 calves per annum x US$5 per calf)	39,600
Grand total	**161,225**

Table 4-2a. Animal health and hygiene controls for beef exports

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$345,960	Inspection, HACCP certification, Vet drugs, microbiological, heavy metals monitoring along with establishing veterinary officers at establishments. See Table 4-2b.	High
On-going cost	US$142,440	Ongoing costs associated with maintaining surveillance programmes and HACCP certification. See Table 4-2c.	High
Difficulty of implementation	4	Difficult. Need to negotiate requirements with Mexican and/or Jamaican governments. Only need to upgrade BAHA laboratory and hygiene controls in up to three slaughterhouses. Need industry cooperation/incentives to make investments.	Medium
Trade impact			
Change in absolute value of exports	US$2.1 million	Current trade is restricted to the informal trade in heads of cattle amounting to $14,300 per annum. If trade is formalised and beef is traded, it is estimated to be valued at US$2,138,400 annually.	Medium
Trade diversification – products	+1	Current exports of beef insignificant	High
Trade diversification – markets	+1	Establishes beef exports to two markets	High
Domestic agri-food impact			
Agricultural/fisheries productivity	+1	Source of supply of animals likely to be smaller producers. Revenue from cattle production likely to increase	Medium
Domestic public health	+2	Significant improvement in safety of beef on domestic markets. Decline in informal markets for beef.	Medium
Environmental protection	-1	Could lead to deforestation. Likely to be shift to semi-intensive or intensive systems of production.	Medium
Socio-economic impact			
Impact on employment	0	Negligible. Likely to be increased production, but not very labour intensive. Slaughterhouse employment small and only three facilities.	Medium
Poverty impact	0	Even small cattle producers are not poor.	Medium
Impact on vulnerable groups	0	Cattle producers predominantly men. North not a marginal area.	Medium

Table 4-2b. Estimated up-front investment

Item	Estimated Cost (US$)
Veterinary inspection	60,000
Surveillance programme for BSE, Bovine Tuberculosis, Boving Brucellosis and Traceability	182,400
Truck	30,000
Vehicle maintenance	3,760
Subsistence	1,000.00
Hotel and travel allowance	750.00
HACCP certification	30,000
Inspection services	11,500
Veterinary drugs monitoring and testing	18,000
Microbiological testing (water & carcass)	8,550
Grand total	**345,960**

Table 4-2c. Estimated on-going costs

Item	Estimated Cost (US$)
Veterinary inspection	60,000
Surveillance programme for BSE	2,880
Vehicle (US$30,000 with value annualised over life of 5 years)	6,000
Vehicle maintenance	3760
Subsistence	1000
Hotel and travel allowance	750
HACCP audits	30,000
Inspection services	11,500
Veterinary drugs monitoring and testing	18,000
Microbiological testing (water & carcass)	8,550
Grand total	**142,440**

Table 4-3a. Animal health and hygiene controls for chicken exports

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$0.25 million	Costs of Surveillance for poultry disease status (Avian influenza, Mycoplasma, Newcastle disease and Salmonella), residues testing, chemical residues analysis and microbiological testing along with HACCP certification. See Table 4-3b.	High
On-going cost	US$222,950	Cost of ongoing monitoring programmes for poultry diseases and chemical residues and microbiological testing.	High
Difficulty of implementation	2	Somewhat easy. Need to negotiate requirements with regional governments, but some have already expressed a willingness to establish trade. Two slaughterhouses with contract production – makes surveillance easier and less costly. Additionally, need PCR capacity to test for the poultry diseases. See Table 4-3c.	High
Trade impact			
Change in absolute value of exports	US$546,000	There are currently no exports of poultry. The estimated potential exports in 2017 are US$546,000 annually	Medium
Trade diversification – products	+1	No poultry exports currently	High
Trade diversification – markets	+2	Potentially a number of regional markets	High
Domestic agri-food impact			
Agricultural/fisheries productivity	+1	Returns to poultry production likely to increase.	High
Domestic public health	+2	Significant improvement in safety of chicken on domestic markets. Decline in informal markets for Chicken.	High
Environmental protection	-1	Issues with waste materials from chicken processing – disposal, scope for environmental contamination, etc.	Medium
Socio-economic impact			
Impact on employment	0	Production is not very labour intensive. Few processing facilities.	Medium
Poverty impact	0	Production predominantly by larger and less poor farmers	Medium
Impact on vulnerable groups	+1	Producers mainly men. Production not in marginal areas. Women employed in processing facilities.	Medium

