Establishing Priorities for SPS Capacity-Building in Uganda Using Multi Criteria Decision Analysis

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LIST OF ACRONYMS / INITIALSMS

AGRA	Alliance for a Green Revolution in Africa
AOAC	Association of Official Analytical Chemists
COMESA	Common Market for Eastern and Southern Africa
DRC	Democratic Republic of Congo
EU	European Union
FMD	foot-and-mouth disease
GAP	good agricultural practices
GVP	good veterinary practices
HCC	hepatocellular carcinoma
IARC	International Agency for Research on Cancer
ICIPE	International Center for Insect Physiology and Ecology
ISO	International Standards Organization
LVEMP	Lake Victoria Environmental Management Project
MCDA	multi-criteria decision analysis
SAT	Southern African Territories
SPEED	Support for Private Enterprise Expansion and Development
SPS	Sanitary and Phytosanitary
STDF	Standards and Trade Development Facility
UFPEA	Uganda Fish Exporters and Processors' Association
USA	United States of America
USAID	United States Agency for International Development
WTO	World Trade Organization

CONTENTS

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1. Executive summary

The Common Market for Eastern and Southern Africa (COMESA) secretariat in collaboration with the Standards and Trade Development Facility (STDF) the latter based at the World Trade Organization, are spearheading the use of an economic analysis tool (the multi-criteria decision analysis, MCDA) for assisting governments and private sector in making investment decisions on Sanitary and Phytosanitary (SPS) capacity building options. MCDA is part of a set of analytical tools to help establish more coherent and accountable decisions in the allocation of scarce resources towards competing SPS capacity-building needs. The use of MCDA is being advocated as providing a structured framework for making the costs and benefits of alternative capacity-building investments explicit and for identifying options that offer the greatest potential return. Because the lack of data can seriously impede such analyses the 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 in several countries in Africa with the active participation of the United States Agency for International Development (USAID) SPS Coordinators for Southern Africa. This report presents the initial results of a priority-setting exercise for SPS capacity-building in Uganda which commenced on 30th July 2012 and was concluded in March 2013 to allow for a consultative period. In this case, 14 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 14 capacity-building options of which the following six are consistently ranked as top priority:

- Biological control of *Bactrocera invadens*
- Extension and implementation of maize good agricultural practices
- Biological control of aflatoxin
- Agro input product and supplier certification
- Oilseed good agricultural practices - implementation and awareness raising
- Awareness of pesticide usage and its potential impact on fish

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 national governments priorities for growth and development. 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 Uganda. It is important to recognize, however, that the results of the analysis presented above represent one starting point in the use of the priority-setting framework in the context of SPS capacity-building in Uganda. 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, among other factors. 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 activity of SPS capacity-building planning in Uganda. Finally, this analysis can form the economic justification for projects aimed at addressing the identified constraints.

2. Introduction

The framework employed in this study aims to present a more comprehensive analysis of options for SPS capacity-building that can feed into the development of a prioritised action plan for the enhancement of SPS capacity. Thus, its ultimate objective is to *generate a prioritised schedule of options for SPS-related capacity-building in Uganda 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 appear to 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.

This section provides a more detailed description and rationale for each of the 14 SPS capacity-building options considered in the priority-setting analysis. This information is based on the preliminary analysis of literature on SPS followed by a series of workshops held in Uganda between the 30th July to 3rd August 2012 with stakeholders from a number of government Ministries, the private sector and NGO's. Additionally, the preliminary results of the analysis were distributed to stakeholders and a period was left open for comments and further inputs was left open up to the end of March 2013. A number of earlier comments let to a revision of the draft findings and these were re-distributed at the end of November 2012. A list of participants is shown in Appendix 2. The methodology and data fed into the analysis are described in more detail in Section 3 below.

Overview of Sanitary and Phytosanitary situation in Uganda

Prior reviews of Sanitary and Phytosanitary requirements and capacity building in Uganda in the context of agricultural policy

National agricultural strategy documents, referred to as Comprehensive African Agriculture Development Programme (CAADP) compacts are 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. The Government of Uganda signed the CAADP Compact on 31st March 2010[1]. Given that Uganda's agriculture sector contributes about 20% to national GDP, employs 73% of the population and contributes 48% of export revenue, the sector is seen as a key driver for growth and poverty reduction. The commitments of Uganda's CAADP compact are in line with the National Development Plan (NDP) and the Development Strategy and Investment Plan (DSIP) for the Agriculture Sector 2010 – 2015 (Anon, 2010[2] and COMESA, 2009[3].) The compact and DSIP both make specific reference to improving rural infrastructure and trade-related capacities for market access – domestically, regionally and internationally.

Assessment of SPS support for national agricultural policy is through the use of a number of tools used for assessing national SPS capacity. In addition to SPS specific toolkits, there are more general trade diagnostic studies including that of the Integrated Framework (IF) and the World Trade Organization. The main SPS and trade evaluation tools are listed and their status in terms of completion and availability in the case of Uganda is shown in Table 1.

Table 1; Existing reviews of Sanitary and Phytosanitary compliance and capacity for Uganda[4]

Source		Completed
Enhanced Integrated Framework	Diagnostic Trade Integration Study[5]	Yes
	Trade Policy Review by WTO (last single country review was 2001 and Uganda was further reviewed as part of the EAC in 2006[6])	Yes
CAADP Compact	Development Strategy and Investment Plan (DSIP) for the Agriculture Sector 2010 – 2015	Yes
Integrated Approach to Food Safety, Plant & Animal Health: National Biosecurity Capacity Evaluation		No
1. Evaluation of Performance of Veterinary Services (PVS) Tool[7]&[8]		(Yes)
Pilot of FAO Guidelines to Assess Capacity-Building Needs to Strengthen National Food Control		No
Phytosanitary Capacity Evaluation (PCE) Tool		(Yes)
Ad hoc and other national case studies		Yes

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

A Diagnostic Trade Integration Study (DTIS) was for Uganda as part of a three country review of the East African Community was carried out and validated in 2005-6 and the findings were incorporated into National Trade Policy in 2007.[9] Identified priorities included improving business climate, targeting high export potential industries and implementing the Marketing and Agro-Processing Strategy (MAPS) of the Plan for Modernization of Agriculture (PMA).[10]

Background and status of Uganda in respect of compliance to the World Trade Organization SPS Agreement and reporting obligations

The SPS mechanisms put in place by the WTO and allied organizations, including FAO, the World Health Organization (WHO) and the World Organization for Animal Health (OIE), have been in place for a decade or more. The mechanisms are accompanied by a number of specific processes and bodies to help poorer countries in terms of compliance with aspects of WTO membership. Uganda has been a WTO member since 1 January 1995. Uganda's international SPS compliance is essentially managed via the various sub structures of the International Plant Protection Convention, (IPPC), CODEX Alimentarius and the OIE.[11] In addition Uganda is a signatory to two international treaties (The Convention on Biological Diversity of 5 June 1992 (ratified 1993-09-08) and the Cartagena Protocol on Biosafety (ratified 2003-09-11) which is an Annex to the Convention on Biological Diversity)[12] & [13]. Both 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 Uganda's compliance with setting up and notifying of national SPS contact points is shown in Table 2.[14]

Table 2; Contact information and with various international Sanitary and Phytosanitary organizations for Uganda as of June 2012 (Sources: various)[15]

WTO TBT enquiry point	Biosafety national focal point	WTO SPS national notification authority	WTO SPS enquiry point	Codex contact point[16]	NPPO contact point[17]	OIE contact point[18]	Official website
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

3. Establishing Sanitary and Phytosanitary priorities using a Multi-Criteria Decision Making Framework

The framework employed in this study aims to present a more comprehensive analysis of options for SPS capacity-building that can feed into the development of a prioritised action plan for the enhancement of SPS capacity. Thus, its ultimate objective is to *generate a prioritised schedule of options for SPS-related capacity-building in Uganda on the basis of the multiple economic and/or social criteria*. The rationale behind the framework 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] Below, 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 Uganda.

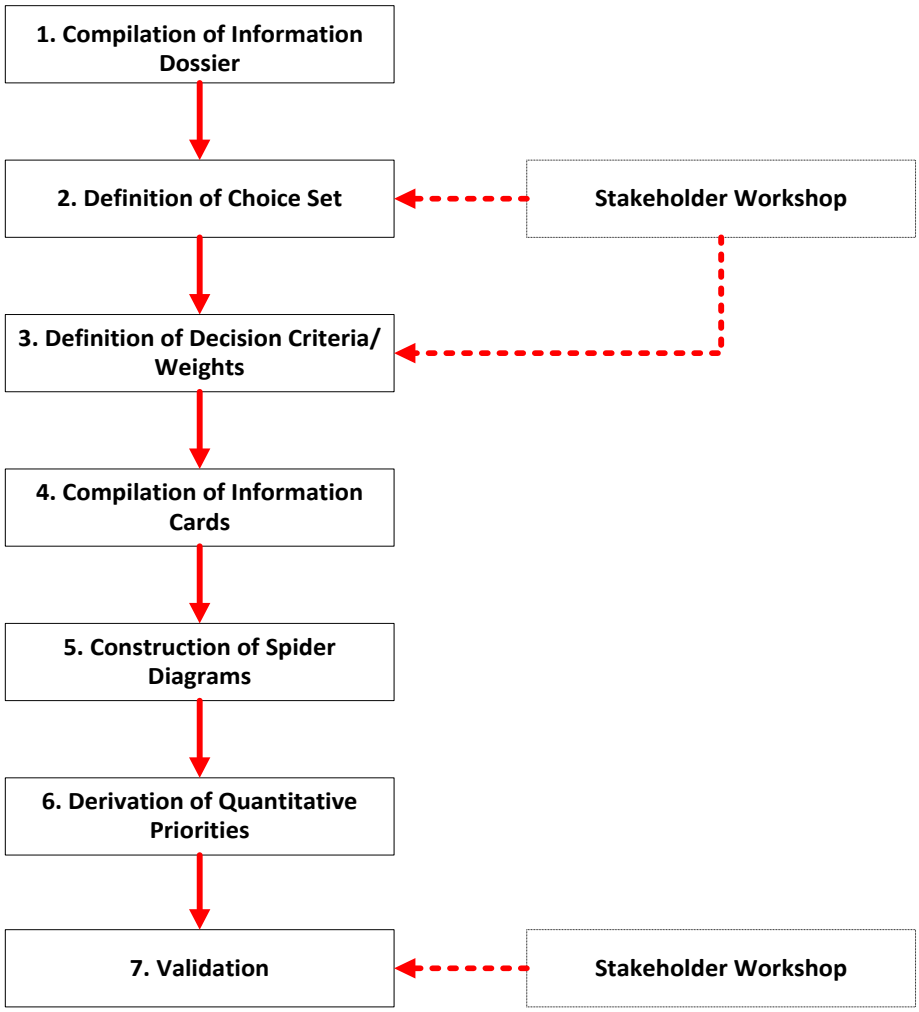
Stage 1: Compilation of information dossier

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 Uganda and the associated capacity-building needs. In so doing, the aim was to ascertain what work had already been undertaken to identify capacity-building options and the definition of priorities for related investments. The documents/information in the dossier are itemised in Appendix 1.

Stage 2: Definition of choice set

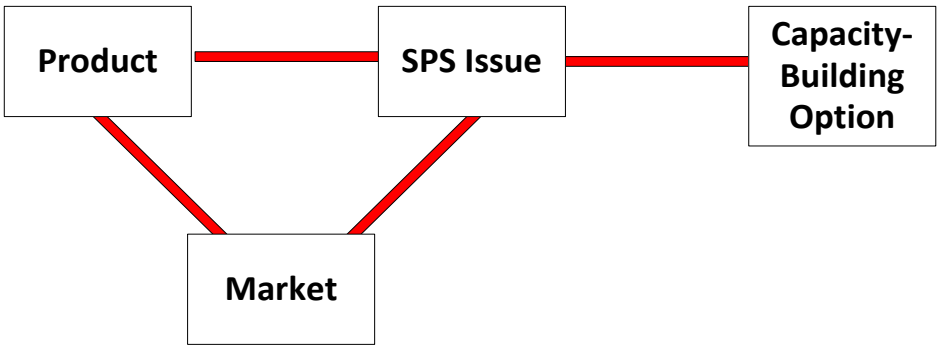
In order to identify the SPS capacity-building options to be considered in the priority-setting framework, a one-day stakeholder workshop was held 30th July. A total of 31 Ugandan stakeholders (Appendix 2) attended the workshop, drawn from government and private sector. Participants were presented with a series of cards and asked to identify the SPS capacity-building needs of Uganda. 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 Sanitary and Phytosanitary capacity building options



The cards of all respondents were collected, shuffled and then reported back to the workshop as a whole through listings on flip charts. The collection of items was then discussed in order to remove any ambiguities and to ensure that each represented a mutually-exclusive capacity-building option. A total of 14 SPS capacity-building options were defined through the above process, of which one was excluded because it were judged not to be a substantive SPS issue involving trade.

Figure 2; Definition of Sanitary and Phytosanitary capacity-building options



The excluded capacity building options are reviewed in Section 2 in the main text; **2. SPS capacity-building options.**

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 3, and asked which (if any) should be excluded and whether any potentially important criteria were missing.

To define the decision weights, the workshop participants were each asked to assign 100 points amongst the nine 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 3.

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

Table 3; Decision criteria and weights for setting priorities of Sanitary and Phytosanitary capacity-building options[1]

Objectives	Decision Criteria	Average	Standard deviation	CoV
Costs and trade impact	Up front investment	11.0	6.7	0.6
	On-going costs	10.1	4.2	0.4
	Trade impact [Market Access]	12.5	5.5	0.4
	Trade diversification impact [value addition]	9.6	2.2	0.2
Agricultural productivity	Impact on domestic agricultural/fisheries productivity	14.5	6.1	0.4
	Impact on domestic public health	8.8	2.7	0.3
	Impact on local environmental protection	8.2	8.2	1.0
Social impacts	Impact on poverty	15.0	9.1	0.6
	Impact on vulnerable groups	9.0	4.5	0.5
	Impact on employment[2]	1.3	4.5	3.3

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 and are set out in Section 2 in the main text;

The metrics to be employed for each of the nine 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 4 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. For the effects of SPS Capacity Building Options (or lack of such) on trade and numbers of households two tables have been constructed to provide a basis for continuous measurements in terms of US$ and numbers of households affected respectively (Appendix 6). However, it is important to recognise that the aim of the framework is not to provide a final and definitive prioritisation of the capacity-building options. Rather, the priorities that are derived should be revisited on an on-going basis and revised as more and/or better data for the decision criteria become available.

Information cards for each of the 14 SPS capacity-building options were then compiled. These are reported in Appendix 3. Each card presents data for the nine decision criteria, measured according to the scales outlined in Table 4. 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

[1] Weights and Criteria as determined in the final workshop of 3rd August 2012

[2] Made a sub component of the 'Vulnerable Group' criteria

considered in interpreting the results of the prioritisation exercise, and in considering how the analysis might be refined in the future.

Table 4; Decision criteria measurement

Criterion	Measurement
Cost of implementation	
Up-front investment	Absolute value ($)
Annual on-going costs	As % value of exports (2017)
Trade impact	
Absolute change in value of exports	Estimated absolute value in 2017 using risk assessment approach (Appendix 6)
Trade diversification – value addition in terms of product or market	Large negative (-2) Negative (-1) No impact (0) Positive (+1) Large positive (+2)
Domestic agri-food impacts	
Agricultural/fisheries productivity	Large negative (-2) Negative (-1) No impact (0) Positive (+1) Large positive (+2)
Domestic public health	
Environmental protection	
Social impacts	
Poverty impacts	Reported as a number based on number of households involved in the sector
Impact on vulnerable groups/areas	Large negative (-2) Negative (-1) No impact (0) Positive (+1) Large positive (+2)
Impact on employment[3]	Large negative (-2) Negative (-1) No impact (0) Positive (+1) Large positive (+2)

[3] Merged with the 'vulnerable groups' criteria

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 14 capacity-building options. Thus, spider diagrams were derived that plotted the 14 SPS capacity-building options against the nine decision criteria i.e.;

1. up-front investment
2. on-going costs
3. change in absolute value of exports
4. poverty impact

Scrutiny of these diagrams (Section 3 Results) identified the decision criteria against which each of the capacity-building options performed relatively well/badly compared to the other capacity-building options in the choice set.

