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Establishing Priorities for Sanitary and Phytosanitary Capacity-Building in Rwanda Using a Multi-Criteria Decision-Making Framework; 2012

Final report

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CONTENTS

Acronyms

ASARECA	The Association for Strengthening Agricultural Research in Eastern and Central Africa
AU	African Union
CAADP	Comprehensive African Agriculture Development Plan
CGIAR	Consultative Group on International Agricultural Research
COMESA	Common Market for Eastern and Southern Africa
COMPETE	Competitiveness and Trade Expansion Program
DRC	Democratic Republic of Congo
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy
EU	European Union
FAO	Food and Agriculture Organization
GAP	good agricultural practices
GoR	Government of Rwanda
GVP	good veterinary practices
HACCP	Hazard Analysis and Critical Control Points
ILO	International Labor Organization
ISAR	Rwanda Agriculture Research Institute
ISO	International Standards Organization
LPI	logistics performance index
MCDA	multi-criteria decision analysis
MINAGRI	Ministry of Agriculture
MLI	Market Linkages Initiative
MRL	maximum residue limits
NEPAD	New Partnership for African Development
nes	not elsewhere specified
OIE	World Organization for Animal Health
PVS	Performance, Vision and Strategy (veterinary service assessment tool of the OIE)
RASFF	Rapid Alert System for Food and Feed
RHESI	Rwanda Horticulture Export Standards Initiative
SADC	Southern African Development Community
SADCAS	Southern African Development Community Accreditation Service
SME	small/medium enterprise
SPIMS	SPS Information Management System
SPS	Sanitary and Phytosanitary
STDF	Standards and Trade Development Facility
TBT	Technical Barriers to Trade
TPC	Third party certification
UNIDO	United Nations Industrial Development Organization
WAHID	World Animal Health Information Database
WHO	World Health Organization
WTO	World Trade Organization

Executive summary

As part of efforts to establish more coherent and accountable decisions in the allocation of scarce resources towards competing Sanitary and Phytosanitary (SPS) capacity-building needs the use of multi-criteria decision analysis (MCDA) is being advocated 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. Because the lack of data can seriously impede such analyses the Standards and Trade Development Facility (STDF) has supported the development of MCDA which enables SPS capacity-building options to be prioritized on the basis of a wide range of decision criteria. MCDA has been applied by the STDF with some success in several countries in Africa with the active participation of the USAID SPS Coordinators for Southern Africa.

This report presents the initial results of a priority-setting exercise for SPS capacity-building in Rwanda which commenced on February 29, 2012. In this case, 10 distinct SPS capacity-building options were identified and prioritized on the basis of a series of decision criteria to which weights are applied, that are again derived by consulting stakeholders. The end result is a clear ranking of the 10 capacity-building options of which the following five are consistently ranked as top priority:

Of 10 capacity-building options identified, the following four are consistently ranked as top priority:

1. Drying services for a range of stored crops
2. Providing domestic capacity within Rwanda for third party certification
3. Detection of potato flavor in coffee beans
4. GAPs for procurement of cereal and cassava.

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

It is important to recognize, however, that the results of the analysis presented above represent just the starting point in the use of the priority-setting framework in the context of SPS capacity-building in Rwanda. Indeed, the results must be revisited and revised on an ongoing basis in the light of improvements in the availability and/or quality of data, changes in policy priorities that imply shifts in the decision weights and/or the introduction of new decision criteria, etc. Further, if new capacity-building needs arise, these can be added to the analysis. Likewise, as investments are made in the options included in the analysis above, these can be excluded and the priorities estimated accordingly. The intention is that the prioritization framework will become a routine element of SPS capacity-building planning in Rwanda. Finally, this analysis can form the economic justification for project applications to the STDF, Enhanced Integrated Framework and other funds/organizations supporting aid for trade in less developed countries.

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 illegal 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 priorities particular capacity-building needs over others. At the same time, the drive towards greater aid effectiveness requires that beneficiary governments are able to present coherent and sustainable plans for capacity-building. Whilst, decisions have to be made between competing needs on an on-going basis, such decisions often lack coherence and transparency, and there are various accusations of inefficiencies in the allocation of resources, whether by developing country governments or by donors.[3]

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

The Standards and Trade Development Facility (STDF) has supported the development of a framework for the establishment of priorities amongst competing SPS capacity-building needs that might be funded by the government or the private sector in developing countries, and/or donors.[5] Through the use of MCDA, the framework enables capacity-building options to be prioritized on the basis of a wide range of decision criteria (for example value of exports, impacts on small-scale producers, improvements in domestic public health and/or agricultural productivity and consequences for vulnerable groups) that are not necessarily measured or even measurable using the same metrics. At the current time, this framework has been applied with some success in several countries in Southern Africa.

Despite the fact that various assessments of the SPS situation and capacity-building needs have been undertaken in Rwanda, there remains a lack of coherence in the establishment of priorities. Thus, many of the existing assessments, whilst identifying an abundance of weaknesses in capacity, generate a

virtual 'shopping list' of needs that evidently outstrip available resources. Further, many of these needs are rather general in their focus, with insufficient attention given to the benefits that will flow from specific investments in SPS capacity relative to the costs involved. Therefore, it is not surprising that Rwanda lacks a coherent and prioritized plan for the enhancement of SPS capacity that might guide government, donor and/or private sector investments. The analysis presented below aims to inform the development of such a plan. This report starts by providing an overview of the agricultural policy environment followed by trade and trade support in SPS sensitive goods and related challenges in Rwanda. The priority-setting framework and related methods are then briefly described. The report then proceeds to lay out the SPS capacity-building needs identified in the analysis and that enter the priority-setting exercise. The results of the analysis are then reported, followed by an assessment of the implications for SPS capacity-building in Rwanda in the medium term.

Overview of sectoral policy in Rwanda as it affects agri-food trade

While poverty rates have declined slightly since the Comprehensive African Agriculture Development Plan (CAADP) was adopted in 2007, in large part, to improved living standards in urban areas, poverty remains extreme in rural areas and the challenge continues as the number of rural households reliant on scarce wage labor increases and access to land becomes more difficult. Rwanda's economy depends mainly on the primary sector, in which agricultural production (particularly of food crops) is essential. Rwanda's agricultural output grew at a rate of almost 10% during the period 1996-2000, but has performed less well since then, with average growth rates of less than 5% from 2001-2006. In 2007 the agricultural output hardly grew at all (0.7%), but in 2008 recorded a significant jump with growth rate of over 10% - due to increased fertilizer usage and good climatic conditions.

2.1 Government developmental objectives and trade support

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

In a sub-Saharan African context national, regional and continental agricultural investments are guided through the New Partnership for African Development (NEPAD) process which has a specific agricultural sub-component, the CAADP.[6&7] It is, therefore, important that any support for agricultural trade builds on national and regional CAADP plans ('compacts'); in particular, where the intention is to direct support to regional and international trade in agricultural and agri-food products. As part of the process of contextualizing any review of SPS capacity-building options it is necessary to review current and past trade support in the context of national development aspirations as laid out in the national CAADP compact as well of international obligations explicitly laid out in the WTO SPS Agreement. Such a review can draw on a variety of sources from country reports by the WTO, national reporting to/by

international institutions responsible for administering various parts of the SPS Agreement, and *ad hoc* reports by a variety of organizations.

2.2. Structure and characteristics of the agricultural sector in Rwanda

Traditionally, coffee, tea, hides and skins and pyrethrum have been Rwanda's leading agricultural exports. These sectors have all seen rapid growth in the last two years, due in part to internationally high prices for coffee and tea, as well as significant investments in the leather sector. The expansion of agricultural exports, which constitute only a small portion of production currently, will be critical to achieving Economic Development and Poverty Reduction Strategy (EDPRS) goals as export crops typically offer a high value per hectare, especially important in light of the small farm sizes in Rwanda. Traditional food crops still account for much of the land under production although Rwanda is beginning to see a slight shift towards higher value commodities such as fruits and vegetables, rice, sorghum, maize, groundnuts and soybeans. Livestock, although still limited in numbers, is becoming a source of sustainable income through programs such as the Government of Rwanda's (GoR) "One Cow per Poor Family", which distributes heifers to poor families.

Although Rwanda has the natural factors conducive to higher yields and higher value agricultural products, farmers are finding it increasingly difficult to satisfy basic subsistence needs. Below are a couple of key limiting factors that are holding the sector back:

1. Scarcity of arable land: there are 1.4 million hectares of arable land but over 1.6 million hectares are cultivated because of high population density and another 0.47 million hectares are permanent pasture, so that 70% of the country's land surface is exploited for agriculture. Furthermore, 11.5% of rural households don't have land and off-farm employment is still relatively rare. Those that rent often get low quality land and without access to quality inputs are very susceptible to food insecurity if production conditions are not ideal.
2. Small size farms: over 60% of households cultivate less than 0.7 hectares and most farms have multiple, scattered plots.
3. High erosion risk: 40% of Rwanda's land has a very high erosion risk and 37% requires retention measures before cultivation; however, controls are insufficiently applied or not deemed necessary by farmers. Less than 25% of cultivated land is more or less free from erosion risk.
4. Soil degradation: although Rwanda has high soil fertility levels, 75% of Rwanda's soil is highly degraded and has some of the highest negative nutrient balances in Sub-Saharan Africa.
5. Loss of soil: Rwanda is losing about 1.4 million tons of soil / year which can be interpreted as an estimated decline in capacity to feed 40,000 people per year. Although close to 45% of the available marshland provides an opportunity for cultivation, it should be approached with the qualification that cultivation by most farmers of these lands so far has been without much assistance and increases the risk of floods and droughts as well as being ecologically destructive.
6. Agro-forestry underdeveloped: the issue is compounded by the scarcity of land as well as the poor use of best practices along the value chain.

2.3. Sector support for trade in Sanitary and Phytosanitary sensitive agri-food products

A number of tools exist for assessing SPS capacity. The main SPS and trade evaluation tools are listed and their status in terms of completion and availability is shown in Table 1. In addition to SPS specific toolkits national agricultural strategy documents, referred to as CAADP compacts are also published by African Union (AU) countries. Since enhanced trade in agricultural products is one deliverable of the Regional Economic Communities within the African Union a significant trade promotion component is usually a major part of a national CAADP Compact. In this respect a number of GoR policy documents such as the CAADP, adopted in 2007, and the EDPRS outline Rwanda's agricultural strategy. Rwanda has been a member of WTO since 22 May 1996.

Table 1; Existing reviews of SPS compliance and capacity for Rwanda:

Source		**Rwanda**
Enhanced Integrated Framework	Diagnostic Trade Integration Study	Yes
	Trade Policy Review (WTO in 2004)	Yes
CAADP Compact	Economic Development and Poverty Reduction Strategy	Yes
Integrated Approach to Food Safety, Plant & Animal Health: National Biosecurity Capacity Evaluation		Yes
Performance, Vision and Strategy (PVS) Tool		(Yes)
Pilot of Food and Agriculture Organization (FAO) Guidelines to Assess Capacity-Building Needs to Strengthen National Food Control		Yes
Phytosanitary Capacity Evaluation (PCE) Tool		Yes
Ad hoc and other national case studies		Yes

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

In terms of more specific issues relating to trade, a trade policy review of Rwanda was completed by the World Trade Organization in 2004.[8] The review contains, among other components, a general overview of SPS requirements and issues focusing on the legislative and institutional arrangements which were generally viewed as being outdated at the time. However many of the issues raised in terms of SPS support have in fact been addressed in the intervening period since publication of the WTO trade policy review findings. The following technical reviews of specific SPS issues have been completed in Rwanda;

1. World Organization for Animal Health, (OIE) – PVS Tool / PVS Gap (Bourzat, 2010[9]) but which is not available to the general public on the OIE website/database[10]
2. A Phytosanitary Capacity Evaluation (PCE) and legislative overhaul was completed in 2007 by the Rwanda Horticulture Export Standards Initiative (RHESI) project implemented by Michigan State University[11]

3. A National Biosecurity Capacity Assessment was carried out by FAO in 2009 which reviewed food safety, plant and animal health.[12]

Other specialist reviews have examined fruit, groundnuts, dairy, cereals and other value chains of strategic importance for food security and agricultural development including the development of exports.

The SPS mechanisms put in place by the WTO and allied organizations, including FAO, the World Health Organization (WHO) and the OIE, have been in place for over a decade or more. The mechanisms are accompanied by a number of processes to help poorer countries in terms of compliance. The WTO maintains a SPS transparency table as well as a table of compliance to some basic provisions of the SPS Agreement. Rwanda has notified the WTO SPS Information Management System (SPIMS) of its SPS Enquiry Points and National Notification Authority but not of any SPS measures. In addition two international treaties (The Convention on Biological Diversity of 5 June 1992 and the Cartagena Protocol on Biosafety which is an Annex to the Convention on Biological Diversity)[13] have some bearing on the workings of the SPS Agreement and have led to the additional requirement for a Biosafety National Focal Point to be set up in countries that are signatories to the convention. The status of Rwanda's compliance with the WTO's requirements for the setting up and notifying of national contact points is shown in Table 2.

Table 2; Contact information and SPS notifications for Rwanda as lodged with the WTO as of August 2010 (Source: WTO SPS Notification Database)[14, 15 &16]

WTO TBT[1] enquiry point	**Biosafety national focal point**	**WTO SPS national notification authority**	**WTO SPS enquiry point**	**Codex contact point**	**NPPO contact point**	**Official website[17]**
Yes	Yes	Yes	Yes	Yes	Yes	Yes

No notifications from Rwanda appear on the WTO SPSIMS database.

Overview of Rwandan Sanitary and Phytosanitary sensitive trade

Trade data for Rwanda is extracted from the COMTRADE database and the patterns over the recent past are analyzed in a general way. The trade volumes are set against the type and difficulty of any SPS issues that might arise in international trade in that commodity. The analysis at this point is very general but it allows one to focus on the general trading strengths and weaknesses of the study country.

Table 3 provides an overview of the key SPS requirements associated with Rwanda's traditional and non-traditional agri-food exports. Agricultural and agri-food exports from Rwanda have averaged just over 700 million US$ annually in the period between 2003 and 2010 though growth in this period has been remarkable averaging nearly 300% annually since 2003 – though starting from a low base. Much of this recent gain has, in fact, been recovery of lost production from disruptions in the 1990's. Exports are

[1] Technical Barriers to Trade

largely dominated by tea and coffee which is responsible for well over four fifths of exports in this general category. The remaining exports only account for 14% of agri-food exports. In the main coffee, tea and beverages have dominated exports but decent developments include live animal exports (to the Democratic Republic of Congo [DRC]), vegetables (including pulses), vegetable extracts and food waste. Categories losing ground are fresh exports – notably cut flowers

SPS requirements as illustrated in Table 3 show that these are particularly an issue for trade in fish, live animals, meat and other animal products, fruits and vegetables and planting materials. It is important to recognise, however, that there are wide differences in the application and enforcement of SPS requirements across markets and segments within markets. Rwanda's agri-food trade is directed predominantly to Europe, neighbouring countries (especially the Democratic Republic of Congo) and other African countries with widely varying SPS standards and level of enforcement. The European Union (EU) Rapid Alert System for Food and Feed (RASFF) Portal lists no notifications for Rwandan imports between 2001 and 2008.

Given the overall composition of Rwanda's agri-food exports and experiences to date, SPS requirements do not appear to be a particularly major issue though a number of studies have highlighted SPS concerns as a potentially a problem and there is no doubt that national SPS capacity is weak (see RHESI reports reviewing SPS issues). Other competitiveness factors, such as primary producer and processor productivity, continuity/reliability of supply, logistical costs, macroeconomic factors and international commodity price trends have arguably have played more of a leading role in explaining Rwanda's agri-food trade performance to date. The major SPS related efforts in recent years have been more oriented to private sector and other types of Third Party Certification (TPC) and have not really involved formal GoR SPS support mechanisms.

A look at the data in Table 3 shows that Rwanda's performance in more perishable and more SPS sensitive agri-food exports, notably animals, fresh vegetables, cut flowers, and animal products suggests that supply chain problems, logistics and seasonality remain the predominant constraints, especially in light of the country's landlocked status and poor ranking in the world logistics performance index (LPI). Rwanda's major trading partners, particularly in the region, are not highly concerned about SPS requirements and anecdotal evidence is that traders circumvent these relatively easily either through informal trade across borders or by certification / testing by international service providers.

Rwanda imports a range of foods mostly maize and with lesser amounts of dairy. Most of these imports can generally be considered of low to moderate risk from an SPS standpoint though mycotoxins in maize do pose some risk. The standards for traded items of most interest to Rwanda are being largely addressed through the development of regional standards by the East African Community (EAC) and thus by extension to Common Market for Eastern and Southern Africa (COMESA) and the Southern African Development Community (SADC). See the Competitiveness and Trade Expansion Program (COMPETE) website (Compete, 2012).[18]

Table 3*;* Rwandan agri-food exports and attendant SPS requirements (average annual exports between 2003 and 2010)

Category (HS 1992 2 Digit)	Average Annual Exports (US$)	Proportion of Total SPS Sensitive Exports (%)	Sensitivity				
			Plant Health	Animal Health	Food Safety	Environmental standards	Private standards
01 Live animals	1569960	2.3		XXX		X	
02 Meat and edible meat offal	7316	0.0		XXX		X	
03 Fish, crustaceans, molluscs, aquatic invertebrates, nes*	147835	0.2		XXX	XXX	XXX	XX
04 Dairy products, eggs, honey, edible animal product, nes	125814	0.2		XX	XX	X	XXX
05 Products of animal origin, nes	39661	0.1		X		XX	
06 Live trees, plants, bulbs, roots, cut flowers etc	142886	0.2	XX			XX	
07 Edible vegetables and certain roots and tubers	1435569	2.1	XX				XXX
08 Edible fruit, nuts, peel of citrus fruit, melons	71767	0.1	XXX				XXX
09 Coffee, tea, mate and spices	59649812	86.1	X		X	X	XXX
10 Cereals	253499	0.4	XX		XX	X	
11 Milling products, malt, starches, inulin, wheat gluten	437548	0.6	X		XX		
12 Oil seed, oleagic fruits, grain, seed, fruit, etc, nes	137805	0.2	XXX		XX		XXX
13 Lac, gums, resins, vegetable saps and extracts ne	843097	1.2			XXX		XXX
14 Vegetable plaiting materials, vegetable products, nes	13469	0.0	X			X	
15 Animal, vegetable fats and oils, cleavage products, etc	65234	0.1			XX		
16 Meat, fish and seafood food preparations, nes	42	0.0		X	XXX	X	XXX
17 Sugars and sugar confectionery	32262	0.0			X	X	
18 Cocoa and cocoa preparations	781	0.0			X	X	
19 Cereal, flour, starch, milk preparations and products	41160	0.1			X		
20 Vegetable, fruit, nut, etc. Food preparations	56675	0.1			XX		XX
21 Miscellaneous edible preparations	81663	0.1			X		
22 Beverages, spirits and vinegar	3458170	5.0			X		
23 Residues, wastes of food industry, animal fodder	308799	0.4	XX	XX		X	
24 Tobacco and manufactured tobacco substitutes	88458	0.1			X		
44 Wood and articles of wood, wood charcoal	96907	0.1	X				X
46 Manufactures of plaiting material, basketwork, etc.	41267	0.1	X				
47 Pulp of wood, fibrous cellulosic material, waste, etc.	1190	0.0			X	XX	X
48 Paper & paperboard, articles of pulp, paper and board	47013	0.1			X	XX	
50 Silk	0	0.0		X			
51 Wool, animal hair, horsehair yarn and fabric thereof	15662	0.0		X			
52 Cotton	27627	0.0			X	X	
53 Vegetable textile fibres nes, paper yarn, woven fabric	2010	0.0					
TOTAL	69240956						

Source: COMTRADE

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 prioritized action plan for the enhancement of SPS capacity. Thus, its ultimate objective is to *generate a prioritized schedule of options for SPS-related capacity-building in Rwanda on the basis of the multiple economic and/or social criteria*. The rationale behind the framework, therefore, is that priorities need to be established on the basis of a range of economic and social considerations that may, at least on the face of it, be difficult to reconcile. In turn, this assumes that the rationale for investments in SPS capacity-building is not compliance with export market SPS requirements *per se*, but the economic and social benefits that might flow from such compliance, whether in terms of enhanced exports, incomes of small-scale producers and/or vulnerable groups, promotion of agricultural productivity and/or domestic public health, etc. The framework provides an approach for different decision criteria to be taken into account, even though they may be measured in quite different ways.