Table 4-3b. Estimated up-front investment

Item	Estimated Cost (US$)
Animal Health Controls	
Staff Salaries	60,000
Poultry Disease surveillance	65,250
Equipment & Supplies	30,000
Consumables (fuel, insurance of vehicles etc.)	10,000
Others(public awareness, training, audit	5,000
Hygiene Controls	
Chemical residues testing	45,000
Microbiological testing	11,200
HACCP system and certification	25,000
Grand total	**251,450**

Table 4-3c. Estimated on-going costs

Item	Estimated Cost (US$)
Animal Health Controls	
Staff salaries	60,000
Poultry disease surveillance	65,250
Equipment and supplies	30,000
Consumables (fuel, insurance of vehicles etc.)	10,000
Others (public awareness, training, audit, etc.)	500
Hygiene Controls	
Chemical residues testing	45,000
Microbiological testing	11,200
HACCP Audit	1,000
Grand total	**222,950**

Table 4-4a. Plant health controls for pitahaya exports

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$0.11 million	Estimated cost of systems approach to manage Mexican Fruit fly (*Anastrepha ludens*) to be able to export pitahaya. See Table 4-4b.	High
On-going cost	US$31,585	Estimated costs associated with maintaining the programme. See Table 4-4c.	High
Difficulty of implementation	2	Costs relatively low. Political will to establish exports.	High
Trade impact			
Change in absolute value of exports	US$500,000	Estimate based on 20 acres in production x 10,000 lbs per acre with an approximate price of US $2.50/lb	High
Trade diversification – products	+1	No exports currently	High
Trade diversification – markets	+1	No exports currently – exports will be aimed at one market	High
Domestic agri-food impact			
Agricultural/fisheries productivity	+1	High value crop.	High
Domestic public health	0	No impact	High
Environmental protection	0	Minimal land use. Production on existing open land. Can't be produced near to forest due to requirements of plant pest controls.	High
Socio-economic impact			
Impact on employment	0	Number of farmers involved will be small. Very seasonal production.	High
Poverty impact	0	Up-front investment high, so difficult for poor farmers to enter.	Medium
Impact on vulnerable groups	+1	Production not in marginal areas. Women engaged in production, harvesting, packing, etc.	Medium

Table 4-4b. Estimated up-front investment

Item	Estimated Cost (US$)
Program coordination	
Field officer	9,600
Staff costs	875
Equipment (computers, etc)	1,300
Office supplies	1,500
Monitoring programme	
Trucks	25,000
Fuel	4,680
Vehicle maintenance	1,880
Materials trapping and ID	1,000
Subsistence	500
Hotel and travel allowance	250
Packing facility	
Construct an export packing facility	50,000
Maintenance of facility	12,500
Grand total	**109,085**

Table 4-4c. Estimated on-going costs

Item	Estimated Cost (US$)
Programme Coordination	
Field officer	9,900
Staff costs	875
Monitoring Programme	
Vehicle maintenance	1,880
Fuel	4,680
Trapping materials and ID	1,000
Subsistence	500
Hotel and travel allowance	250
Packing Facility	
Maintenance	12,500
Grand total	**31,585**