Stage 6: Derivation of quantitative priorities

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

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

The baseline model is considered to provide the most reliable set of priorities, in that it uses the full set of information derived through Stages 1 to 4. The two subsequent models were estimated in order to examine the extent to which the derived priorities are sensitive to changes in the decision weights; if the broad ranking of the 14 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.

Stage 7: Validation

The final stage of the priority-setting analysis is completed with this report on the results of the analysis. The aim of the validation process was to ensure that the results of the priority-setting framework were broadly in accordance with expectations, or that unexpected rankings can be explained through the pattern of data in the information cards. To facilitate this process, the draft report was disseminated to stakeholders by email with a request for comments. Further, the preliminary results were presented at a stakeholder workshop on 3rd August 2012, the participants at which are reported in Appendix 2. Further validation was also solicited in terms of comments on a draft report which was finalized and distributed on 09 July 2012 and a further revised version at the end of November 2012 which incorporated revisions based on initial feedback.

Brief descriptions of *included* Sanitary and Phytosanitary Capacity Building Options for Uganda

Option 1; Accreditation of pesticide testing laboratories in Uganda

Credible controls must be in place in order for exporters to ensure compliance with destination market maximum residue limits, including those of private buyers. Uganda's principle markets are fish exports to the European Union (EU), South Asia, and in the Middle East where standards are strictly enforced. However, in some instances agrochemicals used on crops in Uganda are not registered in the importing countries or no limits are set, such that regulatory maximum is the limit of detection (LoD). Testing capacity is arguably of more importance in the case of EU markets where far stricter limits and associated testing requirements are applied. However, the main mechanism for the control of pesticide residues as required by EU buyers is the application of certified good agricultural practices (GAPs), such as GlobalGAP. The implementation of GAPs 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, and which most exporters can obtain through laboratories in the destination market. Since Uganda already has laboratory facilities for pesticide testing the capacity building option is therefore a reference laboratory and an internationally accepted pesticide testing laboratory accreditation system within Uganda.[21] It has been reported by the Swedish International Development Cooperation Agency (SIDA) that they are supporting the development of such an accreditation body for supporting the international acceptance of tests and measurement.[22] It is thus possible that this capacity building option is already supported by a donor partner.

Option 2; Implementation of good agricultural practices in maize production and handling to reduce pesticides and improve quality – including reduction of moulds and pot harvest losses

Maize is attacked by a wide range of pests and diseases and which, in many cases, need to be managed through the use of agrochemicals and good agricultural practices. A review of current agrochemical recommendations in several African countries including Kenya shows that there are no significant issues relating to potential chemical contamination of maize if agrochemicals are used correctly.

The key issue for maize production is improper chemical and/or crop handling including the use of agrochemicals in stored maize. The use of chemical insecticides in the form of sprays, fumigant or dusts against grain pests is common on large-scale farms in Africa. Small-scale farmers are tempted to use such measures due to their quick action. While some agrochemicals are registered for use in stored maize, it is possible that insecticides meant for use in field crops could be used by farmers leading to an increased potential for agro-chemical residues (Nukinene, 2010).

This option, therefore, involves the training of farmers in GAPs for maize production, including pest and disease control and the appropriate use of agrochemicals. Support would also be provided for infrastructural improvements on farms, including post-harvest handling and storage where contamination by mycotoxins could be a significant problem. The option also needs to look at the reasons for low uptake of improved agricultural practices in Uganda, where it has been shown that only 6 percent of farmers in Uganda plant hybrid maize seed, apply chemicals and inorganic fertilizers on their maize plots.[23] Reasons advanced include the possibility that increased input use in maize crops comes at an unacceptable opportunity cost to smallholder farmers.[24]

Option 3; Meat exports within the region to countries where foot and mouth disease is endemic

Uganda is developing a livestock export sector with the primary market being live animals to the Democratic Republic of Congo (DRC) and South Sudan. Other opportunities exist in the sale of dressed meat to Congo Brazzaville, Central African Republic and other neighbors. The capacity building option aims at the development of capacity within Uganda for slaughterhouses to meet the hygiene and animal health requirements of the regional markets.

Option 4; Meat exports from a foot and mouth disease free compartment in Uganda to European Union and other countries where the disease is not present

Exports of livestock and meat to certain countries are not possible because Uganda has a number of endemic animal diseases of quarantine significance such as FMD. The option would be to construct a FMD (and other diseases of trade significance) free compartment under new OIE rules so as to export to markets currently closed to Uganda. Chapter 8.5 of the TAHC makes provision for the creation of FMD-free compartments in otherwise 'infected' countries or zones (Article 8.5.6), i.e. creation of production enterprises – which can be physically separated and that are managed on the basis of integrated bio-security systems targeting FMD. Theoretically therefore, it would be possible for compartments to be established which contain livestock but exclude neighboring, potentially FMD infected, cattle and wildlife. To achieve that in practical terms would require that the compartments be separated by physical barriers (e.g. game-proof fences) from areas where wildlife or potentially infected livestock occur. In other words, domestic livestock in specific locations could be fenced off from FMD-infected wildlife populations. The system entails the initial testing, vaccination and quarantine of animals over a 21-day period in the first phase (Phase 1), followed by a second phase (Phase 2) where quarantined animals are finished in a feedlot system to bring them up to export weight (400 kg). The benefits of this system are the ability to ensure to trading partners of the ability of Uganda to produce higher quality, certified, disease-free meat that could be exported to countries that are free of FMD.[25]

Option 5; Awareness of pesticide use in crops where downstream contamination of fish stocks are possible

Fish are a 'magnifier' of persistent pesticides in the environment and are affected by water pollution from improper pesticide use by farmers – particularly those growing horticultural crops. This option involves the training of farmers and other potential polluters of water (streams and lakes) in GAPs for horticultural and crop, including pest and disease control and the appropriate use of agrochemicals including the disposal of containers and surplus agrochemicals. Support would also be provided for infrastructural improvements including those for the disposal of pesticides. The capacity building option is best described by Odada et al 2004 as follows;

'Improve natural resource management, farming practice through training, governance and technologies in agriculture. Training of farmers around the lake to practice clean production and to avoid bad farming practices, which result in pollution of the lake, is essential. Poor farming practices are mainly due to lack of education and awareness. The implementation capacity of this policy option exists within partner states and the political and technical feasibility is manifested by the existence of [the Lake Victoria Environmental Management Project] *LVEMP.'*[26]

Option 6; Compliance with dairy standards – exports destined for EAC/COMESA countries

Uganda has significant exports of milk and milk products, predominantly to countries in the region - although most locally produced milk is consumed within Uganda. Food safety controls in milk processing are well-established, with the major facilities implementing hazard analysis and critical control point food safety systems. However, effective food safety controls require multiple interventions/controls along the value chain including at the level of animal feed producers and veterinary product and service providers, and in the bulking and handling of milk prior to processing.[27] There is evidence in the literature (Grimaud et al, 2005) as well as from discussions with regulatory authorities that testing and compliance to milk standards in Uganda fall somewhat short of full compliance.[28]

This option involves the development of curricula for training on GAP and good veterinary practices (GVP), and widespread training amongst input suppliers. At the level of producers and traders, it provides for the training and implementation of quality management in the bulking, storage and transportation of milk. By establishing links to milk processors, compliance with trading partner standards for milk and milk products based on COMESA-CODEX standards will be facilitated.

Option 7; The development, upgrading and capacity building of fish traceability systems in private, artisanal fishermen and public sectors

'Traceability' is an EU requirement for fish exporting countries that involves the ability to track fish through all stages of production, processing and distribution. In the area of fish products coming into the EU market, the legislation concerning the production and placing on the market, and the labeling of fish and aquaculture products has been in place since 1991. Fish-exporting ACP countries are faced with a colossal task, as in the case of Uganda, at all levels of production, including handling of fish on the boat, packaging, and transportation. Traceability is focused mainly on ensuring that operations at each stage comply with EU standards of hygiene. This not only requires an appropriate level of public control, but also a fundamental change in the habits and practices of people involved in the production and handling chain, and requires some significant investment in basic infrastructure, including the provision of ice (and the building of ice-making plants), where the water used must be fit for human potable.

A considerable degree of investment is also required by the operators, particularly small-scale operators who catch and export fish to the EU market. To comply with traceability requirements, they need to be registered, keep records, use hygienic handling, transport and packaging systems, and meet these demands. The Uganda Fish Exporters and Processors' Association (UFPEA) has done a lot to promote fish exports to the European Union market especially following the ban by the latter on Ugandan fish on grounds of health and hygiene in 2000. UFPEA has worked to ensure that all members attain necessary International Standards Organization (ISO) certifications. In collaboration with the USAID-funded Support for Private Enterprise Expansion and Development (SPEED) and other projects, UFPEA implemented a training program to help member companies achieve the necessary certification. However there is still a long way to go to uplift all parts of the value chain into compliance with EU standards.

Option 8; Disinfestation of horticultural produce, in particular fruit, through cold storage

This capacity building option looks at developing a cold storage system capable of carrying out required conditions for disinfestation of products through cold storage. A number of exporters are currently unable to export fruit because of the potential presence of pests which could be excluded through defined periods of cold storage at specified temperatures. An example is that of cold treatment protocols for citrus destined for Japan (Grout et al 2011[29] and Ekesi et al 2006[30]).

Option 9; The certification of agro – input suppliers and inputs

Uganda has a number of limitations to the achievement of its full potential in crop production. An issue is that of substandard inputs including fertilizers and seeds. The lack of quality inputs holds back both domestic producers as well as exporters of agricultural input providers. The option looks at enhancing / scaling up a regulatory framework for agricultural input providers (agrochemicals, fertilizers and pesticides) and the implementation of standards through training and capacity building – both in the private and public sectors. The linkage to improved productivity and exports would be mainly through the provision of tested and certified seed at producer level as well as other inputs such as agricultural remedies of known efficacy under specified conditions (application rates and methods, timing and so on). A similar program to that described here was run by Alliance for a Green Revolution in Africa (AGRA) and was concluded in 2011[31].

Option 10; Determining the pest status of bananas with respect to *Bactrocera invadens*

The possible presence of invasive fruit fly *Bactrocera invadens* presents challenges for Uganda's exports of a range of fresh fruit, including bananas and mango. In the case of bananas, there is currently considerable controversy over the pest status of this crop in respect of *B. invadens*. There is a very limited literature on this subject, such that the true status of bananas as a host of *B. invadens* has not been scientifically established. A potential solution to this problem, as applied to Hawaiian bananas destined for the continental USA, involves post-harvest packing and shipping protocols that exclude fruit as a host for fruit flies, namely ripe bananas. Having established the pest status of bananas, this protocol could be developed and implemented.

Option 11; Biological control of *Bactrocera invadens*

B. invadens is now the dominant fruit fly species in many parts of Africa with reports indicating that several types of fruit are heavily infested, leading to significant losses and problems with trading partners. Some of these fruit, including mango, are seasonally important in local diets. This option proposes the upgrading of facilities for the rearing and release of biological control agents for *B. invadens* as well as various other methods of bio-control of *B. invadens* similar to those described by Vayssières et al (2009)[32]. The efficacy of the natural enemy (*Fopius arisanus*) introduced from Hawaii has been completed against *B. invadens*. The option looks at importing *F. arisanus* from International Center for Insect Physiology and Ecology (ICIPE) in Nairobi as well as looking at other biocontrol options. It is important to note that the introduction of these parasitoid species is not without controversy. In particular some have concerns about their potential impact on indigenous fruit fly species which are important pollinators. This has not been properly assessed and such an assessment needs to be a part of any introduction program.

Option 12; Aflatoxin controls for groundnuts and maize

Mycotoxins are a potential major problem impacting exports of groundnuts from Uganda[33], whilst potentially constraining exports of some other commodities, notably maize aflatoxins (and mycotoxins more generally are also a major public health issue in Uganda. Tackling this problem requires a two-pronged approach. First, mycotoxin controls need to be implemented along the value chain, most notably in harvesting and post-harvest handling. Second, facilities are needed to enable the testing of consignments prior to export and also to monitor the impact of the aforementioned controls on the exposure to mycotoxins within the domestic population.

Prior efforts to control levels of mycotoxins in groundnuts, maize and other crops in Malawi through improved post-harvest handling have been of limited effectiveness.[34] This option aims to enhance the ability of smallholder to meet export market mycotoxin (and especially aflatoxin) limits through the use of a low-cost bio-control approach. Thus, a systems-based approach using GAPs for the control of *Aspergillus flavus* on maize and groundnuts would be employed, coupled with the development and extension of atoxigenic strain technology to reduce aflatoxin levels. The atoxigenic strains would be developed from local land races similar to those developed by the International Institute of Tropical Agriculture (IITA) in Nigeria. Studies have shown not only a direct reduction in aflatoxin concentration in crops through use of such atoxigenic strains, but also that these strains can displace toxin-producing strains in the soil. The long term effect is a sustained reduction of aflatoxins in affected crops by between 90 and 99 per cent.

Application of the atoxigenic strain will also reduce mycotoxin levels in maize and cassava crops grown in nearby fields, with benefits in terms of reduced local dietary intake. The death rate from liver cancer (hepatocellular carcinoma [HCC]) in Uganda is one of the highest in the world.[35] Levels of HCC in countries with a similar climate but good mycotoxin management systems, for example South Africa and Brazil, are much lower. It is estimated that the use of the atoxigenic strain could result in a significant decline in the HCC rate in Uganda. A possibly more significant public health problem in Uganda is oesophageal cancer which is associated with fumonisins that are metabolites of *Fusarium* spp. This issue would also be partly addressed by the introduction and use of GAPs in maize production.

Option 13; Developing a mycotoxin testing capacity within Uganda

Currently, exporters cannot obtain certified tests of export consignments of groundnuts or maize for mycotoxin residues inside Uganda. Thus, exporters run the risk that local test results are inaccurate and/or that aflatoxin levels increase during transit, leading to rejection of the consignment. Although there are accredited laboratories in the region, particularly in Kenya, there is limited sharing of and access to such resources within and between countries. Thus, this option would fund the establishment of internationally-recognized quantitative testing capacity for mycotoxin residues in Uganda. Credible controls and testing must be in place for exporters to ensure compliance with destination market standards, notably those of the EU. At the current time, consignments are retested in Europe and this cost would be avoided if internationally-recognized testing capacity existed in Uganda. At the same time, there are serious domestic public health considerations relating to the presence of dietary mycotoxins. The establishment of laboratory testing capacity in Uganda is necessary in order to ensure monitoring and assessment of the levels and occurrence of these contaminants in the local diet. The

following is extracted from Kaaya and Warren (2005) and there is no apparent reason to believe that the situation has changed materially[36];

There is a serious problem of inadequate up-to-date analytical equipment. The Department of Food Science and Technology, Makerere University is currently the only institution with the VICAM Aflatest® Fluorometer which can quantify aflatoxins in produce. The rest of the laboratories use qualitative or semi-quantitative methods. There is, therefore, [a] *need to upgrade laboratories with recently recommended aflatoxin analytical equipment like high pressure liquid chromatographs (HPLC), high performance thin layer chromatographs (HPTLC), gas chromatographs (GC) and simple presumptive or screening equipment which can predict aflatoxin presence in food samples. Means for maintenance of these equipment and acquisition of disposables like columns should be put in place to ensure that they are available for constant use.*

In addition, there are no laboratories specifically constructed to handle aflatoxin analysis. Aflatoxin analytical equipment is installed together with other analytical equipment thus, putting analysts/researchers in danger. Simple protective devices like gloves, glove boxes, masks and head caps are sometimes lacking and therefore not used during aflatoxin analysis. Some laboratories lack functioning ventilated hoods, exhaust fans and waste disposal facilities. I t is essential to safely handle all experimental materials associated with aflatoxin analyses following mycotoxin safety precautions as described by the International Agency for Research on Cancer (IARC) and the Association of Official Analytical Chemists (AOAC).