In pursuit of this objective, the framework aims to:

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

The framework employs a highly structured process that aims to be applied in a wide variety of contexts and to provide various diagrammatic and numerical outputs. The framework and its practical implementation are described in detail in a draft user's guide.[19] 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 Rwanda.

Stage 1: Compilation of information dossier

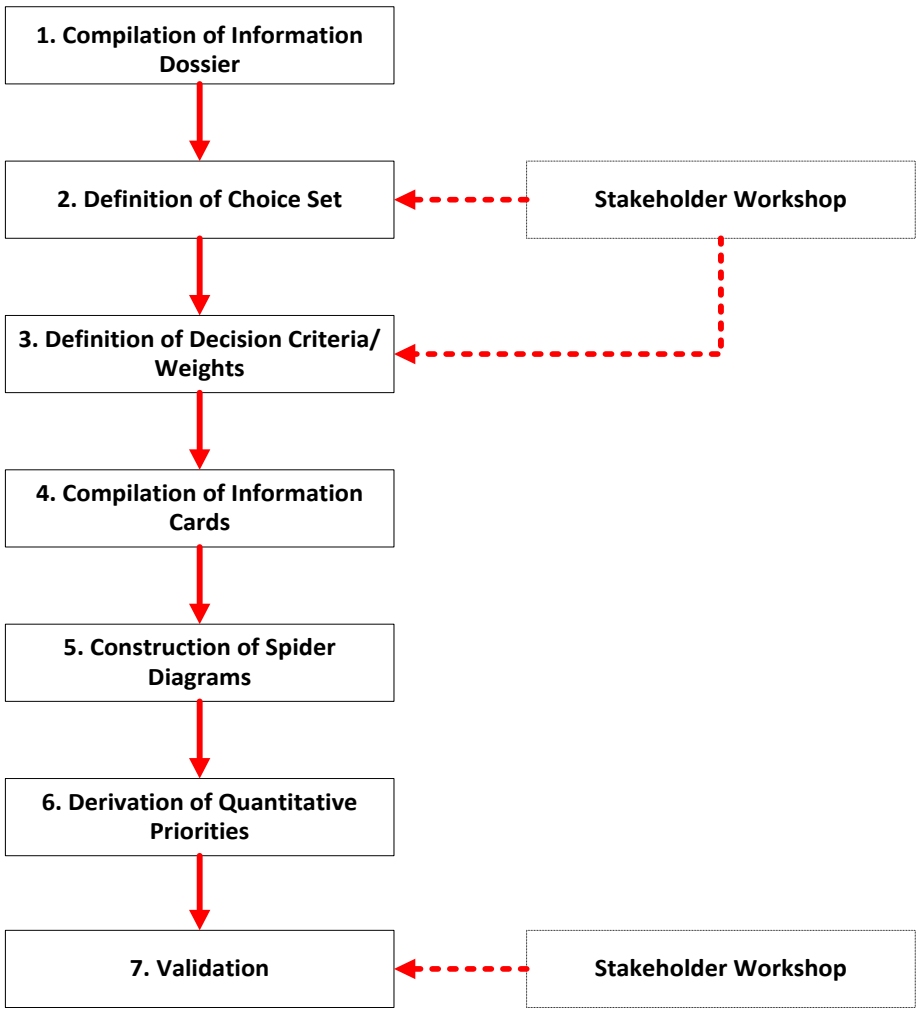
The first stage of the analysis involved the compilation of a comprehensive dossier of existing information on the SPS challenges facing agri-food exports from Rwanda and the associated capacity-building needs. In so doing, the aim was to ascertain what work had already been undertaken to identify capacity-building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

Stage 2: Definition of choice set

In order to identify the SPS capacity-building options to be considered in the priority-setting framework, a one-day stakeholder workshop was held on 29 February 2012). A total of 14 stakeholders (Appendix

2) attended the workshop, drawn predominantly from government and donors. Participants were presented with a series of cards and asked to identify the SPS capacity-building needs of Rwanda. Critically, respondents were asked to define a series of mutually-exclusive needs consisting of four key elements (Figure 2). First, the product(s) affected. Second, the specific SPS issue faced by exports of this product(s). Third, the market(s) where these SPS needs were an issue. Fourth, the capacity-building option(s) that would solve the SPS issue being faced. The combination of these four elements defined a distinct capacity-building option. Respondents were free to define as many specific SPS capacity-building needs as they wished.

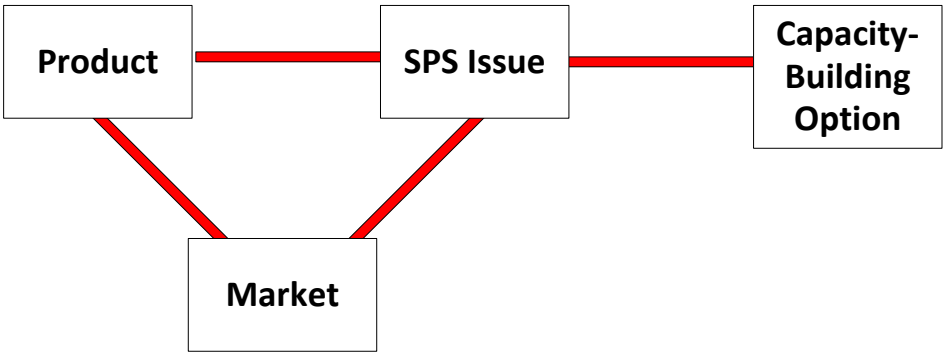
Figure 1. Stages in multi-factorial prioritisation of SPS capacity building options



The cards of all respondents were collected 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 10 SPS capacity-building options were defined through the above process, as described in Table 4.

Figure 2. Definition of SPS capacity-building options



A number of other more generic capacity issues, for example reform of legislative frameworks and upgrading of inspection institutions, were also identified through this process. These were excluded from the choice set, however, because they failed to relate the respective SPS issue to a particular product or market (See Appendix 3).

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 organized into four categories as set out in Table 5, and asked which (if any) should be excluded and whether any potentially important criteria were missing.

Table 4; Choice set of SPS capacity-building options for Rwanda

Option Number	Name	Details
1	Good agricultural practices (GAP's) program for field crops	The development of good agricultural practices guidelines and their extension through a project targeted at growers in cooperatives wanting to export their product. A further refinement of this option is for the development of an atoxigenic strain of *Aspergillus flavus* for use by smallholder producers at an extra cost of US$400,000 as a variant.
2	GAP's program for horticultural crops	Training in horticulture good agricultural practices to agronomists / post harvest extension persons and extension to farmers. The main crops affected would be legumes/pulses and some root crops.
3	Mycotoxin testing services	Development and provision of internationally recognized certified mycotoxin testing services in Rwanda for the pre-testing of export consignments of groundnuts and cereals.
4	Provision and training of drying and storage for stored crops	Provision of drying facilities and accompanying systems and equipment for reducing crop moisture (pulses, cereals, groundnuts, coffee). Such services are not widespread in Rwanda and post harvest losses are a significant problem in the country.

Option Number	Name	Details
5	Pesticide testing services	Development and provision of certified pesticide residue testing services in Rwanda. The country has just passed a new Pesticide Act and needs to be able to both implement the technical provisions of the Act as well as demonstrate compliance with trading partner agrochemical residue limits
6	GAP's for procurement of cereal and cassava	It is necessary as part of a food processing certification, as one pre-requisite, to develop a systems approach to the production and/or procurement of cassava, wheat and maize flour.
7	Detection of potato flavor in coffee beans	Coffee prices can be severely downgraded if the crop is tainted with off-flavors. The proposal is the development of a simple field method for the detection of potato flavor coffee beans at the green or blue bean stages
8	Develop capacity at abattoirs for regional exports	Meat exports compliance to importing country standards including disease diagnosis and surveillance as well as good management and hygiene practices through the development of human capacity at export abattoirs including those targeting markets in Congo-Brazzaville.
9	Certified testing of mineral water and juices	Certified testing of mineral water and juices to required standards for export markets. Although Rwanda is a net importer of juice and bottled water there are good export market opportunities in nearby countries
10	Providing domestic capacity for third party certification	Developing capacity in Rwanda for third party certification, e.g. organic, Fair Trade etc., is of increasing importance in Rwanda. The certifications are not only a way of potentially increasing product value but are increasingly seen as a requirement/pre-condition for market entry in many countries. Currently such certification services have to be contracted to companies outside Rwanda

To define the decision weights, the workshop participants were each asked to assign 100 points amongst the eleven 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. After some discussion the following two criteria had been added in the initial discussions;

1. Ease of implementation and
2. Sustainability.

In addition the definition of trade diversification was widened so that it, in essence, read as 'Enables local manufacturing and beneficiation."

Stage 4: Construction of information cards

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

transparent and open to scrutiny. First, the specific nature of each of the SPS capacity-building options was described in some detail on the basis of existing documentation, consultation with stakeholders, etc. Descriptions of each of the 10 capacity-building options are provided in Section 5 below.

The metrics to be employed for each of the eleven 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 recognize that the aim of the framework is not to provide a final and definitive prioritization of the capacity-building options. Rather, the priorities that are derived should be revisited on an ongoing basis and revised as more and/or better data for the decision criteria become available.

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

Criteria	Minimum	Maximum	Mean	CV	Category
Up front investment	5	15	9.2	0.3	Cost
On-going costs	0	10	7.2	0.2	
Ease of implementation	0	17	2.1	0.4	
Sustainability	7	25	1.9	0.5	
Trade impact	5	30	16.3	0.6	Trade impacts
Enables local manufacturing and beneficiation	0	9	0.7	0.2	
Impact on domestic agricultural productivity	7	20	18.3	0.3	Domestic agri-food impacts
Impact on domestic public health	5	20	14.1	0.4	
Impact on local environmental protection	5	20	8.5	0.3	
Impact on poverty	5	20	12.3	0.4	Social impacts
Impact on vulnerable groups	5	14	9.4	0.2	

Information cards for each of the 10 SPS capacity-building options were then compiled. These are reported in Appendix 4. Each card presents data for the eight decision criteria, measured according to the scales outlined in Table 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 prioritization exercise, and in considering how the analysis might be refined in the future.

Table 6; Decision criteria metrics

Decision Criterion	Details	Measure
Cost		
Up-front investment	Monetary costs of investments to upgrade SPS capacity	Monetary amount ($)
On-going cost	Direct costs of maintaining and operating the upgraded SPS capacity	% of export value in 2015
Ease of implementation	How easy or difficult will the type of proposed intervention be?	Very difficult (-2) to Very easy straightforward) (+2)
Sustainability of option	How sustainable is the option once the initial investment is made?	Very difficult (-2) to Very easy straightforward) (+2)
Trade impacts		
Change in absolute value of exports	Predicted enhancement of exports in 2015 or avoided loss of exports in 2015	Monetary amount ($)
Trade diversification and enablement of local manufacturing and beneficiation	Implementation of the option increases opportunities for local manufacturers in terms of export markets and for value addition activities	Significant negative impact (-2) to significant positive impact (+2)
Domestic agri-food or impacts		
Change in agricultural/fisheries productivity	Changes in productivity of agricultural or fisheries production of commodities to export and/or domestic markets	Significant negative impact (-2) to significant positive impact (+2)
Change in domestic public health	Changes in domestic public health, through food safety, occupational exposure to hazards, etc.	Significant negative impact (-2) to significant positive impact (+2)
Change in local environmental protection	Changes in protection of natural environment	Significant negative impact (-2) to significant positive impact (+2)
Social impacts		
Poverty impact	Change in incidence of poverty	Significant negative impact (-2) to significant positive impact (+2)
Impact on vulnerable groups	Impact on each of women, children, vulnerable areas and smallholders/artisanal fishers	Impact on each group measured on scale: Significant negative impact (-2) to significant positive impact (+2). Then the four individual measures aggregated such that overall measure on scale -8 to +8

Stage 5: Construction of spider diagrams

Through Stages 1 to 4, the inputs to the priority-setting process were collected and then assembled into the series of information cards. The aim of Stage 5 was to present the information in the information cards in a manner that permits easier comparison of the 10 capacity-building options. Thus, a spider diagram was derived that plotted the 10 SPS capacity-building options against the eleven decision criteria. Scrutiny of this diagram permits the assessment of which decision criteria against which each of the capacity-building options performs relatively well/badly compared to the other capacity-building options in the choice set.

Stage 6: Derivation of quantitative priorities

The formal priority-setting analysis involves the use of outranking through the D-Sight software package. The mechanics of the analysis are described in some detail in the user guide to the framework.[20] The inputs to the model are the data assembled in the information cards. For most of the decision criteria preferences were modeled using a level function since these were measured using categorical scales. However, the up-front investment, on-going cost and direct trade impacts were measured continuously and modeled using linear functions.

Three scenarios were modeled:

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

The baseline model is considered to provide the most reliable set of priorities, in that it uses the full set of information derived through stages 1 to 4. The two subsequent models were estimated to examine the extent to which the derived priorities are sensitive to changes in the decision weights; if the broad ranking of the ten SPS capacity-building options remains generally the same under the three scenarios presented by these models, we can be reasonably confident that the results of the framework are robust. The sensitivity of the derived rankings to changes in decision criteria measures for which there are low levels of confidence was also explored though the results are not shown in this report.

Stage 7: Validation

The final stage of the priority-setting analysis is an on-going process of which the next stage is distribution of the results to all interested parties. The aim of the validation process is to ensure that the results of the priority-setting framework are largely in accordance with expectations, or that unexpected rankings can be explained through the pattern of data in the information cards. Also if there is better information than that used in this analysis then that can be fed into the model and the results updated. A validation period from the 28th February 2012 to 31st August 2012 was allowed based on Capacity Building Option cards that were drawn up at the workshop. During this period a draft report was written and distributed to a limited group on April 15 2012. This analysis is based on the feedback received during this period.

SPS capacity-building options

This section provides a more detailed description and rationale for each of the 10 SPS capacity-building options considered in the priority-setting analysis.

Brief descriptions of *included* SPS Capacity Building Options for Rwanda (as determined in the SPS Workshop on 29 February 2012)

CAPACITY BUILDING OPTIONS INCLUDED

1. Training in field crop good agricultural practices to agronomists / post harvest extension persons and extension to farmers (maize, groundnuts, wheat, rice, cassava for flour) with an additional variant which includes the development and registration of aflatoxin biocontrol remedies
2. Develop a national registered pesticide list and update it according to requirements for the international markets in terms of permitted agrochemicals and maximum residue limits (MRL's)
3. Development and provision of certified mycotoxin testing services in Rwanda
4. Provision of drying facilities and accompanying systems and equipment for reducing crop moisture (pulses, cereals, groundnuts, coffee)
5. Development and provision of certified pesticide residue testing services in Rwanda
6. Developing a Hazard Analysis and Critical Control Points (HACCP) based systems approach to the production and/or procurement of cassava, wheat and maize flour for a private sector company
7. Development of a simple field method for the detection of potato flavor coffee beans at the green or blue bean stages
8. Meat exports compliance to importing country standards including disease diagnosis and surveillance as well as good management and hygiene practices through the development of human capacity at export abattoirs (Congo-Brazzaville)
9. Certified testing of mineral water and juices to required standards for export markets
10. Developing capacity in Rwanda for third party certification (e.g. organic, fair trade, Rainforest Alliance,)

Options excluded from the analysis together with reasons for their exclusion are listed in Appendix 3. The data, in the form of information cards, for the included options is presented in Appendix 4.

1 Training in field crop good agricultural practices to agronomists / post harvest extension persons and extension to farmers (maize, groundnuts, wheat, rice, cassava for flour)

Maize and groundnut are the sub-Saharan African crops most prone to aflatoxin contamination through infection by toxin producing strains of the fungus *Aspergillus flavus* along the entire production chain though other cereals and cassava flour are also affected. Aflatoxins are a major concern because of their acute and chronic health effects on humans and domesticated animals. Raising awareness, implementing good agricultural practices and disseminating information about aflatoxin is an important intervention strategy in affected crops[21]. Groundnut and maize production areas in Rwanda may be prone to aflatoxin contamination though, if so, the information is not in the public domain.[22] Aflatoxin management in groundnuts and maize as well as other crops of interest has been well researched and a range of pre- and post-harvest management methods are known for mitigating the problem. These include, methods to manage insect pests that predispose grains to *Aspergillus* spp colonization and

aflatoxin contamination, good harvest practices and rapid grain drying methods to minimize fungal colonization, and good storage practices. The widespread use of moisture meters and, potentially, ultra violet inspection lamps can provide field level quality control feedback to those in the first steps in the value chain. Participatory techniques involving farmers for large-scale diffusion of these technologies can help farmers to achieve low level of aflatoxin in their products that are safe to eat and marketable in the region.