Table 4-5a. Food safety controls for papaya exports

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$0.2 million	Both facilities and fields would have HACCP certification and be on a monitoring programme for pesticide residues and microbiological contaminants. It entails testing of the produce and water. See Table 4-5b.	High
On-going cost	US$110,325	HACCP audit are conducted annually and monitoring for pesticide residues and microbiological contaminants is ongoing. Both fields and packing facility are inspected. See Table 4-5c.	High
Difficulty of implementation	2	Only five or so exporters. Small number of larger producers. Supply chain quite highly integrated.	High
Trade impact			
Change in absolute value of exports	$5.1 million	Threat to 15% of established exports to US. Only one exporter currently meets requirements, which accounts for 85% of exports. Exports in 2012 predicted at $34 million and so loss of $5.1 million	Medium
Trade diversification – products	0	Established exports of papaya.	High
Trade diversification – markets	0	Established exports of papaya to US.	High
Domestic agri-food impact			
Agricultural/fisheries productivity	+1	Threat to existence of three or four exporters and associated producers.	Medium
Domestic public health	+1	Lower levels of pesticides residues in papaya on domestic markets. Better practices for application of pesticides leading to improved worker safety.	High
Environmental protection	+1	Better controls on pesticide use and disposal of water used in processing facilities.	Medium
Socio-economic impact			
Impact on employment	+2	Avoided significant loss of employment. Facilitates expansion of production. One of larger employers in production area.	Medium
Poverty impact	+2	Employment in production and processing significant source of livelihood to poor people in production areas.	Medium
Impact on vulnerable groups	+1	Production not in marginal areas. Significant sources of female employment.	Medium

Table 4-5b. Estimated up-front investment

Item	Estimated Cost (US$)
Training of staff, stainless steel equipment, bathrooms, painting of building, documentation, etc.	200,000
Grand total	**200,000**

Table 4-5c. Estimated on-going costs

Item	Estimated Cost (US$)
Preparation for audit	20,000
Water testing -packing facility	750
Water testing -field	45,000
Residues testing	300
Audit per field	9,000
Administrative Fees (flight, per diem etc.)	20,000
Audit per packing facility	1,200
Registration of facility with BAHA	500
Inspection of facility	1,200
Field inspection	12,000
HACCP Audit	375
Grand total	**110,325**

Table4-6a. Laboratory testing capacity for pesticide residues and veterinary drug residues

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$0.6 million	Initial investment includes procurement of laboratory equipment, reagents and consumables in addition to costs associated with proficiency testing and acquiring accreditation. See Table 4-6b.	High
On-going cost	US$46,810	Major portion of the ongoing costs is associated with equipment maintenance, staff salaries, reagents, and proficiency testing among others. See Table 4-6c.	High
Difficulty of implementation	1	Some additional training for staff required	High
Trade impact			
Change in absolute value of exports	0	No impact – tests done anyway	High
Trade diversification – products	0	No impact – tests done anyway	High
Trade diversification – markets	0	No impact – tests done anyway	High
Domestic agri-food impact			
Agricultural/fisheries productivity	0	No impact	High
Domestic public health	+1	Scope to implement surveillance and testing in domestic markets	High
Environmental protection	+1	Scope to implement surveillance and testing in domestic markets	High
Socio-economic impact			
Impact on employment	0	No impact	High
Poverty impact	0	No impact	High
Impact on vulnerable groups	+1	Scope to implement surveillance and testing in domestic markets	High

Table 4-6b. Estimated up-front investment

Item	Estimated Cost (US$)
Laboratory	
Laboratory Equipment	500,000
Reagents and consumables	7,000
Proficiency Testing	3,000
Accreditation	10,000
Staff	
Laboratory Personnel	21,000
Field Officers	20,000
Office	
Computer	1,300
Office supplies	2,400
Surveillance programme	
Staff cost	5,500
Trucks	25,000
Vehicle maintenance	4,025
Fuel	4,680
Grand total	**603,905**

Table 4-6c. Estimated on-going costs

Item	Estimated Cost (US$)
Equipment maintenance	60,000
Reagents and consumables	3,500
Proficiency testing	3,000
Accreditation	3,000
Staff Salaries	41,000
Other staff costs	5,500
Office Supplies	2,400
Vehicle maintenance	4,025
Fuel	4,680
Sub-total	***127,105***
Less current costs of external testing	***80,295***
Grand total	**46,810**