Option 14; Oilseed good agricultural practices for productivity and product quality and safety

The option proposes the development of good agricultural practices guidelines and their extension through a project targeted at growers in cooperatives wanting to export their product. The basic assumption is that with a series of improvements in growing practices growers could improve oilseed productivity through increases in yield and quality of their product. The agricultural requirements, including cultivar, soil, fertilizer and crop protection practices are well known but there has been some difficulty in extending these to smallholders in a way that ensures that they are adopted in a consistent or sustainable way. Using the framework of Good Agricultural Practices may help with a more sustainable adoption by target groups – particularly smallholders

CAPACITY BUILDING OPTONS EXCLUDED

Developing a germplasm collection of Ugandan bananas where natural variability is being threatened by plant destruction caused by Xanthomonas wilt and continue efforts to exclude Banana bunchy top virus

Uganda has a unique genetic resource in Banana which has been threatened by Xanthomonas Wilt (BXW) which attacks almost all varieties of Musa, destroying the fruits and devastating the crop. It was first identified in Ethiopia in the 1970s, but spread rapidly to other parts of the Great Lakes region after reaching Uganda in 2001. A further problem is Banana Bunchy Top Virus (BBTV) which has had a huge

impact on the regional production. This option involves the development of capacity to maintain the diversity of banana planting material in Uganda in the face of these and other disease threats, leading to continued productivity and exports of plantains and bananas.

3. Results

The descriptions presented above, and the results of the stakeholder workshop, suggest all 14 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. In this section the results are presented using outranking through the software package D-Sight v3. However, to provide a first scan of the relative strengths and weaknesses of the 14 capacity-building options, spider diagrams were constructed of the linear data including on Poverty Impacts (Figures 3 to 6)[4].

Figures 3 and 4 present the up-front investment and on-going costs profiles of the 14 SPS capacity-building options. It is immediately obvious the development of foot and mouth free compartments involves the highest level of up-front investment (estimated at US$30,000,000), with all other options costing $2,500,000 or lower. In respect of ongoing costs the development of a laboratory for certified milk testing involve on-going costs (33% of the annual value of exports) that far exceed all other options, with the nearest other option, fish traceability systems, having on-going costs of 20 per cent of exports.

There are dramatic differences in the predicted impact of the capacity-building options on the absolute value of exports (Figure 5); in most cases, excepting the implementation of good agricultural practices (GAP) in maize and the awareness raising in respect of the potential impact of agro-pesticide use on fish, the predicted trade effects are quite limited. In these cases the impacts of introducing maize GAPs could result in a net trade gain of US$ 14 million by 2017 and the potential for fish is estimated at US$ 7.4 million. In the latter case this would be avoided loss of sales/markets rather than additional trade.

[4] See Appendix 6; Table of Smallholders/households involved in activities related to SPS capacity building options and risk assessment of trade impacts where data has been collected on the potential impact of various capacity building options on trade and numbers of smallholders

Figure 3; Sanitary and Phytosanitary capacity-building options – up-front investment

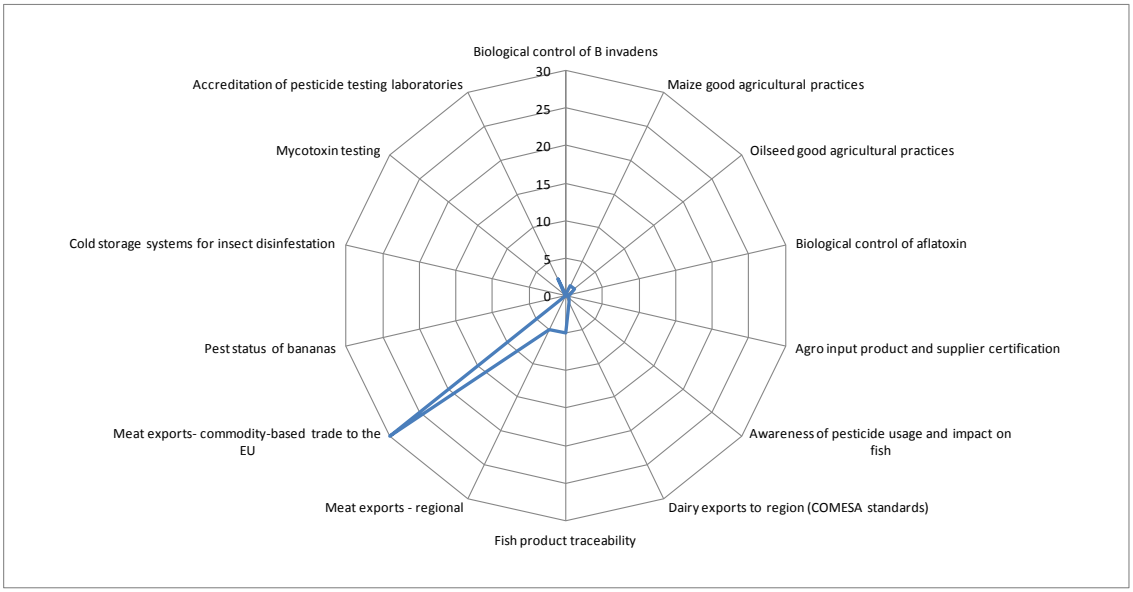


Figure 4; Sanitary and Phytosanitary capacity-building options – on-going costs

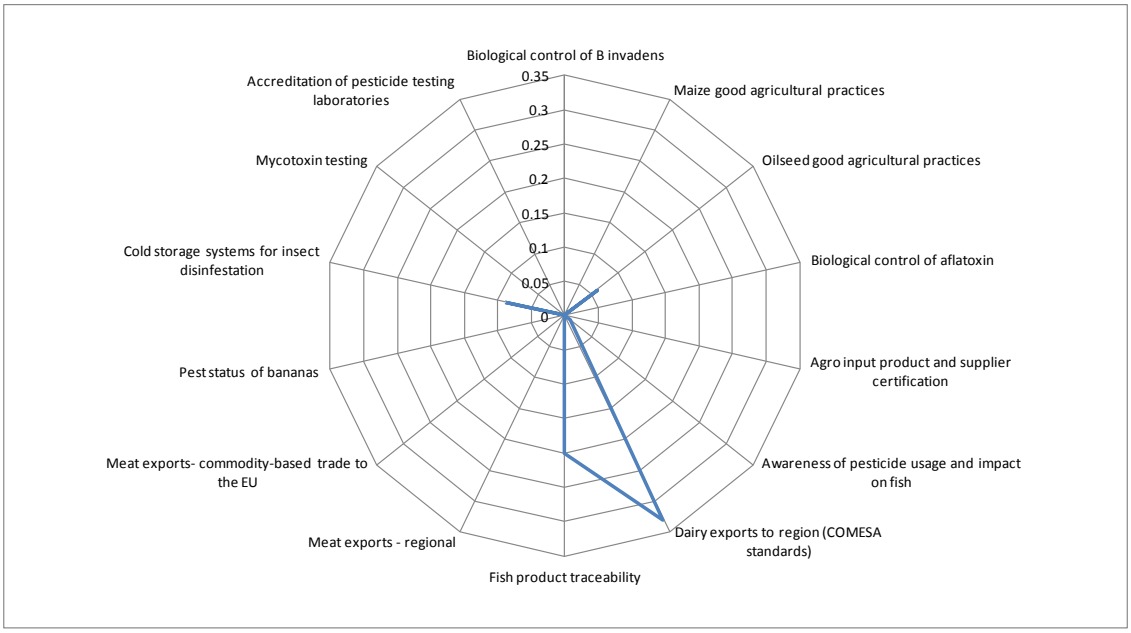


Figure 5; Sanitary and Phytosanitary capacity-building options – change in absolute value of exports

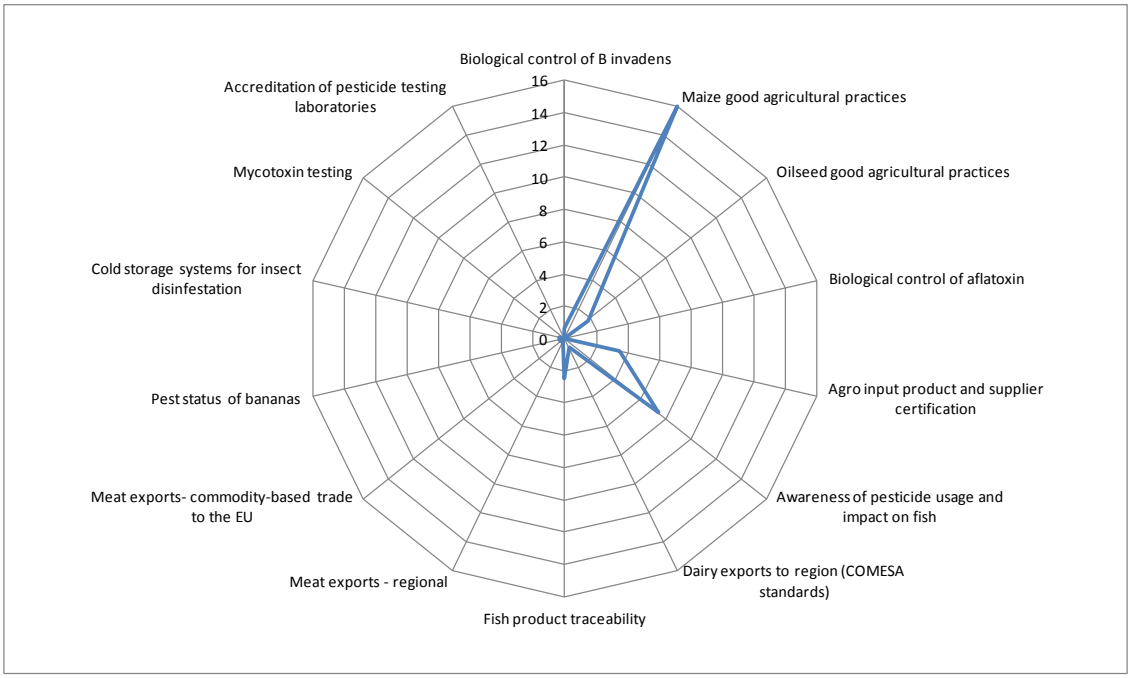
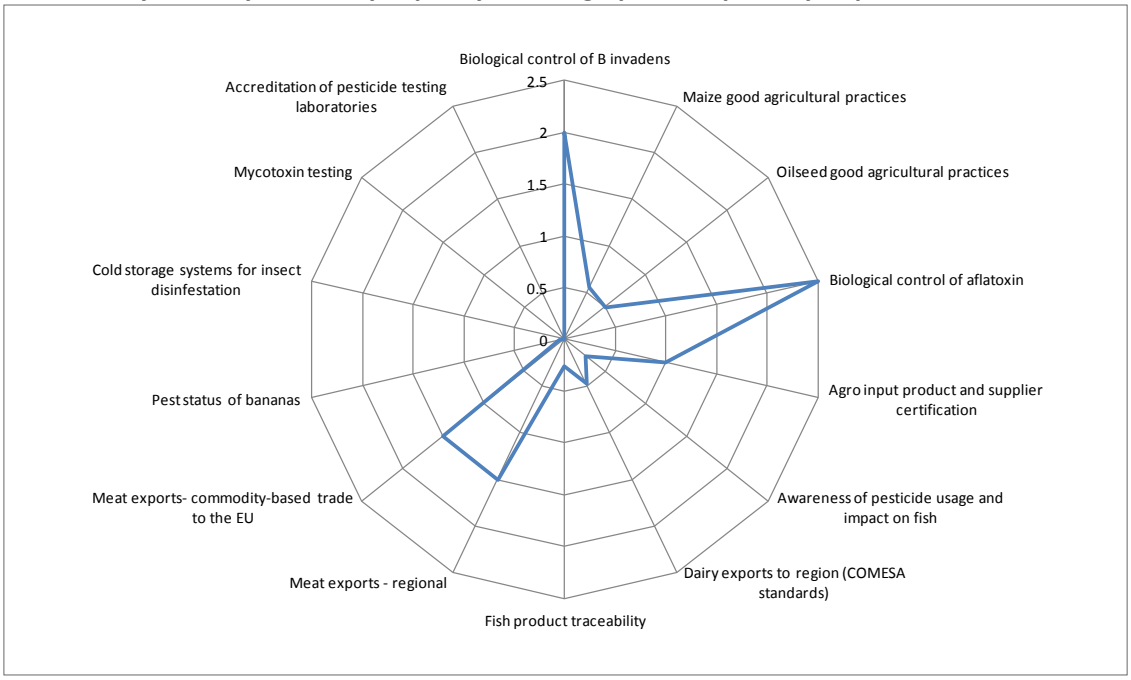


Figure 6 presents the impact of the Capacity Building Options on poverty in terms of potential numbers of household's impacted ('000,000s). Here the option with the largest potential impact is that of the biological control of aflatoxin which could impact on 2.5 million households. The next three options, in terms of impact are biological control of *Bactrocera invadens*, and the two projects aimed at developing meat exports from foot and mouth free compartments to the EU and the development of capacity for regional meat exports. The remaining capacity building options have relatively low potential impact in terms of households impacted.

Figure 6; Sanitary and Phytosanitary capacity-building options – poverty impact



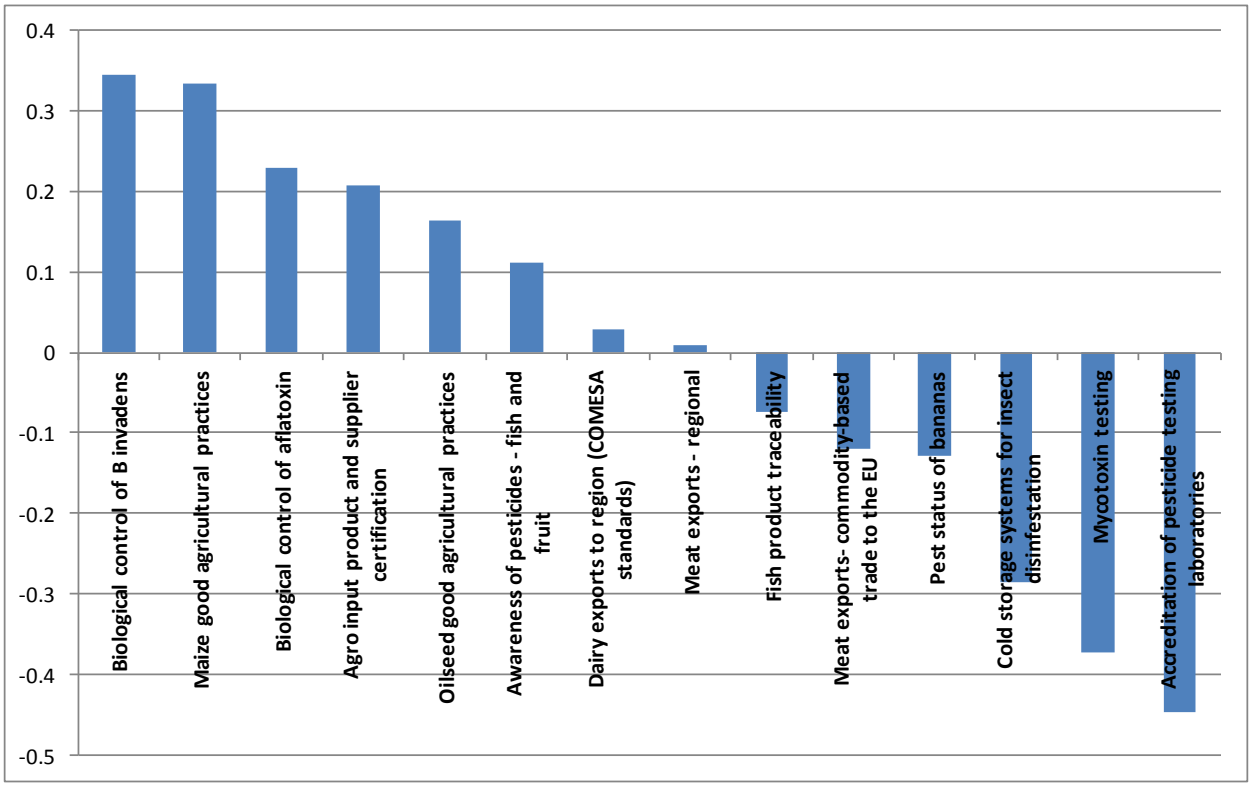
Data for the criteria where the data is non linear criteria i.e. trade diversification, agricultural productivity, domestic public health and local environmental protection and impact on vulnerable groups is not presented as the spider diagrams are not sufficiently differentiated between the various capacity building options. There is thus a strong argument in these instances for better data for these criteria in order to enhance the value of the analysis.