Information passed on from private sources is that such a project co-implemented by a Consultative Group on International Agricultural Research (CGIAR) organization and the Government of Malawi would cost about US$ 1,500,000 over a three year period. However there is some skepticism that such programs are the way forward due to lack of market incentives for smallholder farmers to comply with aflatoxin standards and the shortage of aflatoxin testing services. Any such program in Rwanda would need a range of incentives but whatever they are the most sustainable is likely to require private sector participation.[23]

An alternative method of implementing this option is to couple the GAP's training with the development of bio-control of aflatoxins using atoxigenic strains of *A. flavus*, i.e. AFLASAFE, native to Rwanda.[24] Adding this activity to the capacity building option increases costs by US$400,000 and increases the impact on women and children through reduced dietary aflatoxin.

2 Training in horticulture good agricultural practices to agronomists / post harvest extension persons and extension to farmers

Taking as a definition of horticulture the production of perishable crops including vegetables, flowers, and fruit then it is not entirely clear if this SPS capacity building option is a constraint. In essence such exports are essentially limited to Rwanda's immediate neighbors in the East African Community (EAC) as well as the DRC and would be informal/semi-formal in nature. No standards for horticultural produce have yet been set by the EAC so it is not clear that the application of good agricultural practices will remove any trade constraint.

A significant consideration is that the proposed activity should not overlap with that of the World Bank Land Husbandry, Water Harvesting and Hillside Irrigation Project which together with USAID has allocated US$2.24 million to extension support in Rwanda with some of the activities overlapping with the proposed activity (World Bank, 2009).[25] The Capacity Building Option card in Appendix 4 (Table A4-2) has been constructed with this possibility in mind given that existing extension activities are not SPS oriented but do contribute to the enabling environment.

3 Development and provision of certified mycotoxin testing services in Rwanda

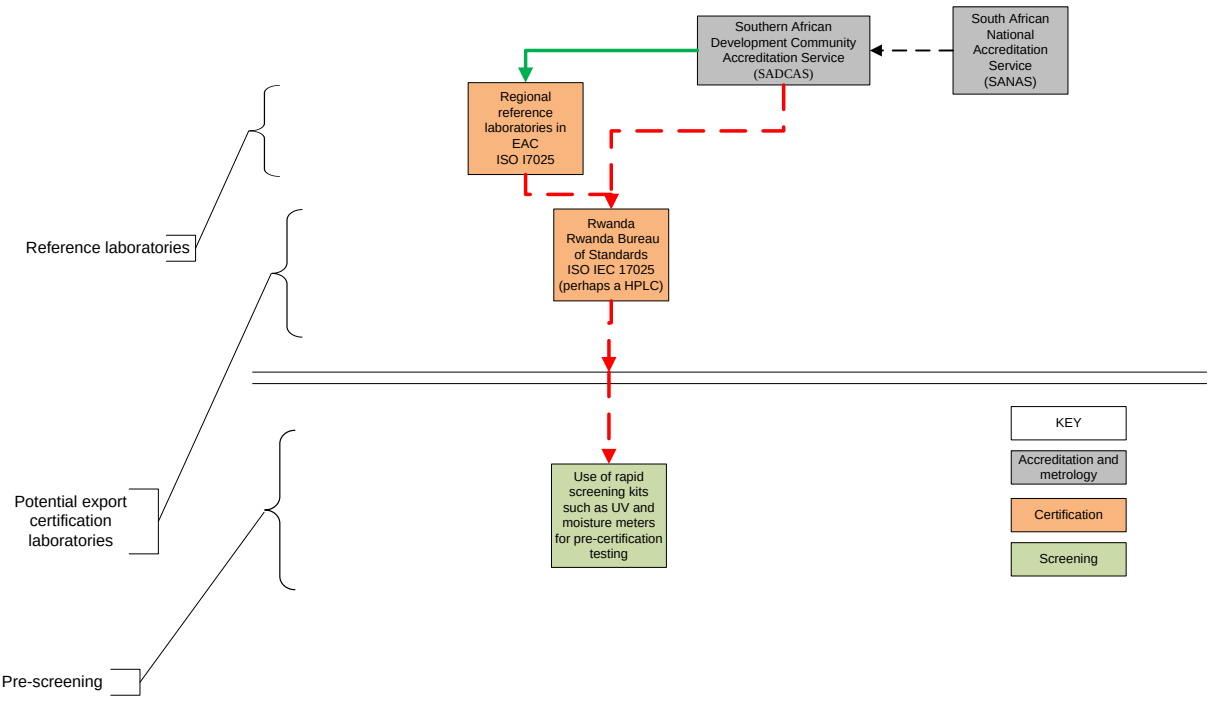
Mycotoxin contamination is generally not appropriately controlled and regulated in Africa unless the product is exported. Aflatoxins are regulated in part per billion (ppb) ranges the measurement of which requires sophisticated equipment. In addition, for export certification, testing laboratories and tests need to be accredited by an internationally recognized certification body of which there are few in Africa. In Southern Africa there are significant gaps in the status of aflatoxin testing including;

1. Needed linkages of laboratories to, for example, the Southern African Development Community Accreditation Service (SADCAS) accreditation services

2. Any needed ongoing calibration of equipment and validation of test methods, if necessary, coordinated via the organic chemistry service of the National Metrology Institute of South Africa (NMLSA) and a regional reference laboratory network.
3. The Rwanda Bureau of Standards have just signed an MoU with SAFOA Services of Rwanda Ltd for the running/operation of the aflatoxin testing services at the Kigali laboratory
4. Personnel training and laboratory certification requirements in International Standards Organization ISO/IEC 17025.

As it is, there is a significant lack of aflatoxin research and testing facilities in Rwanda and there needs to be some coordination to avoid duplication in the services offered, and to upgrade them so that they can offer accredited certificates for exports of maize and groundnuts and for research into the extent of the problem in the country.

Figure 3; Possible hierarchy of aflatoxin testing services in Rwanda as proposed in one interpretation of Capacity Building Option 3



Above is a hierarchy of how this option might look within Rwanda if this capacity building option was implemented using SADC and EAC laboratory accreditation services. It is roughly how the system operates within South Africa and what is being proposed for Malawi and Zambia. There is no information on the costs of implementing such a system. The infrastructure, some equipment and the personnel already largely exist though there will have to be an upgrading of the first two and training mentoring of staff.

4 Provision of drying facilities and accompanying systems and equipment for reducing crop moisture (pulses, cereals, groundnuts, coffee)

The provision of drying and storage facilities as well as monitoring equipment is important in a range of crops. The issue is that of the development of moulds post harvest which would lead to the buildup of mycotoxins. The drying facilities would enable farmers to rapidly reduce the incidence of moulds in their produce and would ensure that the final output is produce at the correct moisture levels suitable for long term storage

Since pulses, cereals and groundnuts are soon to have finalized standards within the EAC which will include maximum permitted levels for mycotoxins. See the following extracted from CARANA a USAID implementing partner - *USAID/East Africa's Market Linkages Initiative (MLI), managed by CARANA, has signed a total of $588,000 in grant agreements with six Rwandan cooperatives and companies, leveraging another $926,000 from the private sector to build drying centers and equipment to boost grain quality. The improvements at collection centers and cooperatives directly and indirectly benefit 45,000 Rwandan farmers who use the centers, as better grain quality will help them get better prices*.[26]

An up to date review of dried grain storage in Rwanda has been recently produced (COMPETE, 2011).[27] Challenges identified in this sector of the value chain in Rwanda include:

1. Lack of adequate and appropriate primary processing and storage facilities.
2. Most of the stores are not mechanized and depend on manual labor.
3. Most of the store operators do not have driers and use sun-drying
4. Farmers use inappropriate maize shelling methods and thrashing of rice, sorghum, millet
5. Grains are delivered from farmers with excessive moisture contents of more than 14% and of initially low quality going into storage.
6. The stores operators/processors do not have adequate financial capital to upgrade and modernize their storage facilities and milling equipment/machinery.
7. Poor transport and other infrastructure in the rural areas results in farmers and traders incurring losses because of delays in transporting their grain produce from the farms to the storage centers.

Recommendations included; necessary investments in post-harvest facilities, farmers' capacity building in technical and improved business practices in postharvest storage, handling and management, access to capital for necessary investment in the sector and an improved enabling environment on the part of the Government of Rwanda.

5 Development and provision of certified pesticide residue testing services in Rwanda

Currently Rwandan exporters of agricultural products where importing countries require pesticide tests are obliged to send samples outside the country to accredited laboratories. The aim of this capacity building option in Rwanda is to by-pass external pesticide testing through the establishment of internationally-recognized pesticide residue testing capability in the country. Currently Rwanda is not able to make scientific assessments of product compliance to the pesticide MRL's of Rwanda's trading partners. Although there are a few accredited laboratories in the region, particularly in Kenya, there is limited investment in human or other resource capacity for determining pesticide levels in food in Rwanda.

There are arguments for and against investments in pesticide residue testing capacity in Rwanda. While credible controls must be in place for exporters to ensure compliance with destination market MRLs, including those of private buyers, in fact Rwanda's main markets are neighboring countries, and the Middle East where standards are relatively easy to meet. In general where pesticide limits are enforced in some countries, such as India, pesticide residue tests are carried out at the port of entry in any case. At the same time, however, the main mechanism for the control of pesticide residues as required by EU produce buyers, for example, is the application of certified Good Agricultural Practices (such as Global GAP). The implementation of GAP is generally backed-up by the testing of crops on the basis of risk assessment rather than on a consignment basis. This means that relatively few samples require testing, which most exporters can obtain through laboratories in the destination market. At the same time, the very limited use of pesticides in Rwanda suggests that the risk of violating export market and/or buyer MRL's is low.

Based on a submission by Mozambique to United Nations Industrial Development Organization (UNIDO) for the setting up of a pesticide laboratory in 2005 and updated to 2010 at 8% this gives an estimated cost of approximately $300,000 for this capacity building option. The cost is likely to be an underestimate – if anything but the basic assumption is that laboratory civils and basic equipment are already in existence at the Rwanda Bureau of Standards. Running costs would be assumed to be recovered from users of the facility.

6 Developing a systems approach to the production and/or procurement of cassava, wheat and maize flour at a Rwandan foodstuffs manufacturer

Sosoma Industries are a small scale manufacturer of fortified food products based on cereals, including maize, sorghum, and wheat together with soy. They are based in Kigali and their markets are limited to Rwanda. Production capacity is limited to 12 tonnes per day and markets outside Rwanda are inaccessible because of lack of an internationally acceptable food safety certification. Production limitations include a building that is not really fit for purpose and equipment and procurement bottlenecks. The building complex does not permit a logical processing flow and equipment and is designed for batch handling of raw materials and finished product. There are significant opportunities for foreign body contamination including widespread use of glass, harborage due to the building and equipment layout, factory fittings and so on.

Raw material issues include a lack of control on raw material quality which requires re-handling in the factory at far greater cost than if it had been done at farm level. The quality control laboratory is not fit for purpose being set up for (inappropriate) microbiological testing. It should be sampling deliveries and raw material for moisture content, visual blemishes, and similar simple tests which should be against various specifications for raw materials and finished product. More complex tests should be done by certified laboratories.

Procurement is a significant issue and significant labor inputs are needed to sort out substandard raw material. The introduction of a premium price for properly sorted raw material delivered at 'goods inward' is generally more than paid back in increased factory efficiencies. The opportunity for developing an export market and the involvement of SOSOMA management in working towards eventual HACCP accreditation presents a good opportunity to develop a sustainable model for food

safety in the cereal value chains – particularly as they would be able to ensure a premium price for in-specification raw material and thus give price signals to growers for introducing good agricultural practices, demonstrated use of AFLASAFE and so on. Properly implemented HACCP presents opportunities for long term cost saving though there needs to be some up-front investment in order to realize these.

7 Development of a simple field method for the detection of potato flavor coffee beans at the green or blue bean stages

In recent years Rwanda has developed a good market for high quality washed Arabica coffees. However the presence of a small number of off-flavor beans, known as 'potato flavor' can taint large batches of coffee. There has been some research into the issue and both the suspected cause (bacterial infection following Antestia bug damage), and proposed solution (sophisticated sorting methods which have yet to be developed) are not yet at the point where control or mitigation can be practiced. The presence of potato flavors reduces the value of the crop and the lack of simple field level exclusion measures means that Rwandan coffee can be sold at significantly discounted prices.[28]

The question here is the development of a costed proposal with a known outcome. The easier part is to work out the value lost due to the problem. The harder part is working out the cost of a successful research program given that we can't determine what the solution is likely to be. The issue of potato flavor is ranked 6th in the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) priority ranking of 13 outstanding technical issues for coffees in East Africa.[29]

8 Meat exports compliance to importing country standards including disease diagnosis and surveillance as well as good management and hygiene practices through the development of human capacity at export abattoirs (Congo-Brazzaville)

Rwanda is developing a livestock export sector with the primary market being live animals to the DRC. Other opportunities exist in the sale of dressed meat to Congo Brazzaville. The capacity building option aims at the development of capacity within Rwanda for slaughterhouses to meet the hygiene and animal health requirements of the Congo Brazzaville

9 Certified testing of mineral water and juices to required standards for export markets

Regional market requirements for juice and bottled water to regional markets require that producers / bottlers are HACCP certified. There are two issues here. The first is to have regionally credible HACCP certification. In practice this means ISO 22000 certification which is only available from outside Rwanda. The second is that potential exporters will need to be assisted to develop the systems needed to attain certification.

10 Developing capacity in Rwanda for third party certification (e.g. organic, fair trade, Rainforest Alliance,)

Third party certification (TPC) is increasingly required by companies importing products to ensure a range of compliances which are not necessarily directly related to SPS issues. These include a range of social, environmental and compliance to International Labor Organization (ILO) and other standards. The capacity building option seeks to develop the capacity within Rwanda to issue a range of third party certifications. .

Results

The descriptions presented above, and the results of the stakeholder workshop, suggest all 10 of these options are credible options for SPS capacity-building. However, the associated costs and resulting benefits may differ substantially, such that it is possible to define clear priorities amongst the options on the basis of the defined decision criteria and weights. Below are presented the results of the prioritization exercise using outranking through the software package D-Sight v3. To provide a first scan of the relative strengths and weaknesses of the 10 capacity-building options, spider diagrams were constructed of the linear data (Figures 4 to 6). As such, the spider diagrams are a useful way in which to present information on the SPS capacity-building options to more senior decision-makers.

Figures 4 and 5 present the up-front investment and on-going costs profiles of the 10 SPS capacity-building options. It is immediately obvious the provision of drying services for stored crops involves the higher level of up-front investment ($1,500,000), with all other options being $1,000,000 or lower. Ongoing re-certification of bottled water and juice exports as well as of abattoirs involve on-going costs that exceed all other options at 10% and 8.8% per cent of increased exports respectively, with the nearest other option, certified mycotoxin testing services, having on-going costs of 4.5% of exports.

There are striking differences in the predicted impact of the capacity-building options on the absolute value of exports (Figure 6) as in the case of determining an effective method for detecting potato flavor in coffee beans. For most of the remaining options, the predicted trade effects are quite limited. The exceptions are the provision of a GAP's program for horticultural crops, drying facilities and accompanying systems for stored crops and both with an estimate trade impact of $1.9 million. The only other significant impact is that of the option of developing disease diagnosis and surveillance as well as good management and hygiene practices through the development of human capacity at export abattoirs which has an estimated trade impact of $1.7 million.

Figure 4; Decision criteria measures scores for SPS capacity-building options – up-front investment

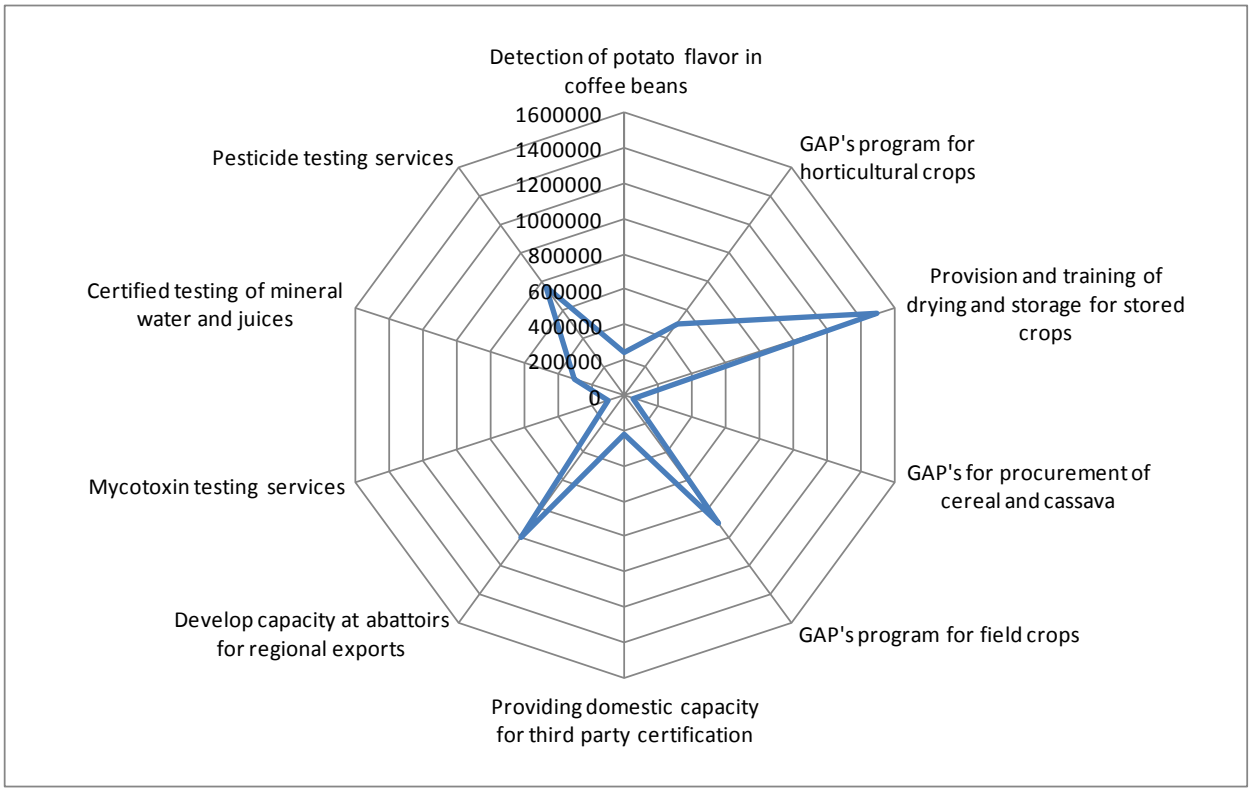


Figure 5; Decision criteria measures scores for SPS capacity-building options – on-going costs