Table 4-7a. Laboratory testing capacity for heavy metals

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$53,000	Main investment required is the fund needed to obtain accreditation. Additional cost includes salaries and reagents. See Table 4-7b.	High
On-going cost	US$43,985	Estimated costs for equipment maintenance, reagents and consumables, proficiency testing and accreditation among others. See Table 4-7c.	High
Difficulty of implementation	1	Some method development required. The additional challenge is the small number of samples required for testing to comply with trade requirements. In summary the three industries - beef, poultry and aquaculture - require services valued at $5,655 annually to comply with market access requirements.	Medium
Trade impact			
Change in absolute value of exports	0	No impact – tests done anyway	High
Trade diversification – products	0	No impact – tests done anyway	High
Trade diversification – markets	0	No impact – tests done anyway	High
Domestic agri-food impact			
Agricultural/fisheries productivity	0	No impact – tests done anyway	High
Domestic public health	+1	Scope to implement surveillance and testing in domestic markets	High
Environmental protection	+1	Scope to implement surveillance and testing in domestic markets	High
Socio-economic impact			
Impact on employment	0	No impact	High
Poverty impact	0	No impact	High
Impact on vulnerable groups	+1	Scope to implement surveillance and testing in domestic markets	High

Table 4-7b. Estimated up-front investment

Item	Estimated Cost (US$)
Salary	40,000
Reagents and consumables	3,000
Accreditation	10,000
Grand total	**53,000**

Table 4-7c. Estimated on-going costs

Item	Estimated Cost (US$)
Equipment Maintenance	5,000
Reagents & Consumables	3,000
Proficiency testing	3,000
Accreditation	1,000
Staff Salary	40,000
Sub-total	**50,000**
Less current costs of external testing	6,015
Grand total	**43,985**

Table 4-8a. Plant health controls for citrus pulp exports

Decision Criterion	Value	Details	Confidence
Cost and difficulty of implementation			
Up-front investment	US$0.37 million	Estimated cost of establishing areas of low pest prevalence to manage Mexican Fruit fly (*Anastrepha ludens)* to be able to utilise grapefruit pulp for export. See Table 4-8b.	High
On-going cost	US$231,306	Estimated costs associated with maintaining the programme. See Table 4-8c.	High
Difficulty of implementation	5	Need to reduce pest prevalence in large area, coordination of farmers, etc.	High
Trade impact			
Change in absolute value of exports	US$13.2 million	Potential benefit in terms of additional exports from low prevalence of Mexican fruit fly is estimated at US$1.32 million annually	High
Trade diversification – products	0	Already have some exports of citrus pulp	Medium
Trade diversification – markets	+1	Establish exports to new market - Japan	Medium
Domestic agri-food impact			
Agricultural/fisheries productivity	+1	Could lead to higher prices paid to farmers since citrus pulp could be converted into a value-added product.	High
Domestic public health	0	No impact	High
Environmental protection	0	No impact	High
Socio-economic impact			
Impact on employment	0	Little or no impact	High
Poverty impact	0	Commercial production not by poor farmers	Medium
Impact on vulnerable groups	0	Production not in marginal areas.	Medium

Table 4-8b. Estimated up-front investment

Item	Estimated Cost (US$)
Programme coordination	
Coordinator	21,000
Staff cost	2,500
Equipment (computers, etc)	1,300
Office supplies	2,400
Monitoring programme	
Monitoring personnel	12500
Staff cost	5,500
Trucks	50,000
Vehicle costs	4,025
Fuel	5,000
Trapping materials and ID	1200
Control of fruit flies in the industry	
Personnel	83,800
Personnel costs	13,031
Trucks	50,000
ATV	30,000
Trailers	3,000
Vehicle costs	9650
Fuel	10,500
Chemicals - Malathion	12,250
Chemicals - Nulure	48,950
Spraying equipment	1250
Personal protective equipment	400
Grand total	**368,256**

Table 4-8c. Estimated on-going costs

Item	Estimated Cost (US$)
Program coordination	
Coordinator	21,000
Staff costs	2,500
Office supplies	1,000
Monitoring programme	
Monitoring personnel	12,500
Staff cost	5,500
Vehicle costs	4,025
Fuel	5,000
Trapping materials and ID	1,200
Control of fruit flies in the industry	
Personnel	83,800
Personnel costs	13,031
Vehicle costs	9,650
Fuel	10,500
Chemicals -Malathion	12,250
Chemicals - Nulure	48,950
Personal protective equipment	400
Grand total	**231,306**