It is apparent that none of the SPS capacity-building options dominates across all or even most of the decision criteria and thus it is not immediately apparent what the order of these options would be in terms of the overall analysis. That is where the outranking analysis becomes important; it compares each of the capacity-building options on a pair-wise basis with respect to each of the nine 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, in 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 nine defined decision criteria. Conversely, options with a negative net flow are generally dominated by other capacity-building options.

Figure 7 reports the net flows for the 14 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 top priority options are the biological control of *B. invadens*, development of maize good agricultural practices, oilseed good agricultural practices. Other options with positive net flows include; biological control of aflatoxin, compliance of dairy exports to the region (COMESA standards) and fish product traceability. 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 14 SPS capacity-building options reflects a trade-off or compromise between the nine 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 7; 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 decision criteria, as reported below in Figures 8 to 21. The criteria are; Upfront investment, On-going costs, Trade impact, Trade diversification / value addition, Agricultural/fisheries productivity, Domestic public health, Environmental protection, Poverty impact, impact on Vulnerable groups and impact on employment (the last merged with Vulnerable groups). For example, whilst the scores for five of the decision criteria are strongly positive, the highest ranked option, biological control of *B. invadens*, have limited trade and public health impact but scores highly on cost and impact on poverty (Figure 8). Conversely, the Development and extension of both the maize and oilseed good agricultural practices which are similarly ranked in the baseline analysis are high in impact on trade and domestic public health but both score relatively less well in up-front costs and poverty impact (Figures 9 and 10). Middle ranking options such as awareness of pesticide usage and its impact on fish scores relatively well in respect of trade and environmental impact but relatively less well in terms of agricultural/fisheries productivity and impact on poverty (Figure 13)and is ranked sixth in the overall analysis The last ranked option, Accreditation of pesticide testing laboratories scores negatively in most of the criteria with the exception of ongoing costs where there is a small positive net flow (Figure 20)

The foregoing discussions presents the core results of the prioritization framework and the rankings in Figure 7 are in many ways the key results representing the recommended priorities between the 14 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 14 options, and the weights attached to the

criteria. A further question however is; does the ranking of the capacity-building options change if any of these key inputs changes? To answer this question, sensitivity analysis was applied to the baseline model, the results of which are reported below.

Figure 8; Criteria scores for biological control of *B. invadens*

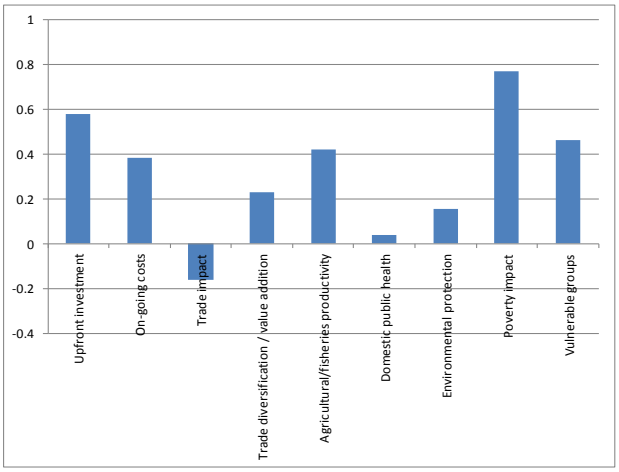


Figure 9; Criteria scores for development and extension of maize good agricultural practices

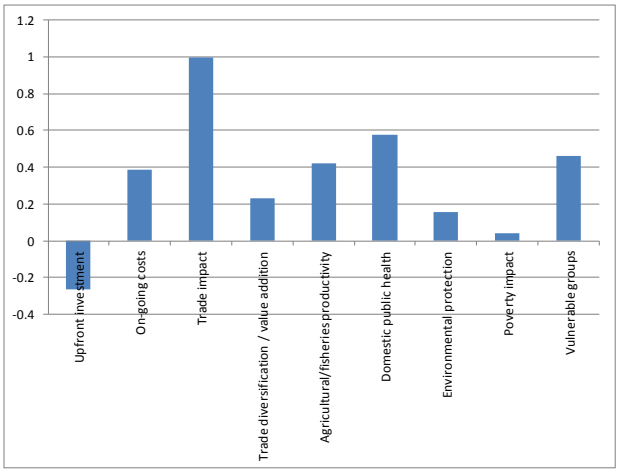


Figure 10; Criteria scores for oilseed good agricultural practices

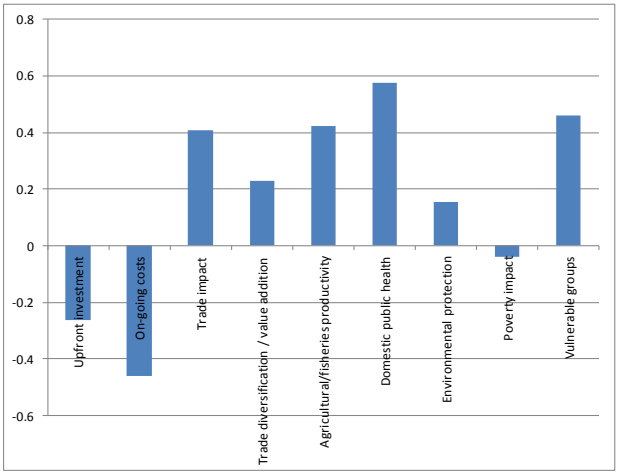


Figure 11; Criteria scores for biological control of aflatoxin

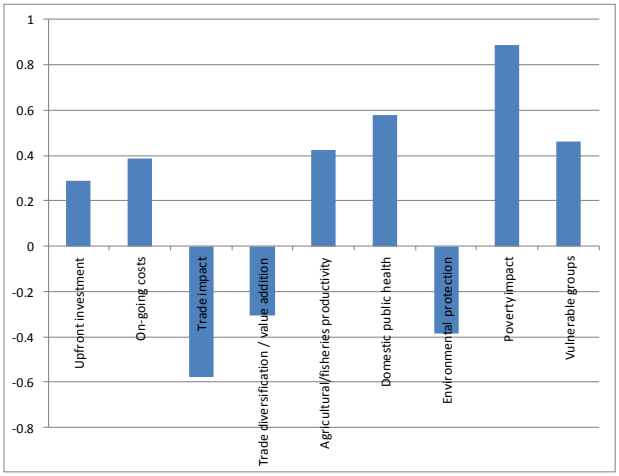


Figure 12; Criteria scores for agro input product and supplier certification

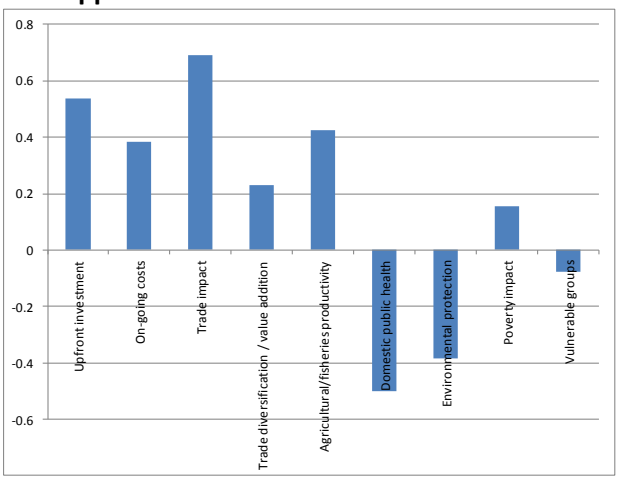


Figure 13; Criteria scores for awareness of pesticide usage and its impact on fish exports

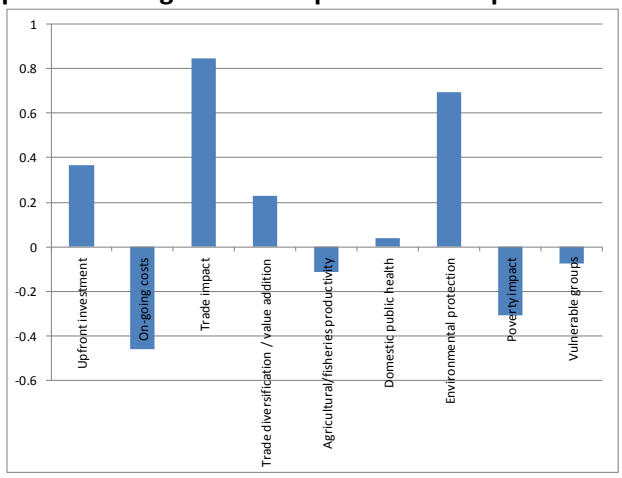


Figure 14; Criteria scores dairy exports to region - COMESA standards

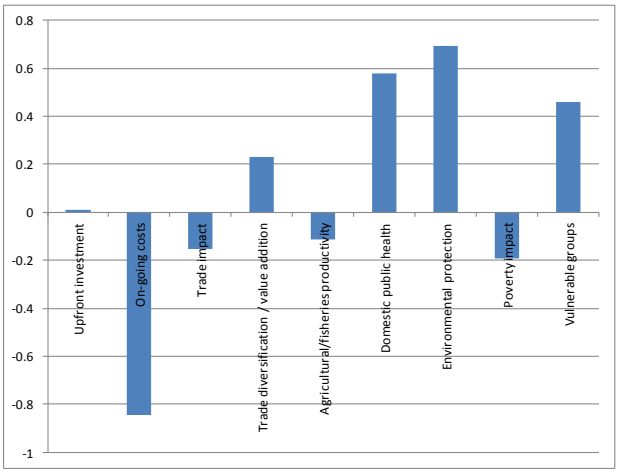


Figure 15; Criteria scores fish product traceability

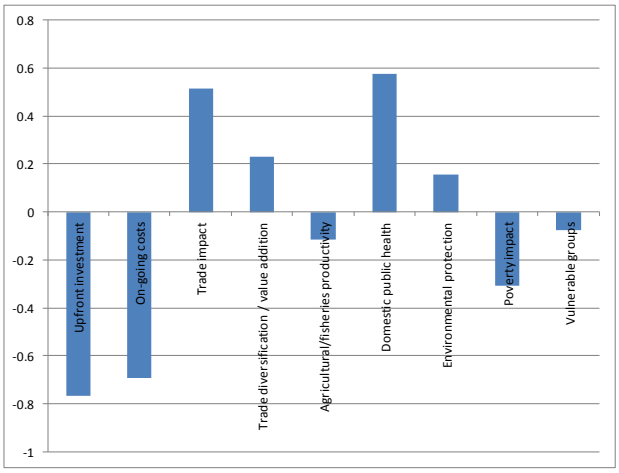


Figure 16; Criteria scores meat exports – regional

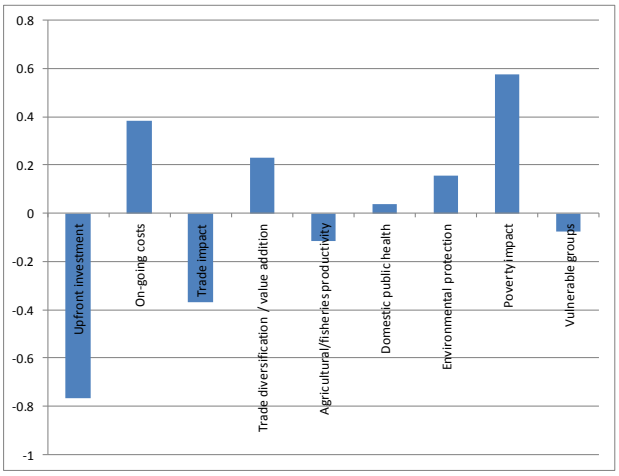


Figure 17; Criteria scores meat exports-commodity-based trade to the European Union

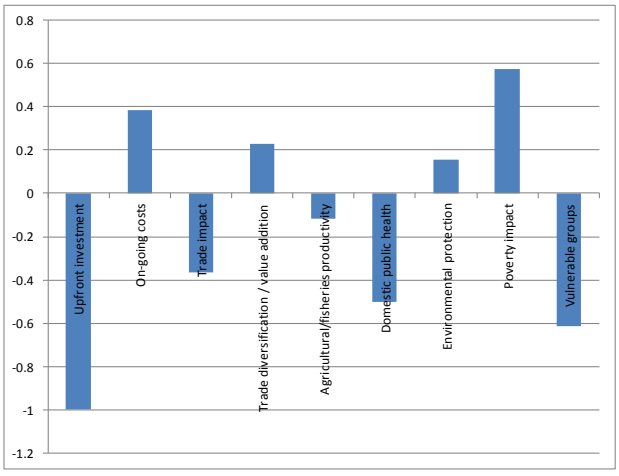


Figure 18; Criteria scores for mycotoxin testing services

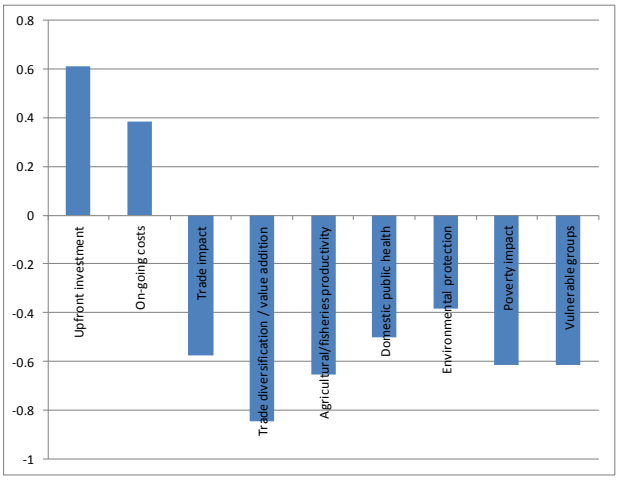


Figure 19; Criteria scores for pest status of bananas

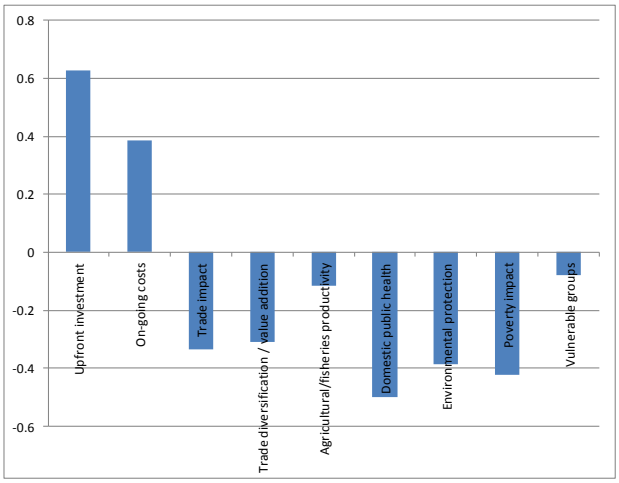


Figure 20; Criteria scores for accreditation of pesticide testing laboratories

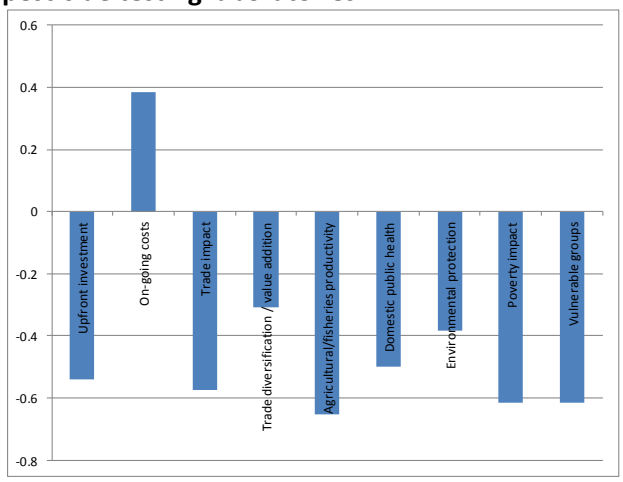
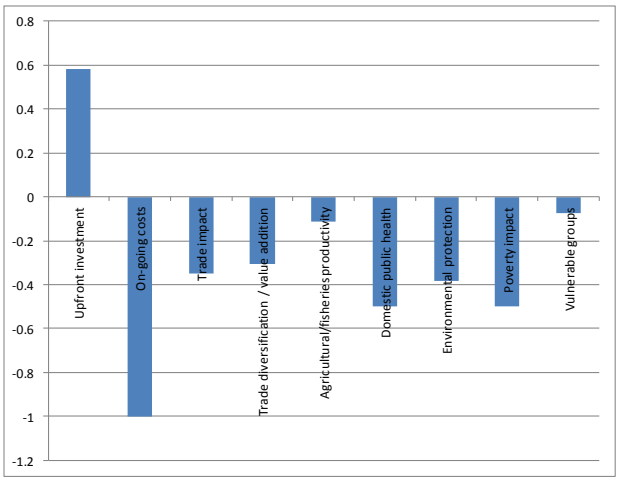


Figure 21; Criteria scores for cold storage systems for insect disinfestation



To explore the impact of changing the weights attached to the nine decision criteria two further models were derived. These were an equal weights model was estimated and a costs and trade impact model only. The equal weights model abandons the weights derived in the stakeholder workshop and assumes all criteria are weighted equally. The results of this model are shown in Table 5 and do differ in some respects from those of the baseline model, but there is some stability in that four of the same capacity-building options identified in the weights elicited in the stakeholders workshop remain ranked in the top six priorities.