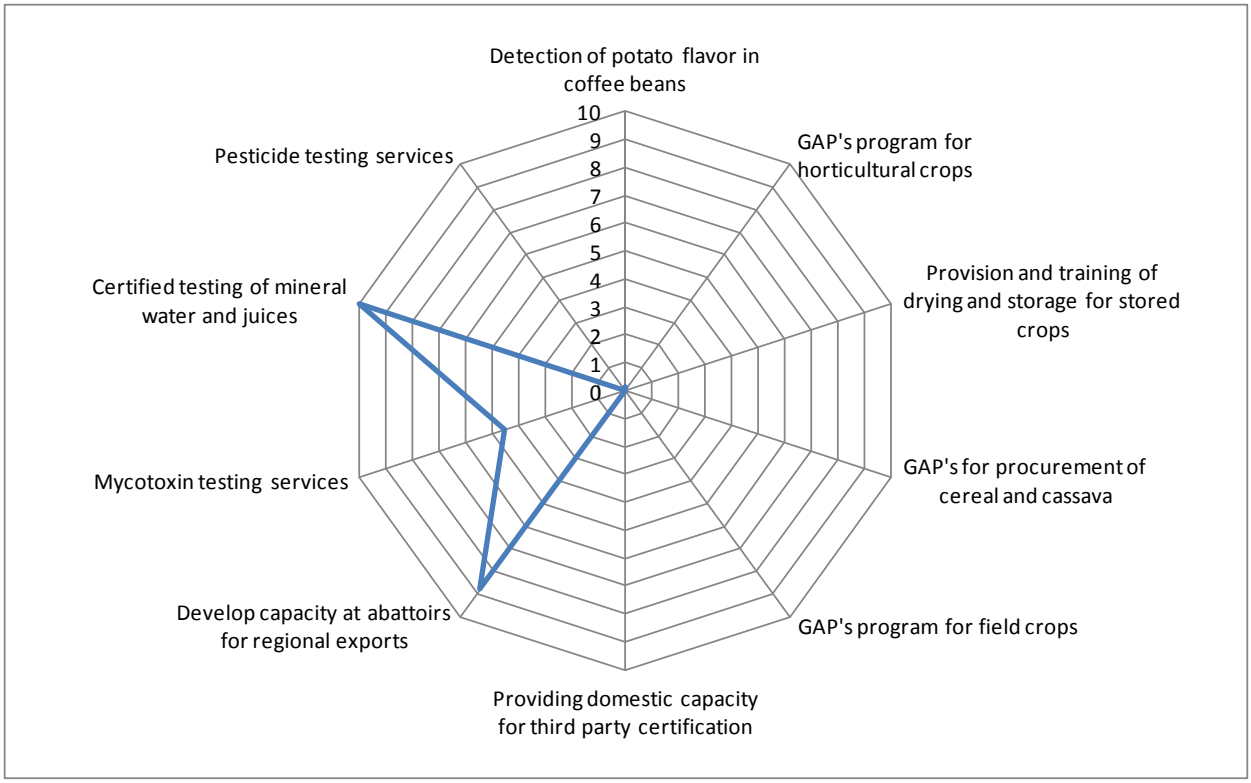
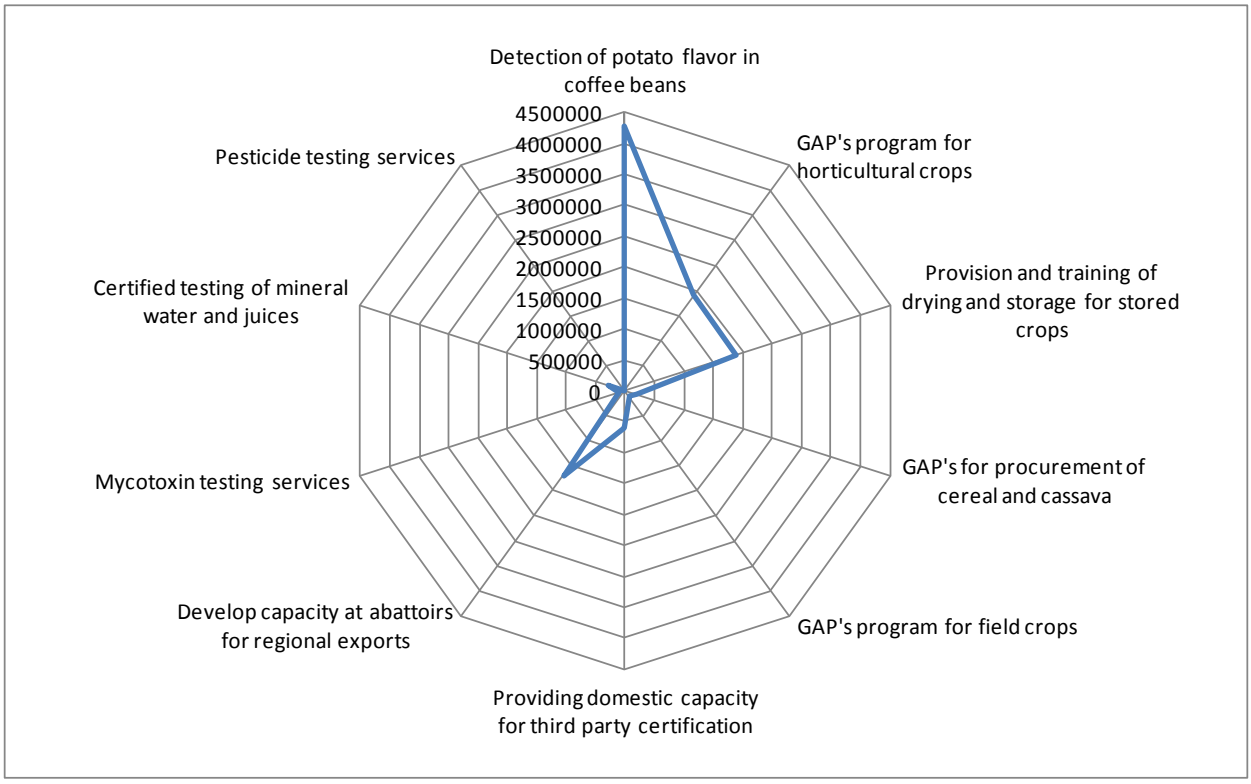


Figure 6; Decision criteria measures scores for SPS capacity-building options – change in absolute value of exports



Figures 7 to 14 present the predicted impact of the SPS capacity-building options on the non-linear criteria i.e. Ease of implementation, Sustainability, Trade diversification and beneficiation, Agricultural productivity, Domestic public health, Environmental protection, Poverty impact and [Impact on] Vulnerable groups. Three of the options, provision of drying services for stored crops and implementing good hygiene practices in abattoirs are expected to be relatively straightforward to implement because these will supplement or reinforce existing programs in this general area while mycotoxin and testing services will be fairly easy – the latter two because of significant private sector involvement in both these options (Figure 7). The most sustainable and export diversifying option is that of implementing good hygiene practices in abattoirs (Figures 8 and 9). Of the 10 options, implementing a GAP's program for horticultural crops and the provision of drying services for a range of stored crops are expected to bring about a significant increase in agricultural productivity (Figure 10). Most of the options have little or no impact on domestic public health, with the exception being mycotoxin controls for groundnuts and maize which is predicted to bring about significant improvements in this area (Figure 11). Four of the capacity-building options, implementing a GAP's program for field crops, implementing a GAP's program for horticultural crops, GAP's for procurement of cereal and cassava and developing capacity in third party certification are predicted to have positive impacts on local environmental protection (Figure 12). Finally, Figures 13 and 14 provide the poverty and social vulnerability impact profiles of the capacity-building options under consideration. The options judged to have the greatest impact on poverty are the capacity development for abattoirs for regional. One option is predicted to have a significantly positive impact on vulnerable groups, namely the detection of potato flavor in coffee beans.

Figure 7; Decision criteria measures scores for SPS capacity-building options – ease of implementation

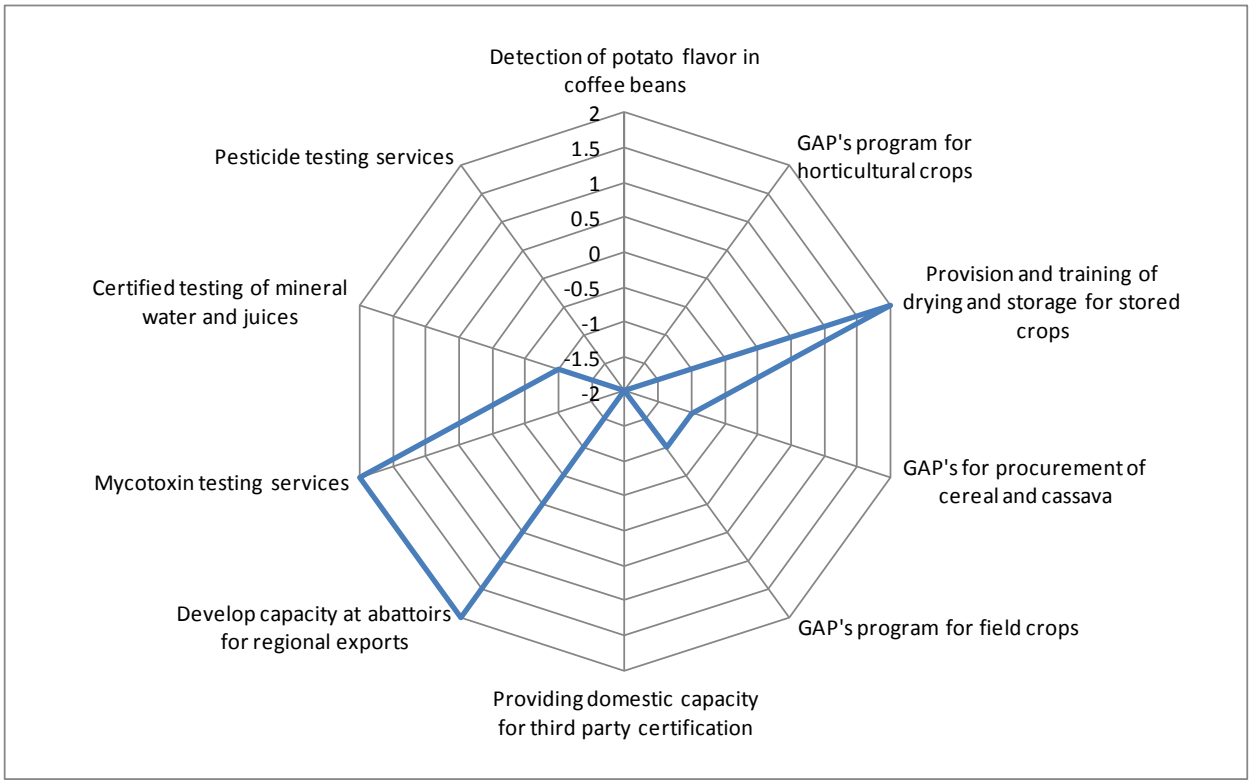


Figure 8; Decision criteria measures scores for SPS capacity-building options – sustainability

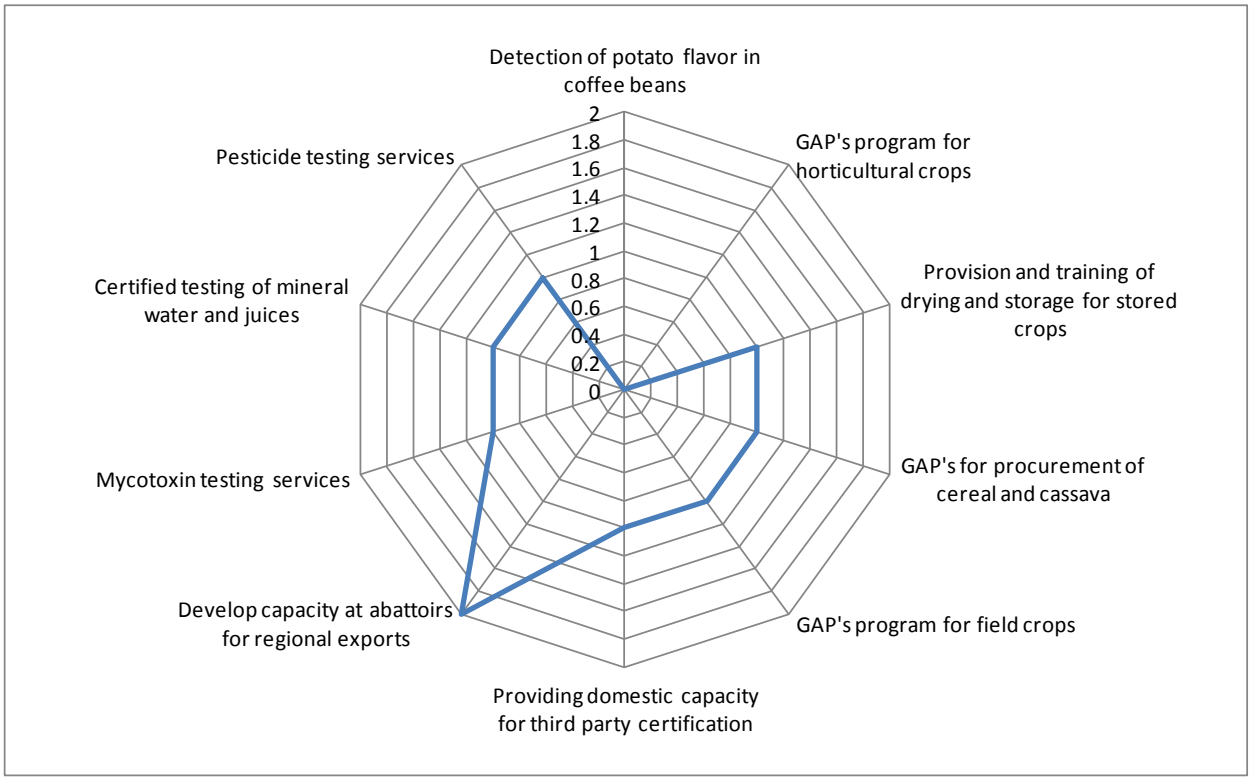


Figure 9; Decision criteria measures scores for SPS capacity-building options – Trade diversification and beneficiation

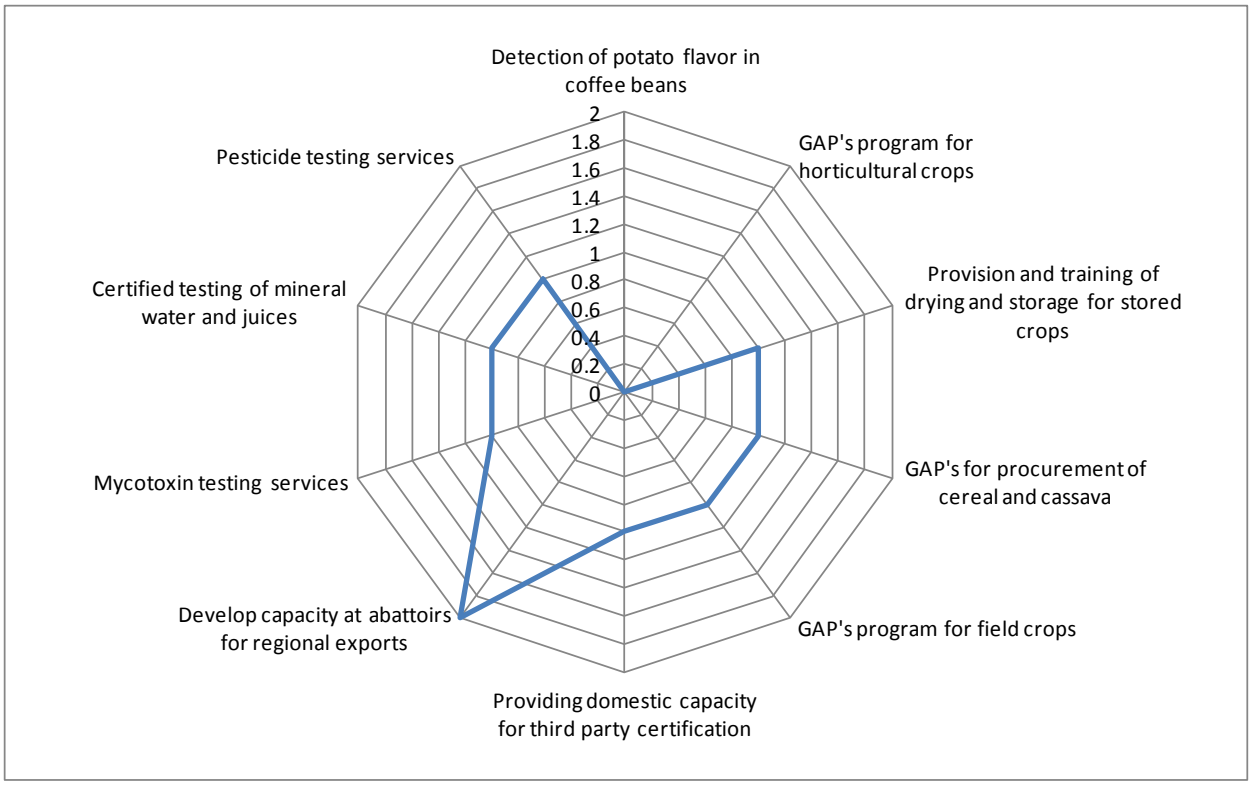


Figure 10; Decision criteria measures scores for SPS capacity-building options – agricultural productivity

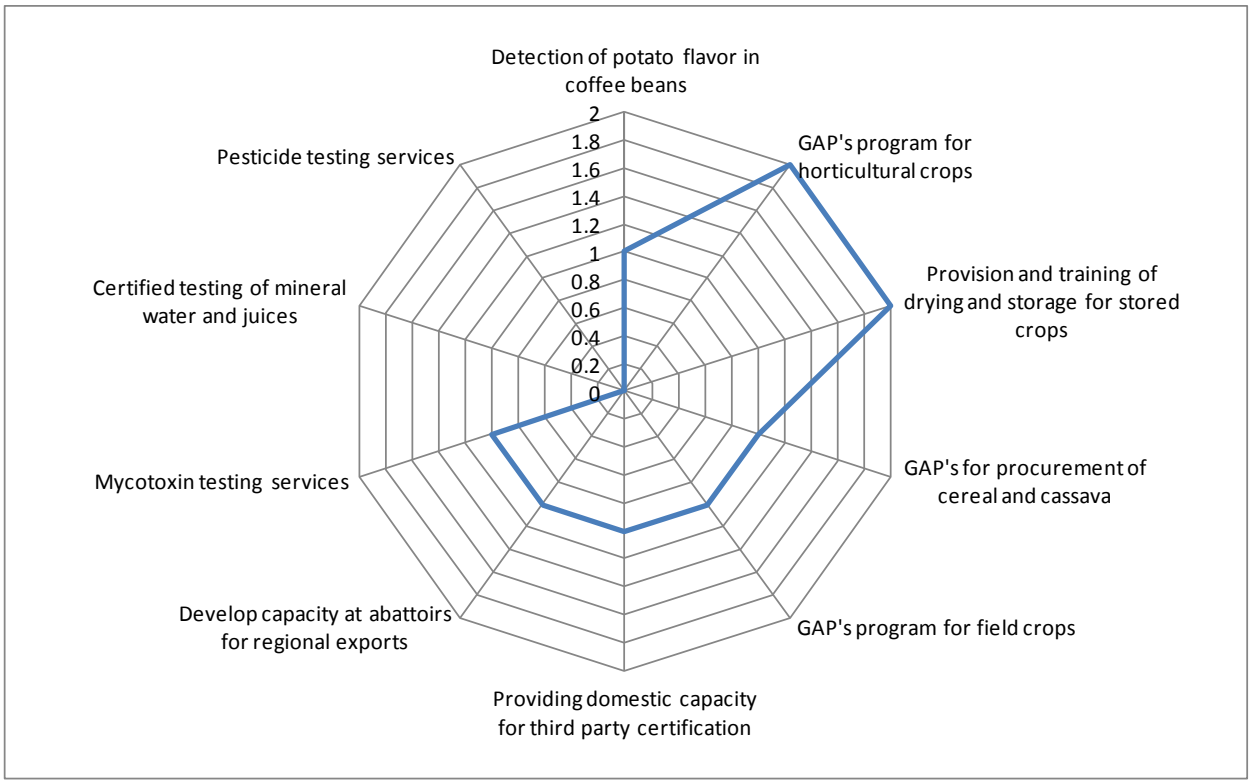


Figure 11; Decision criteria measures scores for SPS capacity-building options – change in domestic public health

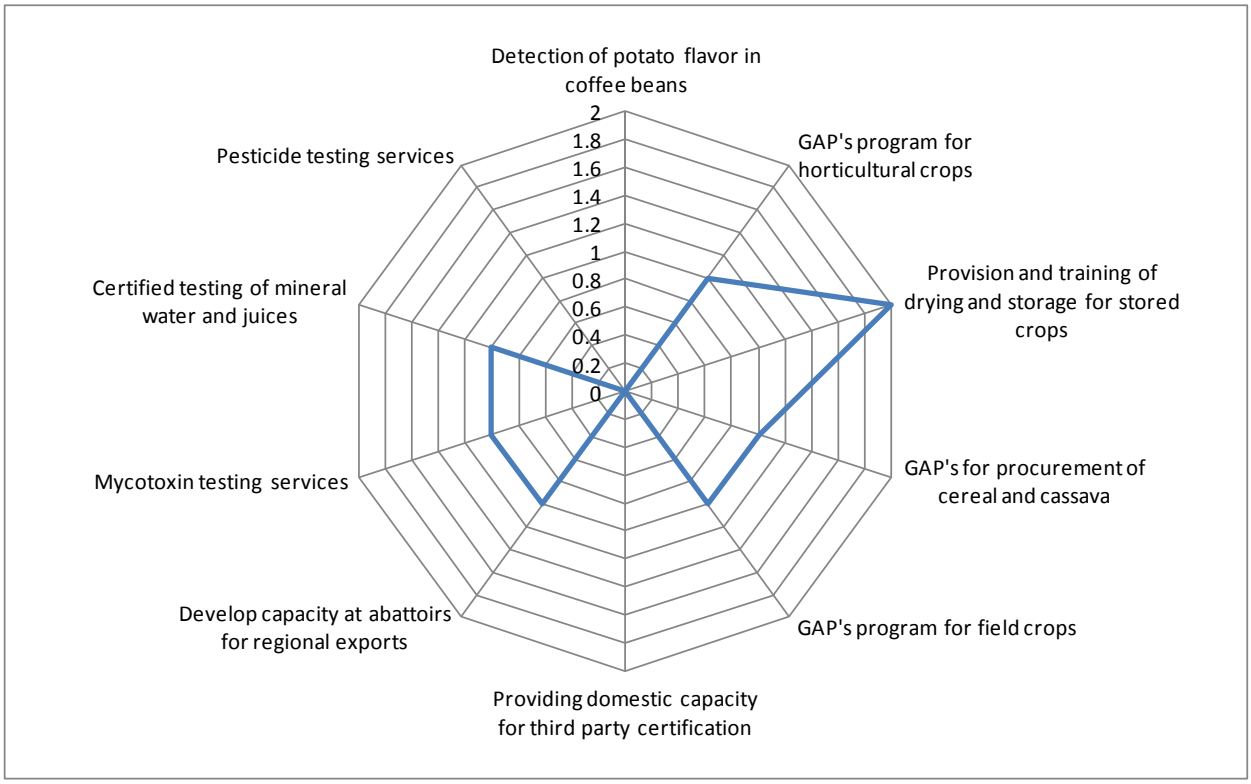


Figure 12; Decision criteria measures scores for SPS capacity-building options – change in local environmental protection

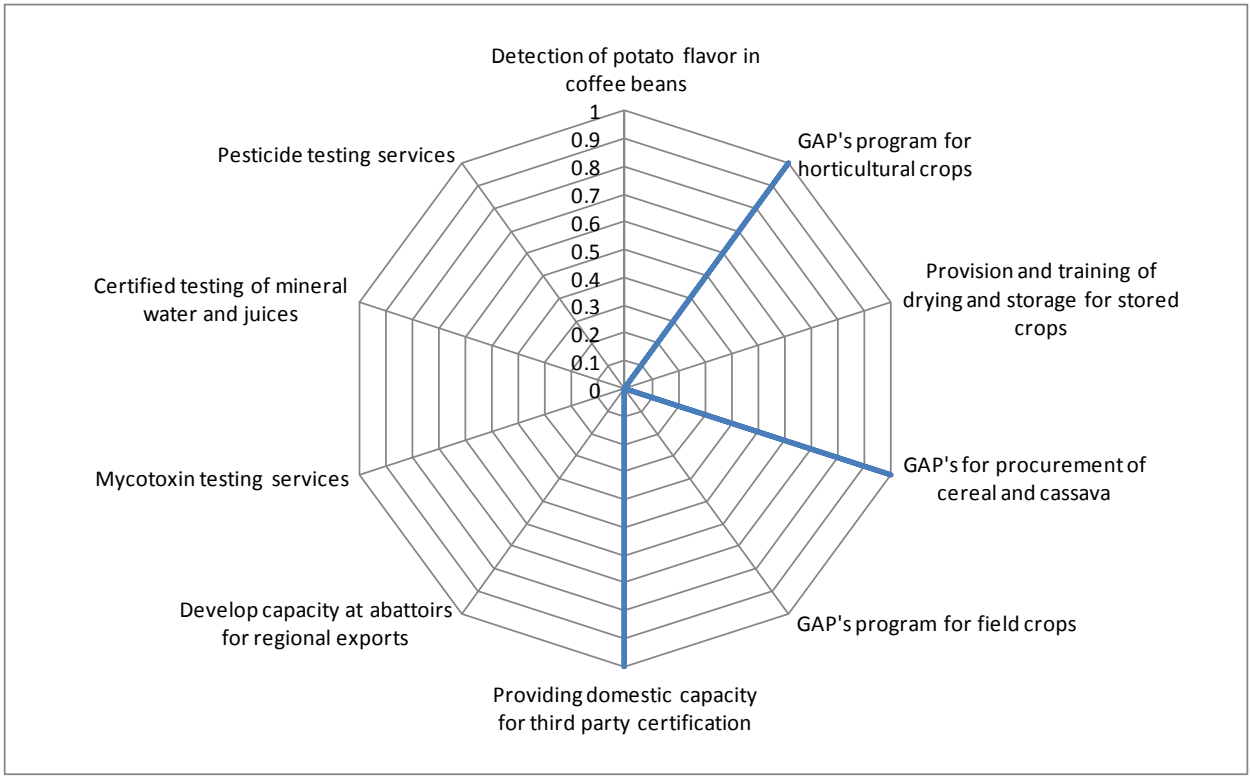


Figure 13; Decision criteria measures scores for SPS capacity-building options – poverty impact

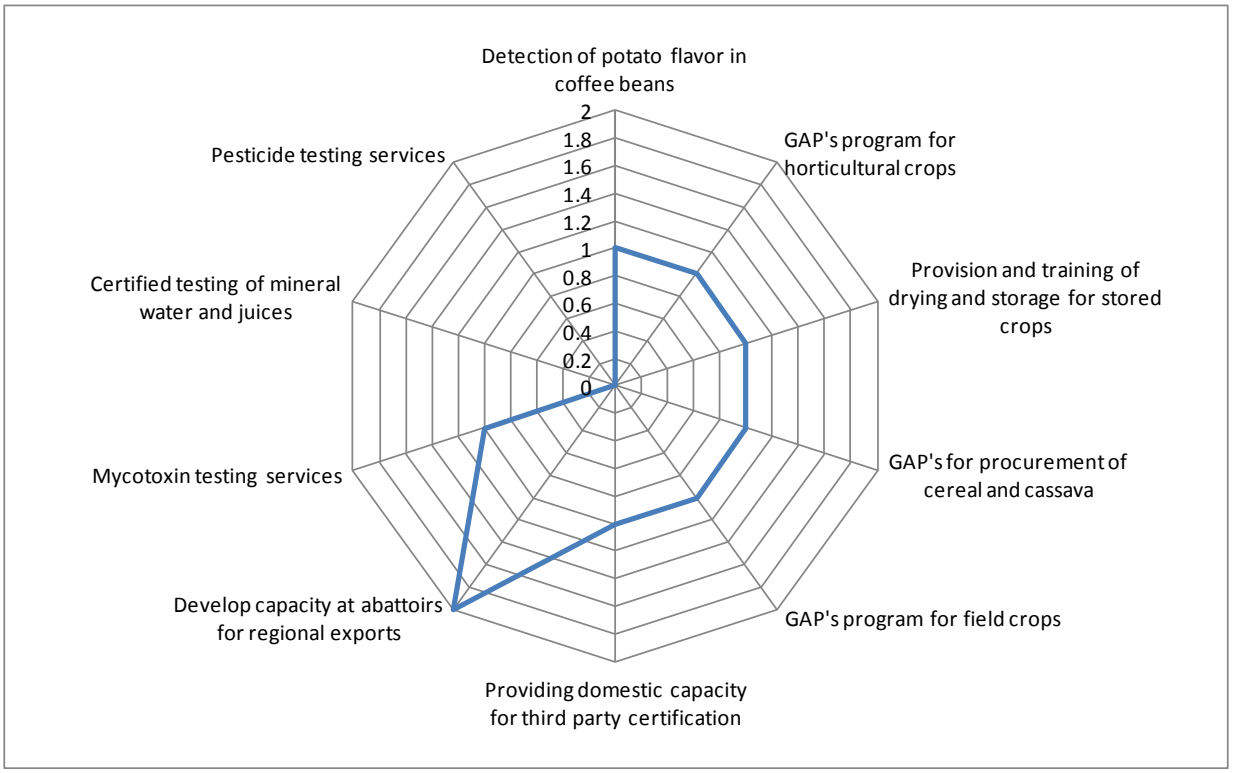
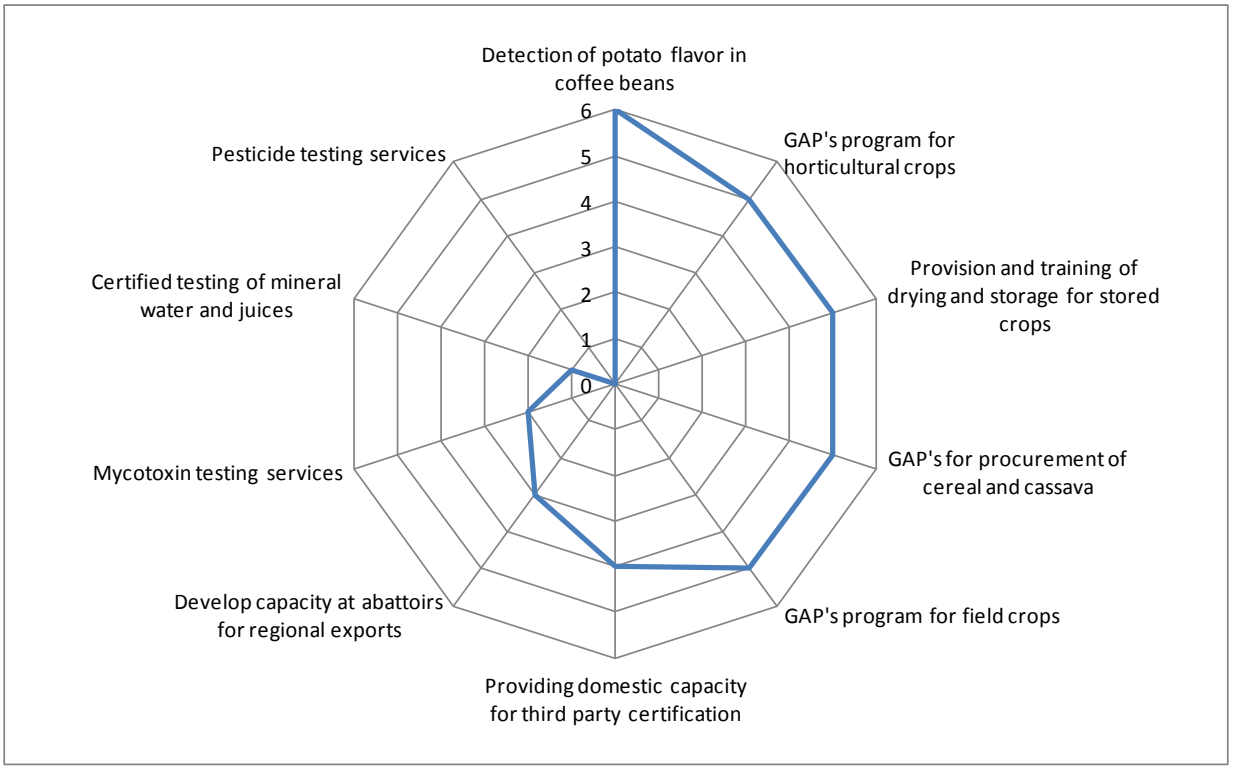


Figure 14; Decision criteria measures scores for SPS capacity-building options – impact on vulnerable groups

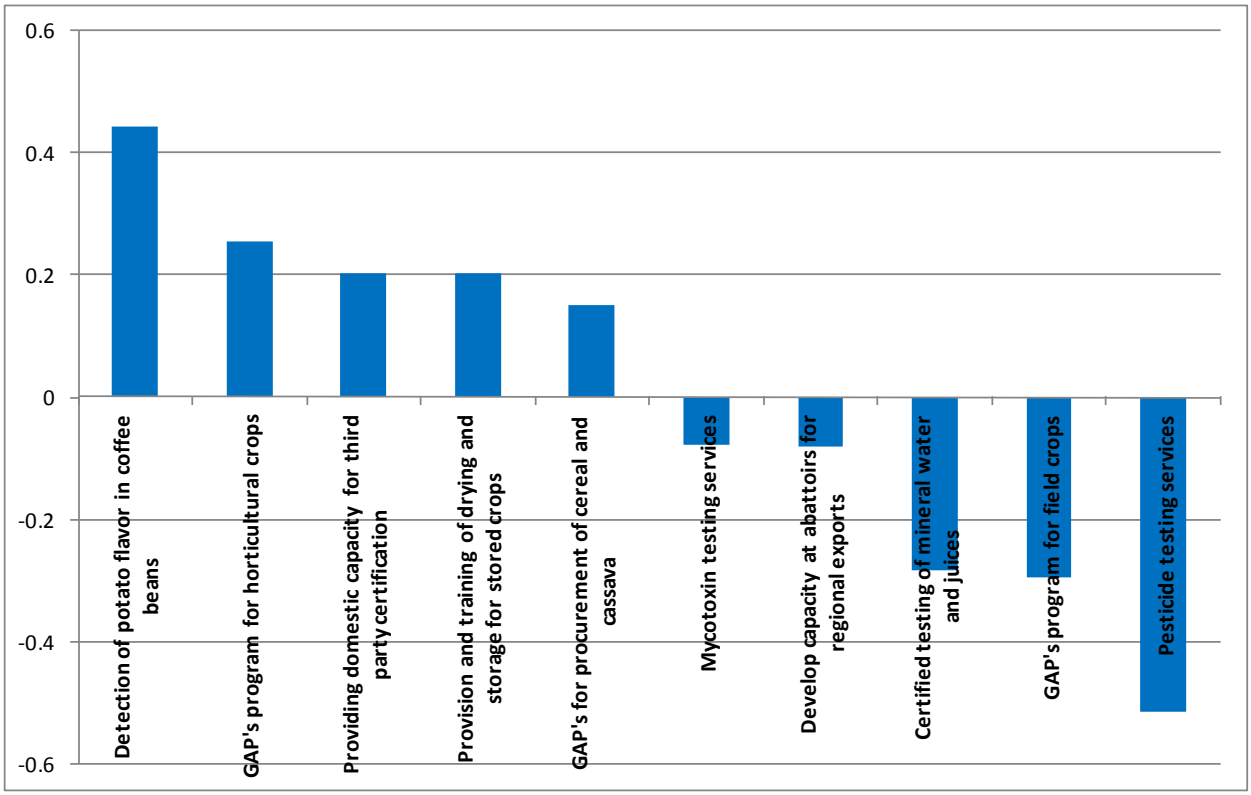


From a review of the spider diagrams it is apparent that none of the SPS capacity-building options dominates across all or even most of the decision criteria, so it is not immediately apparent how these options should be prioritized. That is where the outranking analysis comes in; it compares each of the capacity-building options on a pair-wise basis with respect to each of the eleven decision criteria in turn. Each of these comparisons determines whether one option dominates (or is dominated) by another and by how much. The aggregate of all of these comparisons, taking account of the defined decision weights, gives an overall measure of preference, what is termed the net flow. Thus, options with a positive and larger (or negative and smaller) net flow are given a higher priority. Options with a positive net flow, dominate the other options with respect to the eleven defined decision criteria. Conversely, options with a negative net flow are generally dominated by other capacity-building options.