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; which 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 and the results are also shown in Table 5. The prioritization of options presented by these models is slightly different. The top six options of the baseline model remain the same in the equal weights model with relatively small changes in position. The order in the costs and trade impact model are somewhat more changed from the baseline model – in particular the biological control of aflatoxin which is demoted out

of the top six. These movements are described below. 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 i.e.

- Biological control of *B. invadens* which is 1st in the baseline model moves to 2nd in the equal weights model and to 3rd in the costs and trade impact only model
- Maize good agricultural practices which is 2nd in the baseline model moves to 1st in the equal weights model and is also 2nd in the costs and trade impact only model
- Biological control of aflatoxin is third in both the equal weights model and equal weights model and is then demoted to 7th in the costs and trade impact only model
- Agro input product and supplier certification which is 4th in the baseline module moves to 5th in the equal weights model and is promoted to 1st place in the costs and trade impact only model
- Oilseed good agricultural practices which is 5th in the baseline model moves to 4th in the equal weights model and is further promoted to 3rd place in costs and trade impact only model
- Awareness of pesticide contamination in fisheries is 6th in both the baseline and equal weights model and moves to 3rd in costs and trade impact only model

The lower ranked options do not change very much and in most instances remain in their original ranks. These results suggest that the derived priorities are relatively robust to changes in the decision weights with certain qualifications.

Examination of the sensitivity of the prioritization to changes in measures of the decision criteria is more complex, in that 126 individual measures (nine decision criteria x 14 capacity-building options) enter the analysis and conceivably changes in any one might influence the results.

Table 5; Sensitivity analysis of the rankings of the capacity building options using an equal weights and costs and trade impact model

Baseline analysis			Equal Weights model			Costs and trade impact model		
Actions	Ranks	Net Flow	Actions	Ranks	Net Flow	Actions	Ranks	Net Flow
Biological control of *B. invadens*	1	0.345	Maize good agricultural practices	1	0.334	Agro input product and supplier certification	1	0.462
Maize good agricultural practices	2	0.335	Biological control of *B. invadens*	2	0.320	Maize good agricultural practices	2	0.338
Biological control of aflatoxin	3	0.229	Biological control of aflatoxin	3	0.195	Biological control of *B. invadens*	3	0.258
Agro input product and supplier certification	4	0.208	Oilseed good agricultural practices	4	0.166	Awareness of pesticides - fish and fruit	4	0.246
Oilseed good agricultural practices	5	0.164	Agro input product and supplier certification	5	0.162	Pest status of bananas	5	0.093
Awareness of pesticides - fish and fruit	6	0.111	Awareness of pesticides - fish and fruit	6	0.135	Oilseed good agricultural practices	6	-0.022
Dairy exports to region (COMESA standards)	7	0.028	Dairy exports to region (COMESA standards)	7	0.074	Biological control of aflatoxin	7	-0.052
Meat exports - regional	8	0.009	Meat exports - regional	8	0.006	Mycotoxin testing	8	-0.106
Fish product traceability	9	-0.075	Fish product traceability	9	-0.054	Meat exports - regional	9	-0.130
Meat exports- commodity-based trade to the EU	10	-0.119	Pest status of bananas	10	-0.125	Fish product traceability	10	-0.179
Pest status of bananas	11	-0.128	Meat exports- commodity-based trade to the EU	11	-0.139	Meat exports- commodity-based trade to the EU	11	-0.188
Cold storage systems for insect disinfestation	12	-0.286	Cold storage systems for insect disinfestation	12	-0.295	Dairy exports to region (COMESA standards)	12	-0.190
Mycotoxin testing	13	-0.374	Mycotoxin testing	13	-0.355	Accreditation of pesticide testing laboratories	13	-0.259
Accreditation of pesticide testing laboratories	14	-0.448	Accreditation of pesticide testing laboratories	14	-0.423	Cold storage systems for insect disinfestation	14	-0.269

4. Conclusions

This report has presented the initial results of a priority-setting exercise for SPS capacity-building in Uganda. 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, 14 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 14 capacity-building options which, in many cases appears robust to changes in the weights attached to the decision criteria.

Of 14 capacity-building options identified, the following six are consistently ranked as top priority:

- Biological control of B. invadens
- Maize good agricultural
- Biological control of aflatoxin
- Agro input product and supplier certification
- Oilseed good agricultural practices - implementation and awareness raising
- Awareness of pesticide usage and its potential impact on fish

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 Uganda.

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 Uganda. 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 Uganda.

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.

Appendix 1; Information dossier on literature for Uganda review of Sanitary and Phytosanitary Capacity building options using multi criteria decision analysis

Abegaz, M., Undated c 2008/9, *Mobilizing aid for trade for SPS-related technical cooperation in East Africa, SPS balance sheet for Uganda*. Produced for the STDF, Mimeo 29pp

Anonymous., 2004 *Building a food safety system in Uganda*. Second FAO/WHO global forum of food safety regulators, Bangkok, Thailand, 12-14 October 2004, Mimeo 5 pp

Anonymous., 2005*, Uganda, Aide Memoire for Preliminary Mission for Diagnostic Trade Integration Study (DTIS) under the Integrated Framework for Trade-Related Technical Assistance to Least Developed Countries* (IF) Mimeo 6 pp

Anonymous., 2006 *Uganda, Second National Trade Sector Review and DTIS Validation Conference Kampala, October 2-4, 2006*, Aide Memoire Mimeo 4 pp

Anonymous., 2006 *Uganda Diagnostic Trade Integration Study June 2006, Volume 1* Mimeo 230 pp

Anonymous., 2006 *Uganda Diagnostic Trade Integration Study June 2006, Volume 2* Mimeo 138 pp

Anonymous., 2009 *Comprehensive Africa Agriculture Development Programme (CAADP), Uganda, what does a CAADP compact offer Uganda?* Mimeo 36 pp

Anonymous., 2010 *Uganda CAADP compact to support the successful implementation of the Agricultural sector Development Strategy and Investment Plan (DSIP).* Mimeo, 9 pp

Anonymous., 2011 *Trade Capacity Building for Ghana*. UNIDO, Powerpoint presentation, 18 pp

Anonymous., 2012 *Modified DTIS priority action plan as at 20th July 2012*. Mimeo, 39 pp

Anonymous., Undated c. 2002 *Strategy for agricultural marketing and agro-processing under the Plan for the Modernisation of Agriculture 1*. Mimeo, 21 pp

Bagumire, A., 2009 *Impact of the global economic crisis on LDC's productive capacities and trade prospects. A case study: The fisheries sector in Uganda and the United Republic of Tanzania.* UNIDO, Mimeo 58 pp

Balagadde, S., c 2002, *Fish safety and quality assurance - Uganda's experience.* Uganda National Bureau of Standards, Mimeo, 7 pp

Brattinga, P., 2007, *Overview of SPS related assistance for Kenya, Tanzania and Uganda (2001-2006).* Report, presented on 30 September 2007 at Aid for Trade workshop Dar es Salaam, Tanzania.

CEAS, 2006, *Country-Based Plans for SPS Development. Ugandan Field Study Main Report.* CEAS, Wye.

CEAS, 2006, *Country-Based Plans for SPS Development. Ugandan Field Study Cost Benefit Analysis.* CEAS, Wye.

Chemonics International Inc., for USAID, 2010, *Market assessment and baseline study of staple foods, Country report – Uganda.* Mimeo, 110 pp

Chemonics International, Crimson Capital Corporation, International Law Institute – Uganda, Plexus Consulting Group, and International Business Initiatives, 2006, *Strengthening the competitiveness of private enterprise (SCOPE) Final Report.* USAID, Mimeo 55 pp

Enhanced Integrated Framework., 2012 *Status of EIF Countries.* Mimeo, 1 pp

European Commission, Directorate F, Food and Veterinary Office, Dublin, 2000, *Report of a mission carried out in Uganda from 02 to 06 October 2000 assessing the conditions of production of fishery products and verification of the measures on pesticides in fish.* DG/(SANCO)/1277/2000 - MR final, Mimeo 16 pp

FAO, 2003, *Phytosanitary Capacity Evaluation (PCE) Tool*. Application in Uganda (2003), FAO, Rome

Food and Agriculture Organization of the United Nations (FAO) and Tanzania Bureau of Standards (TBS) 2006 *Workshop report, FAO sub-regional workshop for East Africa, Strengthening National Food Control System.* Mimeo, 17 pp

Fowler, 2002 *Strategy for agricultural marketing and agro-processing under the Plan for the Modernisation of Agriculture.* Mimeo 21 pp

Grimaud, P., Sserunjogi, M. L., Grillet N., 2007, *An evaluation of milk quality in Uganda: value chain assessment and recommendations.* African Journal of Food Agriculture Nutrition and Development, Vol. 7, No. 5

Henson, S., 2007, *Review of Case Studies and Evaluations of Sanitary and Phytosanitary Capacity: Kenya, Tanzania and Uganda*

Kaaya, A. N., 2010, *Status of aflatoxin contamination of foodstuff in Uganda.* Powerpoint presentation

Kaaya, A. N., Undated *Management of aflatoxins in cereals, legumes and tubers AT Uganda Ltd. Final Technical Report*. CPP R8435 (ZA 0653) & R8442 (ZA0666) Appendix 12.

Kaaya, A. N., and Warren, N. L., 2005 A review of past and present research on aflatoxin in Uganda. African Journal of Food Agriculture and Nutritional Development (AJFAND): Volume 5 No 1

Kabeere, F., and Wulff, E., 2008 *Seed sector country profile: Uganda, Volume I: Overview of seed supply systems and seed health issues.* UDV J.NR. 104.M.46, Danish Seed Health Center for Developing Countries

Kiziba Investments Limited, c 2005, *An expert sub-sector study report on the beef sub-sector in Uganda: Final report*. Mimeo, 49 pp

Matsumoto, T., Yamano, T., Sserunkuuma, D., 2010, *Technology Adoption in Agriculture: Evidence from Experimental Intervention in Maize Production in Uganda*. Mimeo, 26 pp

Ministry of Agriculture, Animal Industry & Fisheries 2010 *Agriculture Sector Development Strategy and Investment Plan: 2010/11- 2014-15.* Mimeo 149 pp

Ministry of Agriculture, Animal Industry and Fisheries., Undated c 2004, *Provisional fisheries sector strategic plan.* Mimeo 92 pp

Ministry of Tourism, Trade and Industry, 2007 *National Trade Sector Development Plan 2008/9-2012/13; Trading Out of Poverty, Into Wealth and Prosperity.* Mimeo 109 pp

Molins, R., and Masaga, F., 2006, *Assessment of capacity Building Needs of the Food Control System. Uganda.* FAO, Rome

Muyambi, E., 2007, *The effect of industrial chemicals on biodiversity and human health: A case study of DDT in Kanungu district, Uganda*. A paper presented at the East African Regional Conference on "Population, Health and Environment" (PHE): Integrated Development for East Africa, Mimeo 18 pp

Mwesige, D., 2008, *Oilseed Case study – MSP UGANDA*. Mimeo, 7 pp

National Environment Management Authority (NEMA), 2002, *National biodiversity strategy and action plan, First edition.* Mimeo, 103 pp

Nkonya, E., and Kato, E., 2001 *Agricultural Input Marketing in Uganda*. Presented at the IFPRI Policy Workshop, June 25-26, 2001, Kampala Uganda June 26, 2001 Mimeo, 37 pp.

Nortura, 2007, *Developing an export-oriented meat industry in Uganda. Feasibility study. Final report*. Nortura, Oslo

Odada, E., O., Olago, D., O., Kulindwa, K., Ntiba M., and Wandiga S., 2004, *Mitigation of Environmental Problems in Lake Victoria, East Africa: Causal Chain and Policy Options Analyses.* Ambio Vol. 33 No. 1–2, 13 - 23

OIE 2009, *OIE PVS Global Programme, State of play – 12 October 2009*. Mimeo, 6 pp

Ojiambo, S., c 2004, *Financial vulnerability of maize growers in Uganda - an evaluation of poverty reduction efforts through economic liberalization policies.* Mimeo, 4 pp

Okello, D. K., Biruma, M., and Deom, C. M., 2010, *Overview of groundnuts research in Uganda: Past, present and future.* African Journal of Biotechnology Vol. 9 (39), pp. 6448-6459

Okoboi, G., 2010, *Of what merit is improved inputs use in Uganda's maize productivity?* Contributed Paper presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa, (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010."

Republic of Uganda., 2010, *National Development Plan 2010/11-2014/15*. mimeo, 441 pp

Robbins, P., Ferris, S., 1999, *A preliminary study of the maize marketing system in Uganda and the design of a market information system.* CTA/IITA, Contract No. 4-1-06-215-9, IITA-Foodnet, Kampala Commodity Marketing Information Services, Mimeo 23 pp

Rudaheranwa, N., Undated c 2003, *Uganda's challenges in complying with the WTO Agreement*. Mimeo 28 pp

Skovdal, B., and Kasirye-Alemu, E., 2006,. *Study to assess compliance of Uganda's food safety control system to EU market requirements. Final report.* Carl Bro, Copenhagen

Uganda Bureau of Statistics., 2006, *2002 Uganda population and housing census; Analytical Report Economic characteristics.* Mimeo, 69 pp

Uganda Bureau of Statistics., 2006, *2002 Uganda population and housing census; Analytical Report, Household characteristics.* Mimeo, 120 pp

Uganda Bureau of Statistics., 2006, *External trade statistics, Bulletin volume 4-2006*. 42 pp

Uganda Bureau of Statistics., 2007, *Uganda national household survey 2005/2006, report on the agricultural module.* Mimeo, 214 pp

Uganda Bureau of Statistics., 2009, *2009, Statistical abstract*. Mimeo, 270 pp

Uganda Bureau of Statistics., 2010, *Uganda census of agriculture 2008/2009, Volume IV: Crop area and production report.* Mimeo, 178 pp

Uganda Bureau of Statistics., 2010, *Uganda census of agriculture 2008/09 at a glance*. Mimeo, 22 pp

Uganda Bureau of Statistics., 2010, *Uganda census of agriculture 2008/09, Volume III: Agricultural household and holding characteristics report.* Mimeo, 571 pp

Uganda Bureau of Statistics., 2010, *Uganda census of agriculture 2008/09, Volume II: Methodology report.* Mimeo, 106 pp

Uganda Bureau of Statistics., 2010, *Uganda census of agriculture 2008/09, Volume I: Summary report*. Mimeo, 68 pp

Uganda Bureau of Statistics, c 2006, *2002, Uganda Population and Housing Census Main Report*. Mimeo, 41 pp

Uganda Export Promotion Board, 2009, *Export statistics 2008 & 2009*. Mimeo, 1 pp

United Nations, DESA/CDP Secretariat, *WTO Provisions and Preferential Market Access, Survey on LDC-specific International Support Measures Uganda; Summary results prepared by DESA/CDP Secretariat*. WTO, Mimeo, 18 pp

USAID (2008). *East Africa Value Chain Assessment. Desk Study, Final Edition*. USAID East Africa Regional Mission, Nairobi.