Figure 15 reports the net flows for the ten SPS capacity-building options for the baseline model; that is the prioritization derived using the decision weights defined in the stakeholder workshop. The options are prioritized from left to right. Thus, the analysis suggests the higher priority options are the detection of potato flavor in coffee beans, developing and implementing a GAPs program for horticultural crops and providing domestic capacity for third party certifications. Other options with net positive flows are those of Provision and training of drying and storage for stored crops and developing and implementing GAPs for procurement of cereal and cassava. All other options have negative net flows, indicating that they are dominated overall on the basis of the chosen decision criteria and weights.

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

Figure 15; Net flows for baseline model



It is possible to examine the performance of each of the SPS capacity-building options through their scores for each of the 11 decision criteria, as reported in Figures 16 to 25[2]. For example, whilst the scores for seven of the decision criteria are strongly positive, the highest ranked option, detection of potato flavor in coffee has negative flows for ease of implementation, enabling local manufacturing and beneficiation, impact on domestic public health and impact on local environmental protection. Conversely, the provision of third party certification services is ranked high in impact on the environment and sustainability and is one of the lower cost options and which is ranked third in the overall analysis, performs well with respect to costs and, to some extent in terms of social impact, (Figure 25), but has negative scores for ease of implementation and impact on domestic public health.

[2] See Table 5. The decision criteria are labeled 1-10 in the figures as follows; 1; Up-front investment, 2; On-going costs, 3; Ease of implementation, 4; Sustainability, 5; Trade impact, 6; Enables local manufacturing and beneficiation, 7; Impact on domestic agricultural productivity, 8; Impact on domestic public health, 9: Impact on local environmental protection, 10: Impact on poverty, 11; Impact on vulnerable groups.

Figure 16; Decision criteria scores from baseline model – GAP's program for field crops

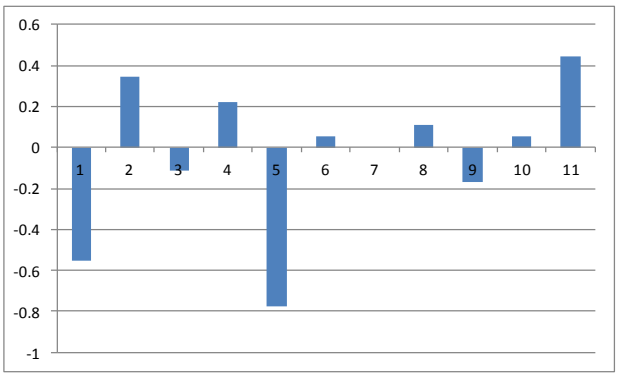


Figure 17; Decision criteria scores from baseline model – GAP's program for horticultural crops

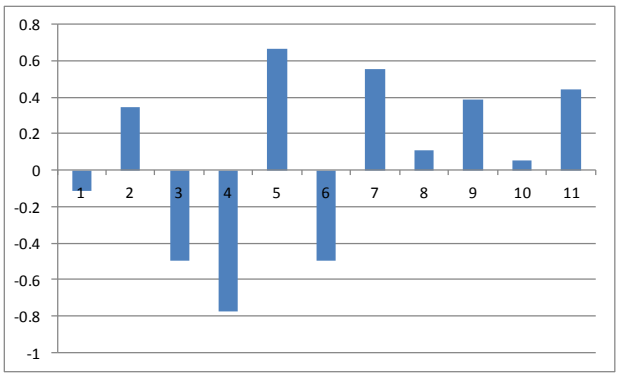


Figure 18; Decision criteria scores from baseline model – Mycotoxin testing services

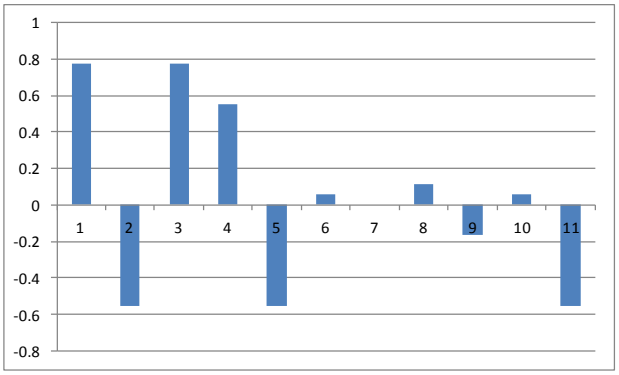


Figure 19; Decision criteria scores from baseline model – Provision and training of drying and storage for stored crops

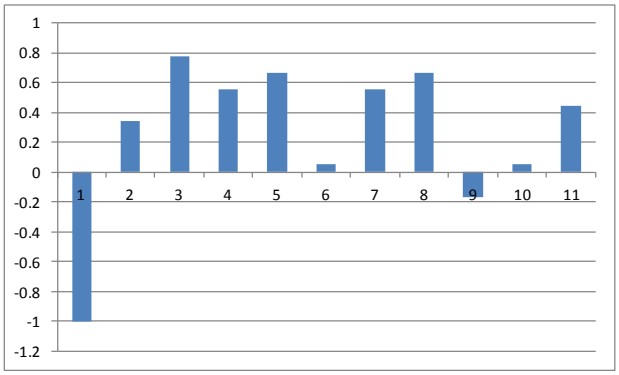


Figure 20; Decision criteria scores from baseline model – Pesticide testing services

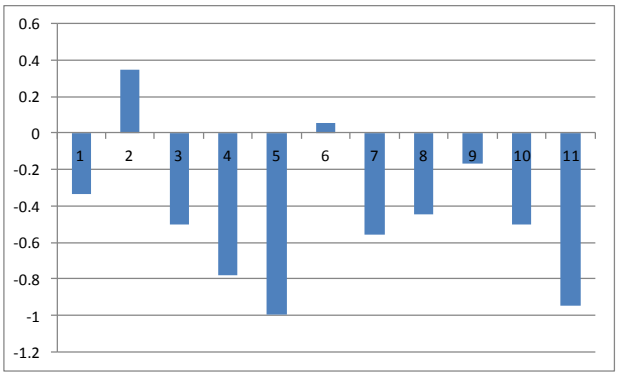


Figure 21; Decision criteria scores from baseline model – GAP's for procurement of cereal and cassava

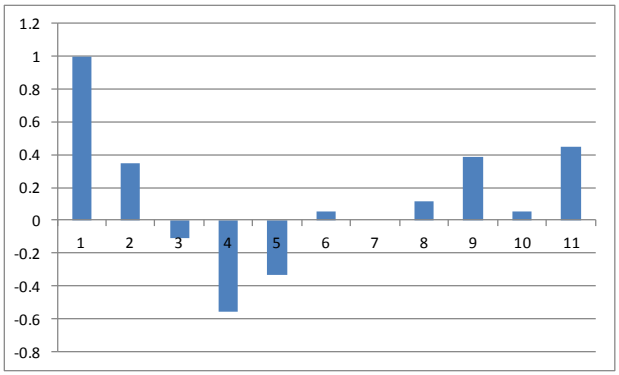


Figure 22; Decision criteria scores from baseline model – Detection of potato flavor in coffee beans

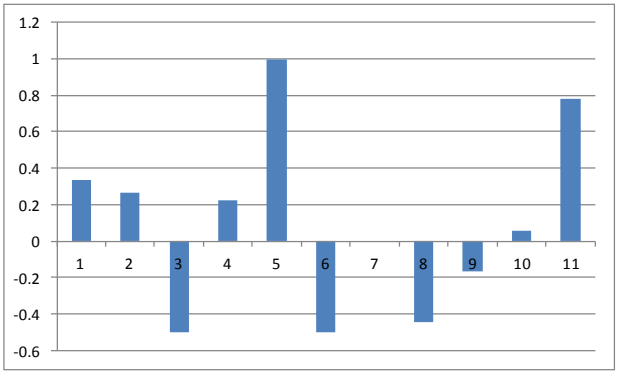


Figure 23; Decision criteria scores from baseline model – Develop capacity at abattoirs for regional exports

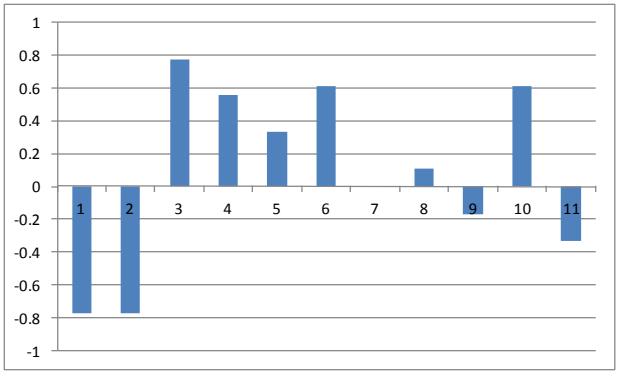


Figure 24; Decision criteria scores from baseline model – Certified testing of mineral water and juices

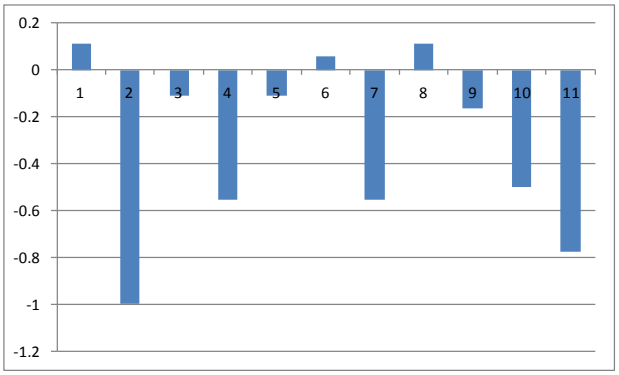
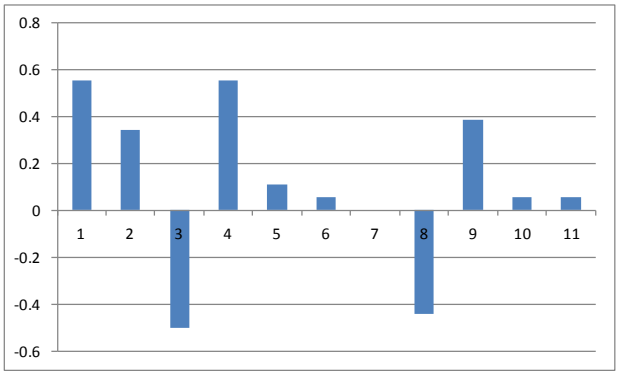


Figure 25; Decision criteria scores from baseline model – Providing domestic capacity for third party certification



The foregoing discussions presents the core results of the analysis, and application of the prioritization framework and the rankings in Figure 15 are in many ways the key results representing the recommended priorities between the 10 SPS capacity-building options included in the analysis. It is important to recognize, however, that these results, and the established priorities amongst the capacity-building options, reflect the chosen decision criteria and the respective measures derived for each of the 10 options, and the weights attached to the criteria. This begs the question, how does the ranking of the capacity-building options change if any of these key inputs changes? To answer this question, sensitivity analysis was applied to the baseline model, the results of which are reported below.

To explore the impact of changing the weights attached to the eight decision criteria, an alternative equal weights model was estimated. This model abandons the weights derived in the stakeholder workshop and assumes all criteria are weighted equally. The results of this model (Figure 26) do differ in some respects from those of the baseline model, but there is some stability in that all seven of the same capacity-building options remain ranked in the top seven as do the bottom three. The option for GAPs in horticulture has been demoted from second to 6th while two options, the provision and training in the use of drying and storage for stored crops, GAP's for procurement of cereal and cassava have been promoted by three and while the development of capacity at abattoirs for regional exports has climbed by two places. The provision of mycotoxin testing services has been demoted out of the top six though

the net flow remains positive. Amongst the options with negative net flows i.e., certified testing of mineral water and juices, the provision of a GAPs program for field crops and pesticide testing services there is major change in the ranking. These results suggest that the derived priorities are relatively robust to changes in the decision weights with certain qualifications.

To further explore the sensitivity of the prioritization of SPS capacity-building options to changes in the decision weights, a cost and trade only model was estimated; this assumes that the only criteria driving the ranking of options is costs (up-front investment and on-going costs) and the impact on trade (absolute change in value of exports). In this model, all three decision criteria are weighted equally. The prioritization of options presented by this model as shown in Figure 27 is somewhat different from the baseline model (Figure 15) and has some smaller differences with the Equal Weights model (Figure 28) where the top two options remain the same though the provision of mycotoxin testing services has now been promoted to third place. The development of GAPs certification for cereal and cassava and a Gaps Program for horticultural crops have both been further demoted – from 2nd to 6th and 6th to 8th place respectively. Clearly, if a quite different pattern of decision criteria is applied, a distinct prioritization of capacity-building options emerges. That being said, there is much commonality in the various models with positive and negative rankings remaining constant regardless of the model applied. In particular the provision and training of drying and storage for stored grain crops, the development of domestic capacity for third party certification and the development of a method for the detection of potato flavor in coffee beans rank consistently high in the sensitivity analyses.

Figure 26; Net flows for equal weights model

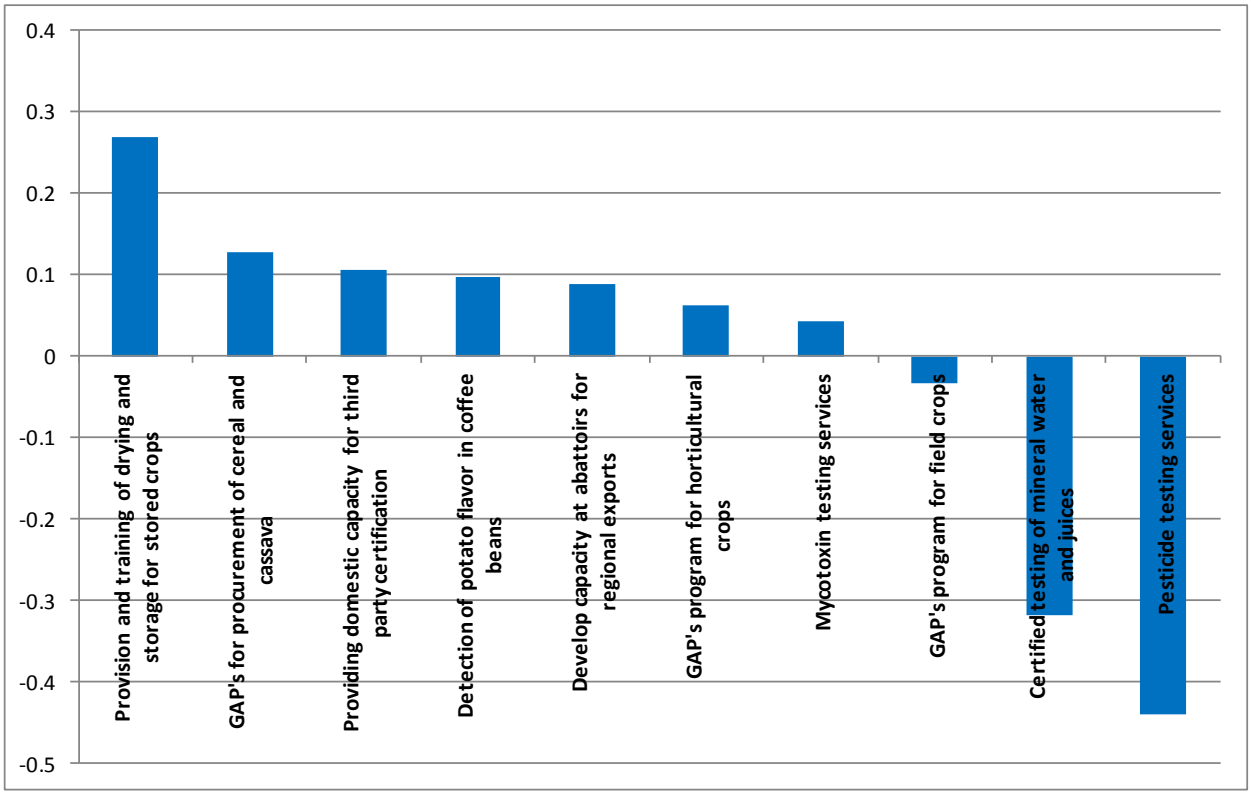
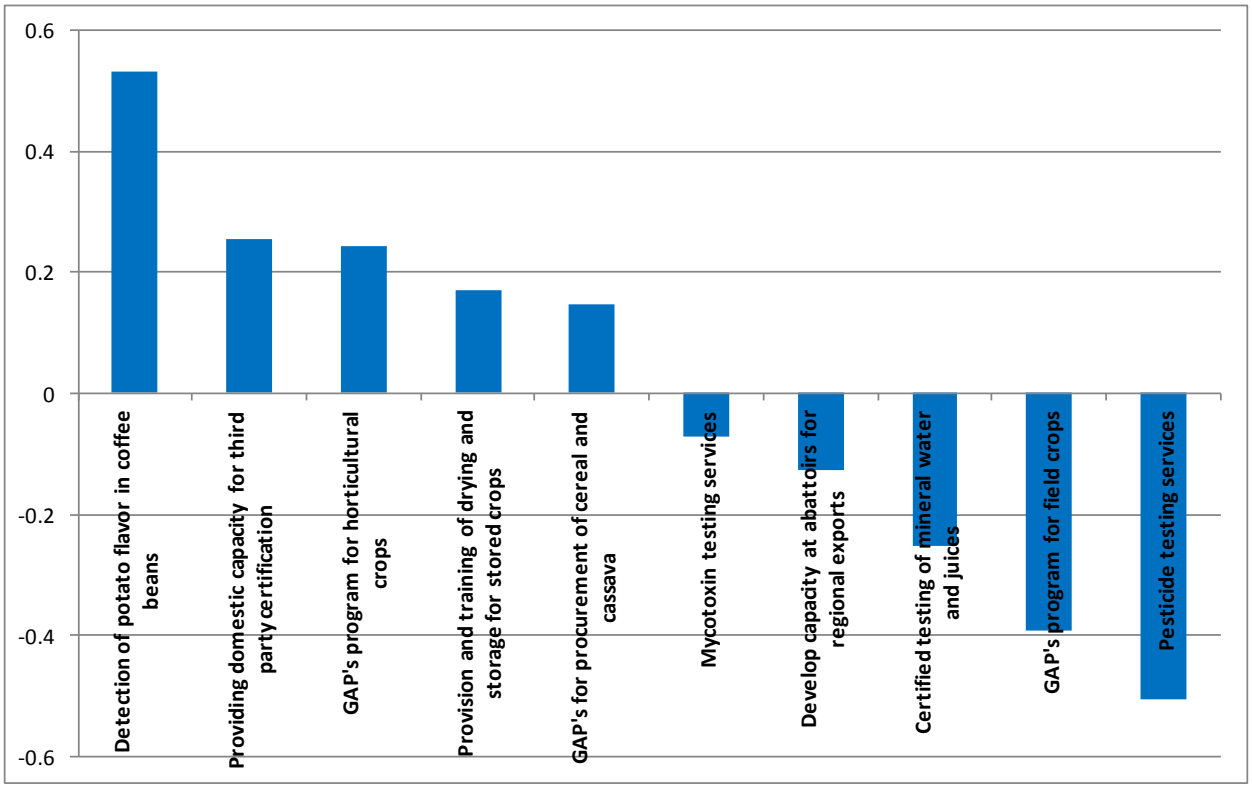


Figure 27; Net flows for cost and trade impact model



Examination of the sensitivity of the prioritization to changes in measures of the decision criteria is more complex, in that 110 individual measures (11 decision criteria x 10 capacity-building options) enter the analysis and conceivably changes in any one might influence the results.