Wasswa, J., Kiremire, B. T., Nkedi-Kizza, P., Mbabazi, J., Ssebugere, P., 2011, Organochlorine pesticide residues in sediments from the Uganda side of Lake Victoria. Chemosphere 82, 130–136

World Bank (2006). *Uganda, Standards and Trade: Experience, Capacities and Priorities*. World Bank, Washington DC.

World Health Organization, Undated c. 2001, U*ganda, Food Safety Regional Assessment : Country Profiles.* Mimeo, 8 pp

World Trade Organization, Committee on Sanitary and Phytosanitary Measures., 2008, *SPS/STDF/OECD Workshop on good practice in SPS-related technical cooperation.* G/SPS/GEN/871 9 September 2008

World Trade Organization Secretariat, 2006, Trade policy review, Report by the Secretariat, East African Community. WT/TPR/S/171, 20 September 2006, 38 pp

WTO, undated c 2006, *Trade policy review.* Multiple documents EAC-Uganda WT/TPR/S/171/UGA Page A3-211

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Appendix 3; Capacity-Building Option Information cards

Table A3-1; Accreditation of pesticide testing laboratories in Uganda

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$2-2,500,000	Variability in costs because the option is for both the setting up of an accreditation system plus the necessary metrology laboratory	Low
On-going cost	0%	These are estimated at US$56000 annually but no increase in exports is expected as a direct consequence of the ability to test for pesticides. However exporters would pay for testing as a part of therefore number set at zero	Medium
Trade impacts			
Trade impact [Market Access]	US$ 0.00	There is no clear linkage between the availability of pesticide testing services and exports as services can be accessed in the destination market or in a third country	Medium
Trade diversification impact [value addition]	+1	Increased access by local enterprises to the testing facilities thereby increasing market access to prime markets. No particular impact on value addition	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	0	There is no linkage between pesticide testing and productivity	High
Domestic public health	0	There is no direct linkage between pesticide testing and domestic public health	High
Environmental protection	0	There is no linkage between pesticide testing and environmental protection	High
Social impacts			
Poverty impact (number of households impacted)	0	There is no linkage between pesticide testing and poverty	High
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 0 0 0 0 0 Net effect 0	There is no linkage between pesticide testing and impacts on vulnerable groups	High

Table A3-2; Maize good agricultural practices for compliance with pesticide and mycotoxin control

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$1,500,000	The development of good agricultural practices guidelines and their extension through a project targeted at growers in cooperatives wanting to export their product. 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 to low
On-going cost	0%	The underlying assumption is that commercial exporters in Uganda 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	Low
Trade impacts			
Trade impact [Market Access]	US$16 million	Cereal exports from Uganda have been declining over the past decade. It could reasonably be argued that the application of GAPs and well established agronomic practices could avoid the necessity to import an additional US$ 50,000,000 of cereals by 2017. The number of US$ 16,000,000 is based on the net trade balance over the period 2009 – 2011 weighted for severity and likelihood of SPS issues being a trade related problem	Medium
Trade diversification impact [value addition]	+2	Good production and post harvest practices ensures high productivity and market access for small, medium and large farmers	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+2	Good production and post harvest practices ensures high productivity for small, medium and large farmers	High
Domestic public health	+2	Maize as a major staple, coupled with GAPs and post harvest handling will ensure domestic public health	High
Environmental protection	+1	GAPs ensures environmental protection	High
Social impacts			
Poverty impact (number of households impacted)	550000	Maize being an important food and cash crop remains very crucial for reduction of poverty. The number is based on an estimate of households involved in maize production	High

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 1 1 1 1 Net effect High	Most of the agricultural activities in Uganda are conducted by women and impact on children, are rurally based and provide opportunities for people with limited other options	High

Table A3-3; Meat exports [support for regional trade by upgrading abattoirs for meat exports to countries with foot-and-mouth disease]

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$5,000,000	No information on costs for this option but there are similar projects in Zambia and Namibia	Medium
On-going cost	0%	Basic assumption is that these will be borne by the abattoir and producers as part of the cost of doing business	Low
Trade impacts			
Trade impact [Market Access]	US$300,000	Annual sales of live animals are in the region of US$300,000 annually. With value addition for chilled beef and increased off take due to better prices the assumption is that $ sales will double in 2017. The number also is close to that estimated by a different method based on the net trade balance over the period 2009 – 2011 weighted for severity and likelihood of SPS issues being a trade related problem	Medium
Trade diversification impact [value addition]	+2	Current exports of live animals will be reduced for value added products attracting greater returns. Significant opportunities also identified in hides and skins value addition	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Attention on stock disease, feeding and general management practices will result into high productivity	High
Domestic public health	+1	Attention on stock disease and general management practices will ensure domestic public health	High
Environmental protection	+1	Attention on stock disease and general management practices will ensure environmental protection	Medium
Social impacts			
Poverty impact (number of households impacted)	1,500,000	Increased returns from meat exports will have positive ripple effects on poverty. The number is the estimated number of households in Uganda that keep beef cattle	Medium
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 0 0 1 1 0 Net effect small positive	Limited impacts	High

Table A3-4; Meat exports [from foot-and-mouth disease free compartment to European Union]

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$30,000,000	Based on calculations done in Namibia which estimated the capital costs for a single compartment at US$10 million. However there were certain additional costs which had already been incurred in the case of Namibia. The sum is for the creation of two similar compartments in Uganda[37]	Medium
On-going cost	0%	Basic assumption is that these will be borne by the abattoir and producers as part of the cost of doing business though these have been estimated as being around 20% of capital costs	Low
Trade impacts			
Trade impact [Market Access]	US$300,000	Annual sales of live animals are in the region of US$300,000 annually. With value addition for chilled beef and increased off take due to better prices the assumption is that sales will double in 2017. The number also is close to that estimated by a different method based on the net trade balance over the period 2009 – 2011 weighted for severity and likelihood of SPS issues affecting trade.	Low
Trade diversification impact [value addition]	+2	With value addition for chilled beef and increased off take due to better prices the assumption is that $ sales will triple in 2017	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Investments in feedlot will increase productivity	High
Domestic public health	0	The intervention mainly targets the export market with little or no impact on domestic public health	High
Environmental protection	+1	Attention on stock disease and general management practices will ensure environmental protection	Medium
Social impacts			
Poverty impact (number of households impacted)	1,500,000	Increased returns from meat exports will have positive ripple effects on poverty. This is the number of households that are involved in the keeping of beef cattle.	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 0 0 1 1 0 Net effect slightly positive	Small impact distributed over a large number of beneficiaries	

Table A3-5; Horticultural producers – awareness of pesticide usage and reducing potential contamination of fish stocks

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$500,000	Develop training material, training of trainers, and extension to farmers, sensitization activities	Medium
On-going cost	10%	Updating materials, trainings, at 10% of the upfront investment figure	Low
Trade impacts			
Trade impact [Market Access]	US$7.4 million	There have been 7 EU RAASF notifications on MRL's since 1997 (fish and crops). Main threat is to fish exports. The assumption is based on a severity x likelihood assessment against average exports between 2009 and 2011.	Low
Trade diversification impact [value addition]	+2	Potential for contamination of fish stock is high from use of pesticides in swamps and along river banks. Any efforts to control this will lead to increased market access	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Increased fisheries productivity from low pesticide contamination in water bodies	High
Domestic public health	+1	Improper storage and usage has contributed to health challenges including stunting in some regions. The intervention will ensure good practices including storage for better public b=health	High
Environmental protection	+2	By implementing GAPs it will lead to enhanced environmental protection	High
Social impacts			
Poverty impact (number of households impacted)	255,000	Proper pest control will ensure increased productivity hence addressing poverty issues. The number is the estimated number of households that depend on fisheries for their primary livelihood	High
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 0 1 1 1 Net effect small positive	Possible small impact due to increased export opportunities	

Table A3-6; Dairy – compliance with EAC/COMESA milk and dairy standards

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$ 965,000	Includes cost of setting-up laboratory (US$ 170,000), equipping the lab & office, & vehicles (USD 495,000), accreditation costs (USD 100,000), salaries & consumable lab supplies (USD 200,000/per year).	Medium
On-going cost	33%	Salaries & lab consumable supplies/year, USD 200, 000	Medium
Trade impacts			
Trade impact [Market Access]	US$610,000	Dairy has moved from being net importer to a net exporter between 2002 to 2010 with annual changes in the region of 1-2 million dollars. The option could conceivably help maintain the growth at this rate = potentially 8 million. The SPS component could contribute to half this = 4 million US$. The number given here is based on severity and likelihood of SPS issues impacting average trade	Medium
Trade diversification impact [value addition]	+2	With clear standards for dairy production we expect an increase in market access beyond Uganda borders. It is estimated that over 80% of the milk is sold unprocessed.	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Better standards and open market access will incentivise farmers to invest in productivity enhancing technologies	High
Domestic public health	+2	Improving standards in dairy result in consumption of safe milk by both producers and consumers thereby ensuring better public health. Assuming implementation is enforced	High
Environmental protection	+2	Reduction of water pollution and basic farm level hygiene ensured	High
Social impacts			
Poverty impact (number of households impacted)	481,600	Government policy; analytical works from partners and governments indicate investments in this area are pro-poor. The number is based on the estimate of households where dairy is a significant portion of income and food.	High

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 1 1 1 1 Net effect large positive	Dairy production is mostly managed by women. There are obvious reasons to this including the constant care and management and utilisation of milk	High

Table A3-7; Fish products – traceability systems and general capacity building

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$5,000,000	Infrastructure, IT, HR, trainings	Low
On-going cost	20%	Assumes ongoing costs at 10% of original investment (which includes repairs and maintenance of capital items plus HR costs)	Low
Trade impacts			
Trade impact [Market Access]	US$2,500,000	Assumes that current growth and/or value addition is maintained (movement into chilled fillets rather than frozen are regional vs. EU/China market prices). Costs: cold storage, transport, packaging, value added	
Trade diversification impact [value addition]	+2	Option will improve prospects for better products e.g. chilled fillets and market access (higher prices)	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Increased private sector investment arising from proper systems and capacity for fish traceability. This will lead to a growth in productivity	High
Domestic public health	+2	Fish is a very important food for national diet. National consumption is still low, but with improved systems and capacity building this per capita consumption is expected to grow.	High
Environmental protection	+2	There is a considerable body of literature on the negative impact of human developments on the fresh water lakes in the region. Part of the negative impact is that of fishery practices and the fact that traceability is one component of good practices – including environmental protection and sustainability.	
Social impacts			
Poverty impact (number of households impacted)	255,000	Investment in the fish sector has positive ripple effects for the poor through value chain engagement in feed production, management and marketing of fish products. This number is based on the estimated number of households that depend on the fishing for a livelihood	High

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 0 0 0 0 Net effect small positive	Some impact expected from women involvement in aquaculture activities	Medium

Table A3-8; Cold storage systems for dis-infestation of product from insects

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$150,000	Similar cold store would cost about US$150,000 assuming that peripheral structure (administration, access roads) existed already. The disinfestations protocols would require smaller facilities than for meat and fresh produce exports or would be add-on facilities to existing cold stores	Low
On-going cost	9%	Running costs about 10% of capital investment plus a further 10% for HR costs	Low
Trade impacts			
Trade impact [Market Access]	US$325,000	Not known. Plants (including cut flowers), and fresh produce exports have increased at an annualized rate of US$4 million annually since 2002. Uganda has become a net importer of fruit during that period with imports increasing at an annual rate of approximately US$250,000 annually. The facility is primarily of interest to fruit exporters. Assumption that fruit export growth could match other fresh produce export growth in % terms from 2002 levels (c25%). Based on trade data for the period 2009-2011 this figure would be considerably lower. However during that period the impacts of the declaration of the presence of Bactrocera invadens had already made a negative impact on the sector.	Low
Trade diversification impact [value addition]	+1	Better market access to countries where fruit flies are a major concern	Low
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Small increases in productivity due to investment in the sector	Medium
Domestic public health	0	No known impact	Medium
Environmental protection	0	No known impact	Medium
Social impacts			
Poverty impact (number of households impacted)	5000	Employment is in the rural areas and would affect those with limited opportunities. The number is based on the likely maximum employment opportunities of a successful fruit export project(s).	Medium

Decision Criterion	Value	Details	Confidence
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 0 0 0 0 Net effect small positive	Primary employment opportunities in the sector are for women	Medium

Table A3-9; The certification of agro-inputs and suppliers

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 Uganda 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.	Low
On-going cost	0	Certification should be borne by companies as a normal cost of doing business	Low
Trade impacts			
Trade impact [Market Access]	US$3,500,000	Assumes that value of coffee exports are enhanced by 1% as a result of the intervention (no assumptions made for other crops especially maize where impacts could be considerable	
Trade diversification impact [value addition]	+2	Certified seed exporters get significant credibility in the market. This encourages market access. Other inputs (fertilizers, agrochemicals) are marketed by diverse groups.	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+2	High value output per unit area compared to ordinary grain. Good seed results in high yields	High
Domestic public health	0	No known impacts	
Environmental protection	0	No known impacts	
Social impacts			
Poverty impact (number of households impacted)	1,000,000	Small holder farmer involvement translates to high productivity and incomes addressing poverty among coffee and maize producers	High
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 0 0 0 0 Net effect small positive	Seed mostly produced and managed by women	High

Table A3-10; Pest status of bananas with respect to *Bactrocera invadens*

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$75,000	Estimated one-off research costs of $75,000	High
On-going cost	0%	No on-going costs	High
Trade impacts			
Trade impact [Market Access]	US$350,000	Uganda is a net importer of fruit. Bananas are an important part of national diet – the number is entirely guesswork based on a single investor who would be only be starting exports in 2017. The number is not directly based on existing trade volumes.	Low
Trade diversification impact [value addition]	+1	Uganda is landlocked with low rankings on the world LPI. Primary opportunities would be in the region where Bi is not a concern	Medium
Domestic agri-food impacts			
Agricultural/fisheries productivity	+1	Potential commercial investment in sector	Medium
Domestic public health	0	No known impact	Medium
Environmental protection	0	No known impact	Medium
Social impacts			
Poverty impact (number of households impacted)	5000	Small impact because of increased employment opportunities. The number is an estimate of the increased employment generation as a result of the measure	Medium
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 0 0 0 0 Net effect small positive	Employment opportunities would primarily benefit women	Medium

Table A3-11; Biological control of *Bactrocera invadens*

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$157,085	Cost of importing insects, rearing and release.	High
On-going cost	0%	No on-going costs	High
Trade impacts			
Trade impact [Market Access]	US$600,000	Uganda has become a net importer of fruit over the period since 2009.	Low
Trade diversification impact [value addition]	+2	Uganda may regain its market access from addressing the issues of Bactrocera invadens	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+2	Higher availability of fruit	High
Domestic public health	+1	Better nutrition through more fruit availability	Medium
Environmental protection	+1	Reduced chemical use as a result of emphasis on biological control	Medium
Social impacts			
Poverty impact (number of households impacted)	2,000,000	Increased availability of fruit in rural areas. The number is the estimated number of rural households that depend in a measurable way from smallholder fruit production.	Medium
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 1 1 1 1 Net effect large positive impact	Significant impact in making fruit more available and cheaper in rural areas	Medium