Conclusions

This report has presented the initial results of a priority-setting exercise for SPS capacity-building in Rwanda. The priorities are defined using a prioritization framework based on MCDA, which provides a structured and transparent approach to ranking capacity-building options on the basis of predefined and agreed criteria. Thus, the options to be considered are identified through a process of stakeholder consultation that is informed by a review of prior assessments of SPS capacity. In this case, 10 distinct SPS capacity-building options were identified. These options are then prioritized on the basis of a series of decision criteria to which weights are applied, that are again derived by consulting stakeholders. The end result is a clear ranking of the 10 capacity-building options which, in many cases appears robust to changes in the weights attached to the decision criteria.

Of 10 capacity-building options identified, the following four are consistently ranked as top priority:

- Drying services for a range of stored crops
- Providing domestic capacity within Rwanda for third party certification
- Detection of potato flavor in coffee beans
- GAPs for procurement of cereal and cassava.

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

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

It is possible that some stakeholders will be concerned about the priorities presented above. It is important to recognize that the aim of the framework is not to make decisions over investments in SPS capacity-building, but to provide an input into established systems of decision-making. Indeed, the framework aims to facilitate a coherent and transparent debate over priorities between capacity-building options. Thus, if a particular stakeholder is unhappy about the priority given to a particular option, they should be invited to present new evidence (in the form of revised data to support measures of particular decision criteria in the capacity-building option information cards/profiles) and/or to suggest how and why distinct decision criteria or differing decision weights should be employed. Such changes can then be employed and the model re-estimated accordingly. The framework is easy to apply and accessible to decision analysts and/or decision makers with little or no prior knowledge of MCDA. Whilst it is not expected that substantive changes will be made to the basic mechanics of the framework, the preliminary prioritization reported above could be revisited at that time.

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Appendix 2. Participants at Stakeholder Workshop, February 29 2012

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Appendix 3; Review of Capacity-Building Options for final consideration

Capacity building options presented at the stakeholders workshop are reviewed to exclude those where;

1. There is already a solution and the capacity to implement it,
2. Other impediments to exports exist that would preclude exports even if the SPS capacity building option is resolved and;
3. Where there is no direct link between the capacity building option and trade in a commodity/group of commodities (Figure A3-1)

Figure A3-1; Decision tree for filtering capacity building options identified in the workshop

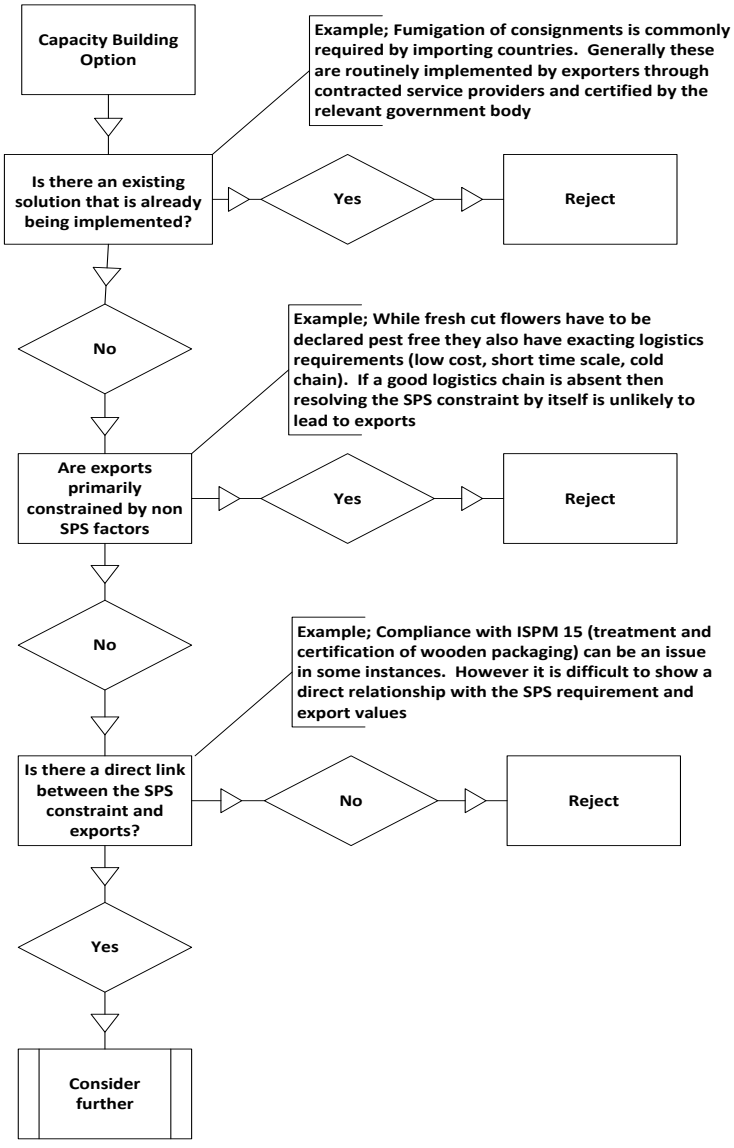

Table A3-1; Review of capacity building options presented in the stakeholder's workshop and the decisions on whether to carry out the analysis further.

#	SPS Capacity Building Option	Evidence an appreciable SPS issue impacting trade	Evidence that a feasible option	Evidence that a commercially-viable export
1	Training in field crop GAPs	Yes	Yes	Yes
2	Training and extension of horticulture GAP's for vegetables and pulses	Yes	Yes	Yes
3	Mycotoxin testing services	Yes	Yes	Yes
4	Training Drying facilities for stored crops	Yes	Yes	Yes
5	Certified residue testing services	Yes	Yes	Yes
6	Procurement of certified cassava, wheat and maize for processing	Yes	Yes	Yes
7	Detecting 'potato' flavor in coffee	Yes	Yes	Yes
8	Developing capacity at abattoirs for meat exports	Yes	Yes	Yes
9	Certified milk testing services	Yes	Yes	Yes
10	Certified water and juice testing services	Yes	Yes	Yes
11	Developing the capability for internationally recognized TPC services	Yes	Yes	Yes
12	Availability of virus indexed planting material of cassava and (Irish/sweet?) potato for smallholders	No impact on trade and already addressed by Rwanda Agriculture Research Institute (ISAR)	Yes	Yes
13	Training in coffee good agricultural practices to agronomists/post harvest extension persons and extension to farmers	Already being addressed	Yes	Yes
14	Training in tea good agricultural practices to agronomists/post harvest extension persons and extension to farmers	Already being addressed	Yes	Yes
15	Training in banana good agricultural practices to agronomists/post-harvest extension persons and extension to farmers	The problem is more related to domestic productivity	Yes	No, perhaps import substitution
16	Developing diagnostic and risk assessment capacity for Xanthomonas and Fusarium wilts of bananas	Diseases are already endemic and the issue is one of productivity	Yes	Yes
17	Heavy metals, especially copper, in yams and colocasia – awareness raising in farmers especially for copper.	No evidence that this is an issue	Yes	No
18	Cut flowers – knowledge of good agricultural practices and post harvest practices coupled with diagnostic services for pests and diseases of phytosanitary importance	Yes	Yes	No, cut flowers unlikely to be a viable commercial export

#	SPS Capacity Building Option	Evidence an appreciable SPS issue impacting trade	Evidence that a feasible option	Evidence that a commercially-viable export
19	Development of integrated pest management in coffee coupled with the targeted registration of ecologically friendly pesticides	Already being addressed	Yes	Yes
20	Livestock disease surveillance \ diagnosis and quarantine capacity in the export of live animals from Rwanda to countries in the region	No evidence on World Animal Health Information Database (WAHID) database that there is any issue for regional trade	Yes	Yes
21	Implementation of a stock feeds regulation in Rwanda	No evidence that it is an issue	No	There is no evidence that stock feeds are likely to be a viable commercial export
22	Provision of bovine semen / bovine embryos	Not an SPS issue	Yes	Yes
23	Surveillance and monitoring of beef cattle and poultry for meat and egg exports to countries in the region (DRC, Tanzania,	No evidence on WAHID database that this is an issue for regional trade. Already being addressed	Yes	Yes
24	Awareness campaigns and training for aflatoxin prevention.	No, the option is not a direct SPS problem	Yes	Yes
25	Develop a national registered pesticide list and update it according to requirements for the international markets in terms of permitted agrochemicals and MRL's	No direct linkage between option and export. Can be addressed alternatively on a crop by crop basis	Yes	Yes

The following is a brief description of the capacity building options that were proposed at the workshop on the 29th of February and excluded from this analysis

Availability of virus indexed planting material of cassava and (Irish/sweet?) potato for smallholders

The research arm of the Ministry of Agriculture (MINAGRI), ISAR, already has a research station and fully equipped facilities together with qualified staff to carry out this work within Rwanda. Therefore the option is already addressed and is not considered.

Training in coffee and tea good agricultural practices to agronomists / post harvest extension persons and extension to farmers and the development of integrated pest management in coffee coupled with the targeted registration of ecologically friendly pesticides

There is already, and has been for a number of years, considerable investment in just this activity so it is, for the purposes of this analysis considered as an option that is being/has been addressed

Training in banana good agricultural practices to agronomists / post harvest extension persons and extension to farmers as well as developing diagnostic and risk assessment capacity for Xanthomonas and Fusarium wilts of bananas

While bananas are a very important crop in Rwanda there is not much evidence that they are extensively traded. Also it is not clear that this is a trade, as opposed to production, issue. There are no

particular SPS constraints to trade that would be addressed by the option as both diseases are now endemic in the region and there is no requirement by customers for a particular growing standard.

Heavy metals, especially copper, in yams and colocasia – awareness raising in farmers especially for copper.

There seems to be no particular linkage between this option and any trade constraint. While the issue may be of some concern these roots are traded without difficulty albeit in small volumes

Cut flowers – knowledge of good agricultural practices and post harvest practices coupled with diagnostic services for pests and diseases of phytosanitary importance

The cut flower sector in Rwanda is very small and has been declining for a number of years. There are a number of reasons for this but the principle one is the lack of logistical and other services to support an export oriented cut flower industry. Even bigger cut flower industries such as that around Arusha in Tanzania can only survive based on the proximity of the Kenyan horticultural sector as well as of the logistical export hub of Nairobi.

Livestock disease surveillance\diagnosis and quarantine capacity in the export of live animals from Rwanda to countries in the region and the surveillance and monitoring of beef cattle and poultry for meat and egg exports to countries in the region (Democratic Republic of Congo, Tanzania),

While implementation of this option is a good idea in terms of the management of the national animal resources of Rwanda it is difficult to see that current and planned exports of animals and animal products to the Democratic Republic of the Congo and The Republic of Congo could be expanded to other countries in the region in the short term. In the first instance there are a significant number of animal diseases on which no information exists in Rwanda and a vigorously followed up surveillance program is quite likely to unearth new problems as determine that a disease is absent. In the second instance the diseases which are recorded or suspected in Rwanda but are absent in Tanzania, Burundi, Tanzania and Kenya such as Anthrax and Contagious bovine pleuropneumonia will be in and of themselves significant issues needing expensive resolution.[30]

Implementation of a stock feeds regulation in Rwanda and the provision of bovine semen / bovine embryos

It is difficult to see a direct linkage between these capacity building options and a traded commodity therefore it is excluded on that basis. These are essentially productivity issues.

Awareness campaigns and training for aflatoxin prevention.
This option is more of a public health option rather than trade related. However a version of it would be incorporated as a sub activity in Capacity Building Option 1; (i.e.Training in field crop GAP's).

Develop a national registered pesticide list and update it according to requirements for the international markets in terms of permitted agrochemicals and maximum residue limits (MRL's)

In respect of a national registered register of pesticides this is a necessary activity in any country. For trading with many countries the default MRL's are generally set at the limit of detection, a default European Union requirement, which is lower than the CODEX limits. However many countries have had, in practice, to follow EU guidelines in order to avoid problems with their processing and re-export sectors that export to the EU. In the case of Rwanda exporters must adhere to current EU guidelines

which are that if no chemicals are registered in the country where the crop is grown then they cannot be used – even if registered for use on that crop in the EU. The timeline for this specific analysis is 2017 and there is unlikely to be any measurable trade impact in that time.

Development of certified testing capacity for milk quality, microbiology and residues including mycotoxins in Rwanda

The context of food safety issues that are identified in the dairy value chain is roughly equivalent to that of food safety. Dairy cattle require food and water that approximates to that necessary for humans in terms of safety standards. In addition the production of milk as a pH neutral high protein liquid needs a clean environment with a high level of hygiene awareness all through the value chain. Delivery of these aspirations therefore requires multiple interventions that intersect with other value chains including that of the smallholder groundnut sector.

Developing traceability and hygiene certification in the dairy export sector requires a systems approach involving the development of good agricultural/veterinary practices (GAP/GVPs), the control of availability and correct use of veterinary pharmaceuticals, training and implementation at producer, bulking and transport level in quality management, and feeding practices. Only by procuring from certified producers with full traceability can private sector processors hope to attain export certification based on COMESA milk standards.

Costs associated with such a certification system are hard to estimate. Traceability and quality standards in these circumstances are difficult in this context. Coupled with the lack of certified microbiology and residue testing facilities in Rwanda it is difficult for the company to obtain an internationally acceptable HACCP accreditation to allow it to easily access regional markets that would insist on adherence to COMESA milk standards. The option was excluded because it has largely been addressed and there are already some milk testing services in Rwanda.

Appendix 4; Capacity-Building Option Information cards

Table A4-1; Development of systems and training in field crop good agricultural practices to agronomists / post harvest extension persons and extension to farmers (maize, groundnuts, wheat, rice, cassava for flour)

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$500,000	The development of good agricultural practices guidelines and their extension through a project targeted at growers in cooperatives wanting to export their product. A further refinement of this option is for the development of an atoxigenic strain of *Aspergillus flavus* for use by smallholder producers at an additional cost of US$400,000 as a possible variant on this option. Costs are based on similar projects in Mozambique, Zambia and Malawi as well as the World Bank Land Husbandry Water harvesting and Hillside Irrigation Project in Rwanda	Medium
On-going cost	0%	The underlying assumption is that commercial exporters in Rwanda will support the extension of quality management and control systems to growers and others in the value chain to ensure that the system is maintained. As these are essentially the costs of doing business the ongoing costs are therefore set at zero	High
Ease of implementation	-1	Somewhat difficult. Larger smallholder farmers involved and fragmented value chain. The ease of getting buy-in from smallholders, who are mostly moved by prices to decide which crop to sow in any season, to implement GAPs makes it difficult.	Medium
Sustainability of option	+1	As an integral part of 'doing business' the ongoing sustainability is assumed to become an integral part of an exporters business operation	Medium
Trade impacts			
Change in absolute value of exports	US$105,000	Rwanda's groundnut exports are small and have been growing from essentially zero in 2000 at an annual rate of about US$700 peaking at US$ 24,000 in 2009. Maize exports have fluctuated wildly from year to year (since 2003 when reliable records for Rwanda start in the COMTRADE database). Average annual growth is just over US$ 20,000 per year. The basic assumption is that Rwanda will preserve this market with the introduction of the new EAC mycotoxin standards and grow at previous rates	Medium

Decision Criterion	Value	Details	Confidence
Trade diversification and enablement of local manufacturing and beneficiation	+1	Limited possibility for beneficiation, mostly porridge type products as well as maize meal	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Limited options for increased price in existing business models though better on-farm controls will help reduce rejections and cost of re-sorting	low
Domestic public health	+1	Awareness creation among producers and suppliers may have a positive impact. An additional assumption is that rejected and sorted grain discard are removed from the food chain	low
Environmental protection	0	No impact assumed	Low
Social impacts			
Poverty impact	+1	The poverty impacts assume that production is in poorer areas by relatively less off people	Low
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 +1 +1 +1 +1 +1 Average =+5	There will be some impact in these groups from an income generation perspective as well as from awareness raising on the potential harm caused by poor farming and post harvest practices. If the AFLASAFE variant is adopted the positive impact on women and children could be greater	Low

Table A4-2; Training in horticulture good agricultural practices to agronomists / post harvest extension persons and extension to farmers

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$500,000	The costs are a rough estimate. They include the development training materials, a basic curriculum and program of training. The amount seems too low given the numbers of farmers in Rwanda. Existing projects such as the World Bank's Land Husbandry, Water Harvesting and Hillside Irrigation Project is covering much of this ground already and this capacity building option should complement this and similar projects	Low
On-going cost	0	Here it is assumed that the project is a one off up lift in the capacity of extension services in Rwanda as much of the project output will be in extant training materials and a GAP curriculum.	Low
Ease of implementation	-2	Probably would require a significant and costly organization	Low
Sustainability of option	-2	Difficult to judge. The project would likely terminate in its entirety once funding was over. Would growers, transporters and traders continue to implement the practices that were extended to their suppliers?	Low
Trade impacts			
Change in absolute value of exports	US$1,900,000	Current exports of vegetables from Rwanda have averaged 1,2 million US$ per year growing at an average annual rate of US$382,000 per year since 2003. The category, in fact, consists mostly of pulses. Some roots such as cassava are also exported. It is reasonable to assume that phytosanitary restrictions on these items are primarily post harvest e.g. fumigation. The effect of a GAPs extension program may affect productivity and availability. An approximate estimate is an increase of 10% productivity due to the introduction of GAP's and increased supplier reliability	Low
Trade diversification and enablement of local manufacturing and beneficiation	0	The project in itself would be unlikely to lead directly to increased beneficiation. Markets are likely to confined to those in the region. . NAEB would assist producers in Market accessibility. [31]	Medium
Domestic agri-food impacts			

Decision Criterion	Value	Details	Confidence
Agricultural/fisheries productivity	+2	Such a project if vigorously implemented would lead to increased productivity	High
Domestic public health	+1	Increased production of many kinds of vegetables should lead to greater availability of lower cost produce on the domestic market	Medium
Environmental protection	+1	Implementation of good agricultural practices will lead to more environmentally sound farming i.e.low impact on environment	Medium
Social impacts			
Poverty impact	+1	Increased production in poor areas together with more produce at lower prices	Medium
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 +1 +1 +1 +1 +1 Net effect +5	The project will be in poorer areas. The general finding is that early adopters of practices such as GAPs are higher income commercial / emerging commercial farmers. Impact will be positive but not greatly so	Medium

Table A4-3; Development and provision of certified mycotoxin testing services in Rwanda

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	100,000	$100,000, Estimated costs of laboratory equipment ($50,000) assuming that much of the necessary equipment is already present at the Rwanda Bureau of Standards, training ($25,000) and certification to ISO 17025 ($25,000) based on 'twinning' with Southern African Grain Laboratory.	Medium
On-going cost	4.5%	Estimated cost after recovery of testing expenses is estimated at US$5,000 annually divided by predicated total value of exports in 2017. Exports of maize and groundnuts are estimated to continue to grow at current rates i.e.markets will be maintained when EAC mycotoxin standards are introduced	Medium
Difficulty of implementation	+2	Very easy. It requires the necessary equipment and personnel	Medium
Sustainability of option	+2	There is a private sector involvement in RBS to provide this service	Medium
Trade impacts			
Change in absolute value of exports	US$ 112000	The figure represents the estimated increased value in exports if present trends are maintained	Low
Trade diversification and enablement of local manufacturing and beneficiation	+1	There are companies interested in producing a number of maize based products – e.g. breakfast cereals	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Increase in market opportunities in local and export markets leading to investment in increased quality and productivity	Medium
Domestic public health	+1	Improved quality of both imported and domestic maize and groundnuts – but impact of activity will be marginal	Medium
Environmental protection	0	No impact	Medium
Social impacts			
Poverty impact	+1	Marginal increase in incomes due to opportunities for accessing formal domestic and export markets	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 0 0 0 +1 +1 Overall impact +2	Some benefit but not across all subsectors.	Low

Table A4-4; Provision of drying facilities and accompanying systems and equipment for reducing crop moisture (pulses, cereals, groundnuts, coffee)

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	1,500,000	Based on figures quoted by CARANA and a descriptive report produced for the USAID COMPETE program	Low
On-going cost	0%	As above. Maintenance costs can be assumed to be based on depreciation e.g. 15% of capital costs assuming a mixture of buildings and equipment. Operating costs should be met by handling and storage charges and these – if the operations are commercial in nature – extend to covering depreciation. Therefore zero.	Low
Ease of implementation	+2	Perhaps easy as seemingly CARANA are finding it relatively easy to meet up with commercial partners	Low
Sustainability of option	+2	As above. If these facilities are value adding in nature (less wastage, better quality, ability to aggregate product etc)	Low
Trade impacts			
Change in absolute value of exports	1,900,000	The assumption made is that good drying and storage will double existing exports of oilseeds, cereals and pulses by 2017. Because of substantial past investments in the coffee sector a conservative assumption of an incremental 1% in exports is assumed.	Medium
Trade diversification and enablement of local manufacturing and beneficiation	+1	Aggregated supply of quality grains will enable easier procurement for businesses involved in agro-processing	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	+2	Post harvest crop losses in Africa are significant. Would this effectively allow farmers to access top quality post harvest handling systems and thus reduce direct and quality losses? Perhaps so if well implemented	High
Domestic public health	+2	Better access to better quality food	High
Environmental protection	0	No impact	High
Social impacts			
Poverty impact	+1	Better market access and better prices. Farmer groups accessing these services may not be the most vulnerable	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 +1 +1 +1 +1 +1 Average = +5	Better market access and better prices. Farmer groups accessing these services may not be the most vulnerable however. Redesigning the option to include the development of atoxigenic strain technology for use by smallholders increases the impact by 2 (one point each for women and children)	Medium

Table A4-5; Development and provision of certified pesticide residue testing services in Rwanda

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$760,000	Using GC-MS for analysis of pesticides residues ($620,000) and long term training of 2 officers ($140,000).	Low
On-going cost	0%	Maintenance	Med
Ease of implementation	-2	Somewhat difficult based on experience elsewhere	Med
Sustainability of option	-2	Not really sustainable because of low volume of anticipated business	Med
Trade impacts			
Change in absolute value of exports	0	No trade impact – consignments that need to be tested can be done by importing countries and so impact is simply to allow for pre-shipment testing with lowered costs	low
Trade diversification and enablement of local manufacturing and beneficiation	+1	No Impact. Testing already exists outside Rwanda and is accessible	low
Domestic agri-food impacts			
Agricultural/fisheries productivity	0	Pesticide residue testing capacity will not increase productivity except very indirectly	High
Domestic public health	0	Pesticides contaminated products are a threat to human life since prolonged intake of the same can lead to low birth weight and birth defects; interfere with child development and cognitive ability; cause neurological problems; disrupt hormone function; cause a variety of cancers, including leukemia, kidney cancer, brain cancer, and non-Hodgkin's lymphoma. So a full capacity will ensure reduction in its associated health risks provided rejected crops do not find their way back into the domestic market	Medium
Environmental protection	0	No impact	Medium
Social impacts			
Poverty impact	0	No impact due to low level of awareness	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 0 0 0 0 0 0	No statistics to support impacts of the residual pesticides having impact in vulnerable groups listed herein	Low

Table A4-6; Developing a systems approach to the production and/or procurement of cassava, wheat and maize flour for a processor

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	USD 50,000	As these crops are grown with minimal pesticides though all are susceptible in some form of mycotoxin contamination. The sum would be used for establishing a systems approach to procurement of which testing costs for pesticides and mycotoxins would be a very minor component. The sum here is a guess based on similar projects in Zambia and South Africa	Low
On-going cost	-1%	The assumption is that implementing a basic form of traceability will reduce procurement costs due to more available and better quality raw material	Medium
Ease of implementation	-1	Somewhat difficult	Medium
Sustainability of option	-1	Needs active participation of private sector	Medium
Trade impacts			
Change in absolute value of exports	200,000	The figure is an estimate for the growth in potential exports extrapolated to 2017	Medium
Trade diversification and enablement of local manufacturing and beneficiation	+1	The raw materials are not easily transformed into very high value items. However the increased availability of traceable raw materials should have some positive impact	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Systems approaches are based on the collation and implementation of best practices and their successful implementation generally leads to improved productivity	Medium
Domestic public health	+1	Widespread use of best practices leads to improvements in quality	Medium
Environmental protection	+1	Best practice includes, by definition, environmentally sustainable methods of production	Medium
Social impacts			
Poverty impact	+1	Increased income in some poor rural areas	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 +1 +1 +1 +1 +1 Average +5	There will be a small impact due to improved quality and productivity	Medium

Table A4-7; Development of a simple field method for the detection of potato flavour coffee beans at the green or blue bean stages

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	240,000	Based on the costs of a post-doctoral student together with laboratory and consumable costs for a two year period. These costs are derived from an unrelated research project so no confidence can be attached to them	Low
On-going cost	0.1%	Result of dividing up-front investment by estimated increase in value of exports	Low
Ease of implementation	-2	Very difficult. There has been quite a bit of research in this area already with no clear result	Low
Sustainability of option	1	Likely to be highly sustainable with high private sector buy in	Medium
Trade impacts			
Change in absolute value of exports	4,280,000	Rwanda's coffee exports have been increasing at an average annual rate of US$ 5,000,000 annually since 2003. The assumption is that resolving potato flavour will help maintain this growth in value. The issue of potato flavour is ranked 6th in the ASARECA priority ranking of 13 outstanding technical issues for coffees in East Africa. Using this ranking and weighting it among the 12 other constraints listed and the arbitrarily multiplying by two = increased quality factor derives this figure[32].	Low
Trade diversification and enablement of local manufacturing and beneficiation	0	No impact (possible acceleration to high end coffee markets?)	Low
Domestic agri-food impacts			
Agricultural/fisheries productivity	1	Higher quality and therefore better price per kg	Med
Domestic public health	0	None	Med
Environmental protection	0	None	Med
Social impacts			
Poverty impact	+1	Will benefit producers in poor rural areas	Med

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 +1 0 +1 +2 +2 Average +6	No direct impact on children. Small impact on women and vulnerable areas, higher impact on smallholders and small/medium enterprise (SME's)	Low

Table A4-8; Meat exports compliance to importing country standards including disease diagnosis and surveillance as well as good management and hygiene practices through the development of human capacity at export abattoirs (for export to Congo-Brazzaville)

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	At least USD 1,000,000	Export abattoir set-up & staff training, assuming an existing abattoir could be upgraded & throughput of 10 cattle/hour	Medium
On-going cost	8.8%	Salaries for 4 cattle disease & meat inspection vets, & lab analyses for disease diagnosis & residues (e.g., antibiotic) at abattoir or public laboratories (e.g., RAB), USD 150,000/year	Medium
Ease of implementation	+2	No problems foreseen	Medium
Sustainability of option	+2	Could be sustainable as long as market for product exists. Also, levies could be charged for inspected animals or carcasses. The proposed market is Congo Brazzaville. The logistics are unknown but likely to be problematic.[33]	Medium
Trade impacts			
Change in absolute value of exports	1,700,000	Based on assumption that current growth in animal exports continues to 2017 but that half are diverted to slaughter at a net value added of 25% of live weight.	Medium
Trade diversification and enablement of local manufacturing and beneficiation	2	Aside from the direct benefits of the abattoir there will be the increased availability of meat and other animal by products for local retailers and manufacturers	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	1	Moderate impact restricted to improvement of livestock productivity.	Medium
Domestic public health	1	Moderate impact through indirect control of zoonotic diseases.	Medium
Environmental protection	0	Low impact except through safer disposal of abattoir wastes.	Medium
Social impacts			
Poverty impact	2	Scale 0 to 4 (0 = no impact – 4 = very high impact) – moderate impact through increased market for cattle & revenue flows	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 0 0 1 1 1 Overall impact = +3	Low & indirect impact on vulnerable groups but high for smallholders, vulnerable areas and SMEs	Medium

Table A4-9; Certified testing of mineral water and juices to required standards for export markets

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	300,000	This is the cost of setting up microbiology and chemical testing laboratories only. Certification of the bottlers themselves is essentially a cost of doing business	Low
On-going cost	10%	Testing services will be paid for by exporters as a cost of doing business. Costs are the depreciation of the up-font investments set at 20%	Low
Ease of implementation	-1	Building, equipping and certifying a microbiology and chemical testing laboratory is not easy	Low
Sustainability of option	-1	Sustainability is problematic given low traded volumes (US$ 250,000 of exports in 2011). Also Rwanda's	Low
Trade impacts			
Change in absolute value of exports	+300,000	Rwanda is becoming a net importer of bottled water and the assumption behind the number is that Rwanda will restore parity between imports and exports by 2017	Low
Trade diversification and enablement of local manufacturing and beneficiation	+1	Limited but perhaps some markets in DRC, Burundi and Tanzania could be exploited	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	0	No impact	
Domestic public health	+1	Some impact with cheaper more available drinking water	Medium
Environmental protection	0	No impact	Medium
Social impacts			
Poverty impact	0	No impact	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 0 0 0 0 +1 1	No significant impact	Medium

Table A4-10;Developing capacity in Rwanda for third party certification (e.g. organic, fair trade, Rainforest Alliance,)

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$220,000	The amount of US$120,000 represents the investment by Pearl Capital to turn around an existing company (Africert). The best approach for such a venture in Rwanda would be to open up a franchise for an existing certification company rather than create one from scratch. The sum would be for setting up the company, training of certification specialists and so on. US$100,000 has been added in as the probable initial value of Africert's goodwill.	Med
On-going cost	0	Certification is already being carried out in Rwanda by outside certification bodies and should be borne by companies as a normal cost of doing business	Med
Ease of implementation	-2	Not easy to do	Med
Sustainability of option	+2	There should be significant demand for cheaper in-country certification options from the coffee and tea sectors	Low
Trade impacts			
Change in absolute value of exports	600,000	The number represents an additional 10% per kg value on the volume of coffee and tea exported in 2011.	Low
Trade diversification and enablement of local manufacturing and beneficiation	+1	Expanding into high end retailers	Low
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Higher value of exports per unit weight	Low
Domestic public health	0	No impact foreseen	Med
Environmental protection	+1	Some, if not all, certification standards require environmental protection. Others e.g. Rainforest Alliance are highly focused on the environment	Med
Social impacts			
Poverty impact	+1	Increased income is possible	Med

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • SMEs	 +1 +0 +1 +1 +1 Overall impact +4	Coffee is grown in rural areas. My impression is that coffee farmers are among the more well to do in rural areas. However there will be some benefits to poorer and vulnerable groups and some trickle down effects	Med

Appendix 5; Endnotes

[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, S.J. and Masakure, O. (2009).

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

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.

[6] New Partnership for Africa's Development (NEPAD); a program of the African Union (AU) adopted in Lusaka, Zambia in 2001. http://www.nepad.org/, Website accessed 26 12 2011

[7] Comprehensive African agriculture Development Programme, (CAADP) which has four pillars, each dealing with key issues:

Pillar 1: Land & water management

Pillar 2: Market access

Pillar 3: Food supply and hunger

Pillar 4: Agricultural research

Pillar 4: Agricultural research

http://www.nepad-caadp.net/about-caadp.php (Accessed 26/12/2011).

[8] World Trade Organization, 2010, Trade Policy Review, Rwanda, Report by the Secretariat, Trade Policy Review Body, WT/TPR/S/129, 13 April 2004

[9] Bourzat, D., 2010, OIE -PVS Tool / PVS Gap, Analysis, State of play, Powerpoint presentation BTSF training - Gaborone 9 – 12 March2010

[10] http://www.oie.int/support-to-oie-members/pvs-pathway/, Website accessed 22 12 2011

[11] Cassidy, D., 2007, Phytosanitary Capacity Evaluation of Rwanda, Dermot Cassidy November 2007 (prepared on behalf of the Government of Rwanda, World Trade Organization and Michigan State University)

[12] Cassidy, D., 2007, Assessment of Biosecurity and Phytosanitary Capacity in Rwanda, Dermot Cassidy November 2007 (prepared on behalf of the Government of Rwanda, World Trade Organization and Michigan State University)

[13] The Convention on Biological Diversity was finalized in Nairobi in May 1992 and the Cartagena Protocol was finalized and adopted in January 2000

[14] http://spsims.wto.org/ Website accessed December 22, 2011.

[15] Data on the WTO SPS Agreement notification, focal and contact points for Rwanda as held in the WTO Database. SPSIMS Website accessed December 22, 2011.

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

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

[18] Compete, 2012, Staple Foods Standards, http://www.competeafrica.org/what-were-doing/curabitur-auctor-venenatis/index.php. Website accessed 14 April 2012.

[19] Henson and Masakure (2011).

[20] Henson and Masakure (2011).

[21] WHO. 2005. Public Health Strategies for Preventing Aflatoxin Exposure. Workgroup Report for the International Mycotoxin Workshop: Public Health Strategies for Preventing Aflatoxin Exposure. WHO, Geneva, Switzerland.

[22] A report commissioned by the USAID Regional Office in East Africa 'Aflatoxin, a Synthesis of the Research in Health, Agriculture and trade' and published early in 2012 which reviews the recent literature on the issue cites no studies in Rwanda.

[23] Williams, J. H., (undated but circa mid 2011), An OPED: appraisal of the 'competitive atoxigenic' fungi technology (CAFT) for addressing aflatoxin contamination of foods and human aflatoxicosis in African developing countries. Peanut Collaborative Research Support Program : University of Georgia

[24] There is extensive literature on the subject. For example see;

Cotty, P.J., Jaime-Garcia, R. and Probst, C., 2008, Etiology and management of aflatoxin contamination. In Mycotoxins-Detection Methods, Management, Public Health and Agricultural Trade ed. Leslie, J.F. pp. 287–299. Wallingford, UK: CABI.

[25] World Bank, 2009, Project Appraisal Document; Land Husbandry Water harvesting and Hillside Irrigation Project; Report No: 50901-RW. 151 pp;

See following extract; *25.*

The demand for extension services under the LWH is considerable. The LWH project calls for a holistic approach to watershed management, involving technical and technological challenges in sustainable land husbandry for rain fed and irrigated agriculture alike. For commercialization, it also involves knowledge and understanding o f phytosanitary issues and will call for very specialized and intensive horticultural technical assistance. Several actors are involved in the delivery o f extension services, including MINAGRI and its specialized agencies, decentralized local administration, farmers' organizations, NGOs, the private sector, agricultural education institutions, and agricultural research institutes. While the seven guiding principles of the Government's sound extension strategy' are entirely in the right direction, to translate them into operationally meaningful actions will require addressing many o f the weaknesses and threats.

[26] CARANA, 2012, http://www.carana.com/index.php?option=com_content&view=article&id=423&Itemid=66, website accessed 08 April, 2012.

[27] USAID COMPETE, 2011, Survey and mapping of grain storage facilities in Rwanda, Rwanda country report, September 2011, Acacia Consultants Ltd.

[28] Waikar, S. P., 2011, Sorting of coffee beans for 'Potato Defect'. M.Sc. Thesis, Texas A&M University.

[29] See http://www.asareca.org/researchdir/FILES/NPPFULLCOFFEE.PDF). Website accessed 09 April 2012

[30] See OIE WAHIS Database; http://web.oie.int/wahis

[31] Head of Horticulture in NAEB: n.epimaque@hotmail.com, Tel 0788612292 for more information

[32] (http://www.asareca.org/researchdir/FILES/NPPFULLCOFFEE.PDF). For more information :Dr GATARAYIHA (NAEB) Celestin gatarayiha@hotmail.com tel: 0788267481

[33] more information can be found in Rwanda Agriculture Board (RAB), Rwanda Civil Aviation Authority (RCAA), and Private Sector Federation (PSF)