Table A3-12; Biological control of aflatoxin in maize and groundnut value chains

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$600,000	Estimated cost of scoping study for 4 mycotoxins in diet, land race typing of *Aspergillus flavus* to geographical indicators, and 3 year field trial with multiple strain atoxigenic strain *Aspergillus flavus.*	High
On-going cost	0%	Limited additional production costs estimated conservatively at 0.1 per cent of the value of exports. Say treatment of 500,000 ha at US$ 2.00 per ha	High
Trade impacts			
Trade impact [Market Access]	US$0	Oilseeds are not significant exports. Uganda is a net importer of cereals	
Trade diversification impact [value addition]	+1	With better quality cereals market access will be enhanced by achieving COMESA standards	
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	
Domestic public health	+2	Better access to better quality food	
Environmental protection	0	No impact	
Social impacts			
Poverty impact (number of households impacted)	2,500,000	Some impact as smallholders' access markets (processors and others). Impacts on stunting. The number is based on the estimated number of smallholders who produce both oilseeds and maize – about half of rural households in Uganda.	
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 1 1 1 1 0 Net effect large positive	Significant impact. Women are main producers of field crops, Infants and children would be the main beneficiaries of improved food quality	

Table A3-13; Mycotoxin testing services

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	US$250,000	Estimated cost of testing equipment and training of personnel.	
On-going cost	$0	Costs of maintaining laboratory accreditation $25,000/year. Annual maintenance costs $5,000. Costs of retesting in EU avoided. On balance, will be little or no additional on-going costs.	
Trade impacts			
Trade impact [Market Access]	US$0	Samples already tested in non-accredited laboratory in Malawi and then retested in EU, or tested in accredited laboratory in the region. Thus, no additional exports created. Ongoing actual costs estimated at US$ 30,000 annually.	
Trade diversification impact [value addition]	0	No impact on market access.	
Domestic agri-food impacts			
Agricultural/fisheries productivity	0	Samples already tested in non-accredited laboratory in Malawi and then retested in EU, or tested in accredited laboratory in the region. No change.	
Domestic public health	0	Samples already tested in non-accredited laboratory in Malawi and then retested in EU, or tested in accredited laboratory in the region. No change.	
Environmental protection	0	Samples already tested in non-accredited laboratory in Malawi and then retested in EU, or tested in accredited laboratory in the region. No change.	
Social impacts			
Poverty impact (number of households impacted)	0	No change in exports, so no impact	High
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	 0 0 0 0 0 Net effect - none	No change in exports or food quality, so no impact	High

Table A3-14; Oilseed good agricultural practices for productivity and product quality and safety

Decision Criterion	Value	Details	Confidence
Cost			
Up-front investment	$1,500,000	The development of good agricultural practices guidelines and their extension through a project targeted at growers in cooperatives wanting to export their product. Costs are based on similar projects in Mozambique, Zambia and Malawi as well as the World Bank Land Husbandry Water harvesting and Hillside Irrigation Project in Rwanda	Medium to low
On-going cost	6%	There will be a continued necessity for extension of GAPs by the Ugandan Ministry of Agriculture and the private sector amounting to US$ 100,000 annually.	Low
Trade impacts			
Trade impact [Market Access]	US$1,800,000	Uganda is a net importer of oilseeds and cooking oil. The assumption is that application of GAPs by oilseed producers could reduce the present trade gap i.e. provide a net benefit to Uganda of US$1,800,000 annually by 2017	Medium
Trade diversification impact [value addition]	+2	Good production and post harvest practices ensures high productivity and market access for small, medium and large farmers	High
Domestic agri-food impacts			
Agricultural/fisheries productivity	+2	Good production and post harvest practices ensures high productivity for small, medium and large farmers	High
Domestic public health	+2	Maize as a major staple, coupled with GAPs and post harvest handling will ensure domestic public health	High
Environmental protection	+1	GAPs ensures environmental protection	High
Social impacts			
Poverty impact (number of households impacted)	500,000	The number represents the estimated number of sunflower producers in Uganda	High
Impact on vulnerable groups: • Women • Children • Vulnerable areas • Smallholders • Unemployed	1 1 1 1 1 Net effect large positive	Most of the agricultural activities in Uganda are conducted by women and additionally children will benefit from an improved diet	High

Appendix 4; Analysis of Uganda's trade data

Trade in Sanitary and Phytosanitary sensitive agri-food products

Table A4-1 provides an overview of the key SPS requirements associated with Uganda's traditional and non-traditional agri-food exports. Agricultural and agri-food exports from Uganda have averaged just over 1000 million US$ annually in the period between 2002 and 2011 though growth in this period has been remarkable averaging nearly 17% annually since 2003. Exports are largely dominated by coffee which is responsible for well over 40% of agri-food exports during this period. Exports of oilseeds vegetables, cut-flowers and live animals account for much of the remainder of SPS sensitive exports. Categories losing export share both in terms of relative and absolute importance are sugar and cereals.

SPS requirements for important exports as illustrated in Table A4-1 show that private sector standards are particularly an issue for coffee exports, animal health, food safety, environmental and private sector standards are important for fish exports, plant health, environmental and private standards are important for plant and horticultural exports and finally that tobacco has relatively low SPS requirements.[5] 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. Uganda's agri-food trade is predominantly with Europe, neighbouring countries including Kenya 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 36 Notifications for Ugandan SPS sensitive imports between 1993 and 2012 (Table A4-2).

[5] Key to sensitivity of SPS issues on trade
XXX high influence
XX some influence
X little influence
Blank no influence

Table A4-1*;* Ugandan agri-food exports and attendant Sanitary and Phytosanitary requirements (average annual exports between 2002 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	1,411,584	0.2%		XXX		X	
02 Meat and edible meat offal	371,491	0.1%		XXX		X	
03 Fish, crustaceans, molluscs, aquatic invertebrates, nes	113,775,607	17.0%		XXX	XXX	XXX	XX
04 Dairy products, eggs, honey, edible animal product, nes	3,393,147	0.5%		XX	XX	X	XXX
05 Products of animal origin, nes	7,187,392	1.1%		X		XX	
06 Live trees, plants, bulbs, roots, cut flowers etc	34,974,605	5.2%	XX			XX	XX
07 Edible vegetables and certain roots and tubers	12,743,599	1.9%	XX				XXX
08 Edible fruit, nuts, peel of citrus fruit, melons	1,824,473	0.3%	XXX				XXX
09 Coffee, tea, mate and spices	266,017,022	39.7%	X		X	X	XXX
10 Cereals	21,581,232	3.2%	XX		XX	X	
11 Milling products, malt, starches, inulin, wheat gluten	11,703,137	1.7%	X		XX		
12 Oil seed, oleagic fruits, grain, seed, fruit, etc, nes	5,462,147	0.8%	XXX		XX		XXX
13 Lac, gums, resins, vegetable saps and extracts nes	345,735	0.1%			XXX		XXX
14 Vegetable plaiting materials, vegetable products, nes	4,400,664	0.7%	X			X	
15 Animal, vegetable fats and oils, cleavage products, etc	28,333,870	4.2%			XX		
16 Meat, fish and seafood food preparations, nes	563,343	0.1%		X	XXX	X	XXX
17 Sugars and sugar confectionery	22,267,466	3.3%			X	X	
18 Cocoa and cocoa preparations	15,734,982	2.4%			X	X	
19 Cereal, flour, starch, milk preparations and products	6,280,082	0.9%			X		
20 Vegetable, fruit, nut, etc. food preparations	1,940,418	0.3%			XX		XX
21 Miscellaneous edible preparations	3,672,227	0.5%			X		
22 Beverages, spirits and vinegar	20,850,097	3.1%			X		
23 Residues, wastes of food industry, animal fodder	2,493,709	0.4%	XX	XX		X	
24 Tobacco and manufactured tobacco substitutes	50,796,110	7.6%			X		
44 Wood and articles of wood, wood charcoal	3,874,254	0.6%	X				X
46 Manufactures of plaiting material, basketwork, etc.	32,796	0.0%	X				
48 Paper & paperboard, articles of pulp, paper and board	4,480,948	0.7%			X	XX	X
50 Silk	516	0.0%			X	XX	
51 Wool, animal hair, horsehair yarn and fabric thereof	254	0.0%		X			
52 Cotton	22,775,889	3.4%		X			
TOTAL	669,288,797						

Source: COMTRADE

Table A4-2; Rapid Alert System for Food and Feed (RASFF) alerts for Ugandan imports 2004 to June 2012 (Source, RASFF)[6]

Product and issue		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fish	Microbiology	1				1	4					2							1	
	MRL							1							1					
	Organoleptic																1			1
	Heavy metal																	1		
	Cold chain																			1
Coffee	Mycotoxin								2		1		1	1						
Herbs	MRL's																	1		
	Microbiology																			1
Special foods	Microbiology															2				
Fruit / vegetable	MRL's																		2	2
Nuts, nut products	Mycotoxins										2			2						
TOTAL		1	0	0	0	1	4	1	2	0	3	2	1	3	1	2	1	2	3	5

The highest number of notifications relate to microbiological issues in fish exports with related issues on cold chain and organoleptics. Both mycotoxins (in coffee and nuts) and excessive pesticide residues (in produce, herbs and fish) have been 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 also have played a more leading role in explaining Uganda's agri-food trade performance, particularly in the fruit and produce sectors though there has been remarkable growth in most agri-food exports which have doubled in the period between 2002 and 2010.

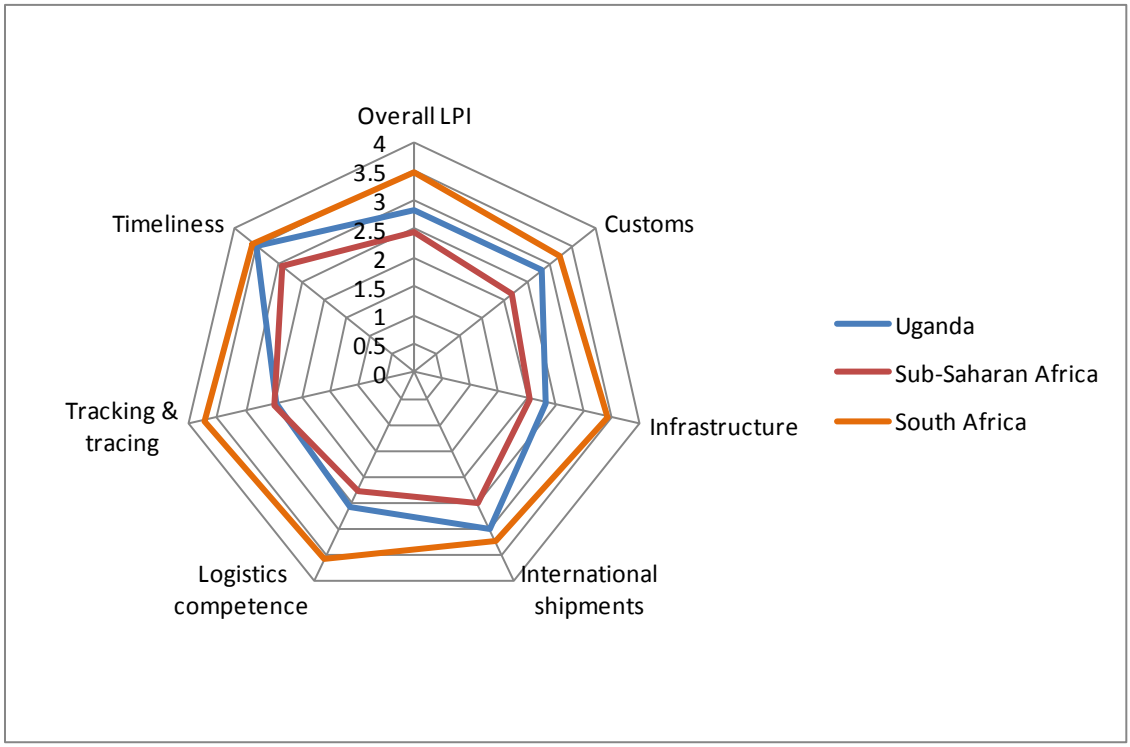
A look at the data in Table A4-1 shows that Uganda's performance in more perishable and more SPS sensitive agri-food exports, notably fish, are suggestive that some supply chain problems, logistics and seasonality have been overcome despite the country's landlocked status and poor ranking in the world logistics performance index (LPI) as shown in Figure A4-1. However the RASFF notifications do indicate that there are some issues that remain to be resolved. Uganda's major trading partners, particularly in the region, are as 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 outside service providers.

Uganda imports a range of foods mostly cereals and edible oils – the latter mainly derived from animal sources. Most of these imports can generally be considered of low to moderate risk from an SPS standpoint though mycotoxins in cereals do pose some risk. The standards for traded items of most

[6] RASFF notifications show general increase over time of y=0.1519 + 0.20503

interest to Uganda are being largely addressed through the development of regional standards by the East African Community (and thus by extension also to COMESA and SADC).

Figure A4-1; Spider diagram showing Uganda's (blue) relative Logistics Performance Index scores against sub-Saharan Africa (maroon), and South Africa (green). Source; World Bank, June 2011



Uganda's net trade performance in terms of SPS sensitive Exports minus Imports at the HS two figure level is shown in Table A4-3 which shows that Uganda's exports, particularly of fish (HS 03), plant material (HS 06), coffee/tea/spices (HS 09) and tobacco products (HS 24) are large and growing whereas imports of cereals (HS 10), animal fats (HS 15) and sugar (HS 17) are rapidly increasing. However in terms of the trade balance in US$ terms Uganda enjoys a healthy trade surplus in SPS sensitive products.

Table A4-3; Net trade flows of Sanitary and Phytosanitary sensitive trade for Uganda – 2002 to 2010*.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 2002 2010
01 Live animals	-362174	-1042163	-453343	-716439	-404650	849603	865304	2883877	1638716	362081
02 Meat and edible meat offal	-120763	2740	368821	748559	431103	154832	90814	-33458	923751	285155
03 Fish, crustaceans, molluscs, aquatic invertebrates, nes	85755623	84002467	99555228	138323597	140455720	117119823	118291873	108586333	127740106	113314530
04 Dairy products, eggs, honey, edible animal product, nes	-2365387	-2034426	-1785507	-1682423	-2820691	-4806307	-592031	2992153	12136743	-106431
05 Products of animal origin, nes	2580500	4926495	4158695	4374529	8034183	11183904	14467774	7286883	5688417	6966820
06 Live trees, plants, bulbs, roots, cut flowers etc	18257370	23889281	29766626	34330743	31422481	34770450	42109787	47317014	45763818	34180841
07 Edible vegetables and certain roots and tubers	2202860	1790515	-3602508	-7169108	3714812	1184792	14071275	17884633	12823575	4766761
08 Edible fruit, nuts, peel of citrus fruit, melons	655467	87380	1158776	1130105	455505	1225306	4160198	-1413327	-1742637	635197
09 Coffee, tea, mate and spices	134146431	149110139	167154651	212593679	243403449	317607809	450968075	343370362	354959703	263701589
10 Cereals	-49393076	-77140457	-97119576	-109505682	-120306188	-120214491	-125451393	-143552025	-113349305	-106225799
11 Milling products, malt, starches, inulin, wheat gluten	-10434491	-10477455	-11887914	-3330892	-1028435	752995	-7255772	-5503443	951780	-5357070
12 Oil seed, oleagic fruits, grain, seed, fruit, etc, nes	265836	-7082780	-3267270	-8001407	-3678738	-680441	9967361	-16283954	-8653331	-4157192
13 Lac, gums, resins, vegetable saps and extracts nes	-14046	42170	126692	-220081	-60018	1836897	-102819	-157930	-32838	157559
14 Vegetable plaiting materials, vegetable products, nes	1412430	2055489	8133460	7031360	3473078	7008402	210607	1341453	7649827	4257345
15 Animal, vegetable fats and oils, cleavage products, etc	-33490405	-52326172	-56299163	-58407274	-65504519	-53844960	-163146927	-82391861	-134109870	-77724572
16 Meat, fish and seafood food preparations, nes	-335502	-894769	-175167	-191787	-638740	-989892	-48025	-747604	-566048	-509726
17 Sugars and sugar confectionery	-15383079	-14309457	-21216056	-22096362	-30683011	-37711187	-31762736	-29930913	-30318192	-25934555
18 Cocoa and cocoa preparations	2722732	6741454	5365622	8073398	8229281	14136737	21581331	26525748	33277824	14072681
19 Cereal, flour, starch, milk preparations and products	-1409638	-1179559	-401824	5046	-1507638	1968303	5669687	-207869	-2666646	29985
20 Vegetable, fruit, nut, etc. food preparations	-775772	-967035	-1200960	-1484872	-1847712	-3103609	-3189493	-4074589	-2796759	-2160089
21 Miscellaneous edible preparations	-3618559	-4649114	-4600855	-4941283	-7151271	7526163	-9858618	-11154531	-10393887	-5426884
22 Beverages, spirits and vinegar	311658	-801110	-8069017	-3015258	-5137501	3771362	1665648	-17944583	-19658918	-5430858
23 Residues, wastes of food industry, animal fodder	-229188	437476	495599	1250297	772230	1851924	2231889	3437506	6543661	1865710
24 Tobacco and manufactured tobacco substitutes	44160151	41831953	37635083	28253456	22007182	57981572	58681690	50586257	56893979	44225703
44 Wood and articles of wood, wood charcoal	-1576351	-2788412	-2302610	-2057797	-4001495	-2962272	-200986	-4415512	1465370	-2093341
46 Manufactures of plaiting material, basketwork, etc.	24699	18142	71479	-52436	-88932	-165017	-98997	-168540	-175222	-70536
48 Paper & paperboard, articles of pulp, paper and board	-32896566	-37048208	-46900689	-48083450	-61231123	-65144932	-94647865	-90935928	-87875157	-62751546
50 Silk	1854	-5519	-794	-428	-5641	-7150	-130283	-29453	-9780	-20799
51 Wool, animal hair, horsehair yarn and fabric thereof	-771	-2823	-8646	-18541	-53019	-4758	-27044	-17919	-36297	-18869
52 Cotton	7876652	16069344	36983336	25522036	17429117	17027625	7975612	16529616	13359772	17641457

*Red = lowest 10% (i.e. net imports)

Yellow = mid 80%

Green = highest 10% (best export performers)

Cross referencing trade data with Revealed Comparative Advantage data for Uganda

RCA only reflects comparative advantage for a given industry and time period across countries. Where, trade costs are higher, the smaller the country and the lower the national average technological position, the less reliable the RCA as a measure.[38] The analysis is limited to those product groupings that represent more than 5% of SPS sensitive exports at the HS 2 figure level as shown in Table A4-3 i.e.;

1. 03 Fish and other aquatic animals
2. 06 Live trees, plants, bulbs, roots, cut flowers etc
3. 09 Coffee, tea, mate and spices
4. 25 Tobacco and manufactured tobacco substitutes

Revealed Comparative Advantage in Uganda's agri-food exports

Data for the 'Revealed Comparative Advantage' (RCA) for Uganda's fish, live plants, coffee/tea/spices and tobacco exports have been extracted from World Bank WITS Database[39] at the HS4 level (statistical data and results are shown in Appendix 5). The following observations are the conclusions of an analysis of the extracted data for the period 2002-2011. Technically a positive RCA is any value above 1. Because of the variability of year to year trade data the Coefficient of Variation (CV) is included to reflect the stability or otherwise of exports.

i. Sectors which have revealed comparative advantages (RCA) at the HS4 level are the following;

- Vanilla
- Coffee, whether or not roasted or decaffeinated
- Coffee, tea, mate and spices
- Tea, whether or not flavored.
- Fish fillets and other fish meat (whether or not minced)
- Unmanufactured tobacco; tobacco refuse.
- Other live plants (including their roots), cuttings and slips
- Live trees and other plants;
- Fish and crustaceans, molluscs and other aquatic invertebrates
- Tobacco and manufactured tobacco substitutes
- Cinnamon and cinnamon-tree flowers.
- Cut flowers and flower buds of a kind suitable for bouquets
- Pepper of the genus Piper
- Fish, fresh or chilled, excluding fish fillets
- Ginger, saffron, turmeric (curcuma), thyme and other spices
- Cigars, cheroots, cigarillos and cigarettes

ii. Sectors which have "increasing" revealed comparative advantages in the time period under review;

- Live fish.
- Fish, fresh or chilled, excluding fish fillets
- Fish, frozen, excluding fish fillets

- Molluscs, whether in shell or not
- Other live plants (including their roots), cuttings and slips
- Vanilla
- Cinnamon and cinnamon-tree flowers.
- Tobacco and manufactured tobacco substitutes
- Cigars, cheroots, cigarillos and cigarettes

iii. Sectors which have "decreasing" revealed comparative advantages in the time period

- Fish fillets and other fish meat (whether or not minced)
- Bulbs, tubers, tuberous roots, corms, crowns and rhizomes
- Cut flowers and flower buds of a kind suitable for bouquets
- Foliage, branches and other parts of plants
- Coffee, whether or not roasted or decaffeinated
- Tea, whether or not flavored.
- Mate
- Pepper of the genus Piper
- Seeds of anise, badian, fennel, coriander, cumin or caraway; juniper berries.
- Ginger, saffron, turmeric (curcuma), thyme and other spices
- Unmanufactured tobacco; tobacco refuse.

iv. Sectors which have revealed comparative advantages at present and had revealed comparative disadvantages in 2002

- Live fish.
- Fish, fresh or chilled, excluding fish fillets
- Fish, frozen, excluding fish fillets
- Molluscs, whether in shell or not
- Other live plants (including their roots), cuttings and slips
- Cinnamon and cinnamon-tree flowers.

Stability of the revealed comparative advantage indices

Mean and coefficient of variation (CV) have been calculated for each commodity group at the HS4 level for the years 2002 to 2010 for RCA and trade values as expressed in US$ (statistical data and results are shown in Appendix 6).

v. Coefficients of Variation for both RCA and export volumes at the HS 4 level are all <1 for the following (in order of increasing values);

- Live trees and other plants;
- Coffee, tea, mate and spices
- Coffee, whether or not roasted or decaffeinated
- Fish and crustaceans, molluscs and other aquatic invertebrates
- Tea, whether or not flavored.
- Other live plants (including their roots), cuttings and slips
- Fish fillets and other fish meat (whether or not minced)
- Unmanufactured tobacco; tobacco refuse.

vi. Exports where coefficients of variation at the HS 2 and 4 level for both RCA and export values are all >1 are shown in order of increasing values;

- Fish, frozen, excluding fish fillets
- Fish, fresh or chilled, excluding fish fillets
- Nutmeg, mace and cardamoms
- Cut flowers and flower buds of a kind suitable for bouquets
- Seeds of anise, badian, fennel, coriander, cumin or caraway
- Crustaceans, whether in shell or not
- Bulbs, tubers, tuberous roots, corms, crowns and rhizomes
- Live fish.
- Mate
- Molluscs, whether in shell or not

Appendix 5; Statistical data

In order to inform the relative importance of both the data being entered into the capacity building options as well as the capacity building options themselves the following table has been constructed using selected Ugandan export trade data at the HS 2 and 4 digit level. Trade data has been extracted from the World Bank WITS database on Revealed Comparative Advantage and from the United Nations COMTRADE database for total exports. Average Revealed Comparative Advantage and total exports for the period between 2002 and 2010 have been calculated together with the Coefficient of Variation so as to provide an estimation of stability for the period under review. In addition the trade data has been regressed and a slope and intercept (in US$) for each has been calculated so that the relative importance to Uganda of each commodity can be assessed in US$ terms (Table A5-1).

Table A5-1; Statistical analysis of Ugandan trade data between 2002 and 2010

Export code (HS 2 and four figure)	HS Code	Revealed Comparative Advantage		Trade data (US$)			
		Average	CoV	Average	CoV	Slope	Intercept
Fish and crustaceans, molluscs and other aquatic invertebrates	03	22.1	0.3	113572	0.2	4368.8	91729
Live fish.	0301	0.9	2.2	157	2.2	85.6	-271
Fish, fresh or chilled, excluding fish fillets	0302	2.0	1.3	2519	1.6	1099.3	-2977
Fish, frozen, excluding fish fillets	0303	0.9	1.2	1268	1.4	423.4	-849
Fish fillets and other fish meat (whether or not minced)	0304	102.2	0.4	105368	0.2	1190.7	99414
Crustaceans, whether in shell or not	0306	0.0	1.9	13	1.8	-0.3	15
Molluscs, whether in shell or not	0307	0.2	2.8	142	2.9	81.2	-264
Live trees and other plants;	06	26.1	0.2	34928	0.3	3480.8	17524
Bulbs, tubers, tuberous roots, corms, crowns and rhizomes	0601	0.2	1.9	18	1.8	-12283.0	24
Other live plants (including their roots), cuttings and slips	0602	53.7	0.3	31999	0.4	4812.5	7937
Cut flowers and flower buds of a kind suitable for bouquets	0603	8.5	1.6	2886	1.5	-1330.2	9538
Foliage, branches and other parts of plants	0604	0.3	0.7	24	0.8	-0.3	26
Coffee, tea, mate and spices	0	131.1	0.2	265769	0.4	36050.0	85521
Coffee, whether or not roasted or decaffeinated	0901	162.4	0.2	212824	0.5	32265.0	51499
Tea, whether or not flavored.	0902	128.2	0.3	113572	0.2	4368.8	91729
Mate	0903	0.3	2.5	157	2.2	85.6	-271
Pepper of the genus Piper	0904	2.8	0.6	2519	1.6	1099.3	-2977
Vanilla	0905	411.6	0.4	1268	1.4	423.4	-849
Cinnamon and cinnamon-tree flowers.	0906	12.8	1.6	105368	0.2	1190.7	99414
Nutmeg, mace and cardamoms	0908	0.0	1.5	13	1.8	-0.3	15
Seeds of anise, badian, fennel, coriander, cumin or caraway	0909	0.2	1.6	142	2.9	81.2	-264
Ginger, saffron, turmeric (curcuma), thyme and other spices	0910	1.5	1.1	34928	0.3	3480.8	17524

Export code (HS 2 and four figure)	HS Code	Revealed Comparative Advantage		Trade data (US$)			
		Average	CoV	Average	CoV	Slope	Intercept
Tobacco and manufactured tobacco substitutes	24	20.5	0.3	18	1.8	-12283.0	24
Unmanufactured tobacco; tobacco refuse.	2401	70.5	0.4	31999	0.4	4812.5	7937
Cigars, cheroots, cigarillos and cigarettes	2402	1.2	0.8	2886	1.5	-1330.2	9538
Other manufactured tobacco and tobacco substitutes	2403	0.2	1.6	24	0.8	-0.3	26

*Note; Analysis is of export trade flows to all markets

Appendix 6; Table of and risk assessment of trade impacts and smallholders/households involved in activities related to Sanitary and Phytosanitary capacity building options

While the use of multiple criteria including substituting ranking systems where data is lacking allows an analysis to proceed there are a number of problems with the method. These mainly relate to weaknesses in the use of the Likert scale.[7] For instance capacity building option may be agreed as having large impacts on smallholders engaged in the sector but the scale does not necessarily account for the total numbers of individuals or households engaged in that particular activity. Therefore information has been gleaned from a number of studies and sources to derive Table A6-1 which shows the numbers of households that might be affected by various capacity building options. A review of the sources has revealed that much of the available data on household activities and income sources is in fact quite weak. Nevertheless Table A6-1 in below does provide a basis for estimating relative impact of capacity building options in terms of households involved in the activity. In most instances the relative impact of a capacity building option has not been assessed in this study. A further elaboration would be needed to determine whether an option that lightly impacts on a large number of households would be better than one that impacts significantly on a smaller number. In the context of the current study the analysis can only go so far using existing data but it does highlight areas where stronger data will help in refining the analysis.

Table A6-1; Sanitary and Phytosanitary capacity building options in Uganda and potential impact on smallholders/households

Capacity building option	Number of smallholders	Source and assumptions
Accreditation of pesticide testing laboratories	0	No direct linkage with smallholders
Maize good agricultural practices	550000	MARKET ASSESSMENT AND BASELINE STUDY OF STAPLE FOODS COUNTRY REPORT - UGANDA; produced for review by the United States Agency for International Development. It was prepared by Chemonics International Inc.
Meat exports - regional	1500000	Census says 5 million rural households - other data says 30-60% of households keep beef cattle and assumption is that average household keeps four head
Meat exports-commodity-based trade to the EU	1500000	Census says 5 million rural households - other data says 30-60% keep beef cattle and assumption is that average household keeps four head

[7] The Likert scale as used in this analysis is a multi-item scale indicating the level of agreement or disagreement with a series of statements, for example the impact of a capacity building option on vulnerable groups which in this context would be women, children and unemployed is scaled at; Large negative (-2), Negative (-1), No impact (0), Positive (+1), Large positive (+2)

Capacity building option	Number of smallholders	Source and assumptions
Awareness of pesticides - fish and fruit	255000	Agriculture for Food and Income Security Agriculture Sector Development Strategy and Investment Plan: 2010/11- 2014-15 Republic of Uganda Ministry of Agriculture, Animal Industry & Fisheries March 2010
Dairy exports to region (EC/COMESA)	481600	Census says 5 million rural households - other data says 6% keep beef cattle though other sources indicate 6% odd % of cattle are 'milking cattle' - data used is conservative and assumption is that average herd is 1.5 head
Fish product traceability	255000	Agriculture for Food and Income Security Agriculture Sector Development Strategy and Investment Plan: 2010/11- 2014-15 Republic of Uganda Ministry of Agriculture, Animal Industry & Fisheries March 2010
Agro input product and supplier certification	550000	Numbers estimated to be producers of maize
Pest status of bananas	5000	Number of workers in fruit exporting enterprises
Biological control of aflatoxin	2500000	There are 5 million rural households - assume that 50% will benefit
Mycotoxin testing	0	No direct linkage with smallholders
Cold storage systems for insect dis-infestation	5000	Number of workers in fruit exporting enterprises
Biological control of B. invadens	2000000	Numbers of smallholders with some level of fruit production
Oilseed good agricultural practices	500000	Sunflower production supports poverty alleviation of more than 500,000 farming households whose livelihood directly depends. Oilseed Case study – MSP UGANDA, Duncan Mwesige – SNV Uganda

A further issue that was discussed at length in the workshops that were held in Kampala between the 30th July and 3rd of August 2012 was that of deriving credible numbers for trade impact of SPS related constraints. The issue is that while values for exports of SPS sensitive goods and the nature and potential severity of SPS measures has been made for Uganda (Table A4-1 in Appendix 4) and net trade flows (which are shown in Table A4-3 in Appendix 4) these do not translate easily into the potential impact of a SPS capacity building option. In order to some basis for the estimation of the potential trade impact of investing in a capacity building option Table A6-2 has been constructed in the form of a basic risk assessment. The starting point of the risk assessment is gauging the traded values. Net trade flows of goods at the HS 2 level are used as this captures both important imports such as cereals as well as important exports such as fish and coffee (Column A). The next steps in the analysis are determining likelihood and severity of an SPS issue on trade. These have been estimated and are shown in the columns designated B and C. A further column (Column D) has been inserted which shows Uganda's ranking in the World Bank Logistics Performance index.

Table A6-2; Estimated impact of not addressing Sanitary and Phytosanitary issues in relation to trade based on severity (high Sanitary and Phytosanitary impact) and likelihood (estimate of how likely an Sanitary and Phytosanitary trade issue is to arise in the future)[8]

Exports or imports at HS 2 figure level	Average of net trade flows between 2009 and 2011 (US$)	Severity of SPS constraint*	Likelihood**	LPI Value	Effect on exports from a SPS constraint assessed by likelihood and severity (US$)	Effect on exports from a SPS constraint as assessed by importance in the LPI[#]
	A	B	C	D	= A-(A x B x C)	
01 Live animals	1795966	0.01	0.50	2.5	1786986	44899
02 Meat and edible meat offal	327036	0.01	0.50	2.5	325400	8176
03 Fish, crustaceans, molluscs, aquatic invertebrates, nes	118206104	0.25	0.25	2.5	110818223	2955153
04 Dairy products, eggs, honey, edible animal product, nes	4845622	0.25	0.50	2.5	4239919	121141
06 Live trees, plants, bulbs, roots, cut flowers etc	45063540	0.25	0.50	2.5	39430597	1126588
07 Edible vegetables and certain roots and tubers	14926494	0.25	0.50	2.5	13060683	373162
08 Edible fruit, nuts, peel of citrus fruit, melons	334745	0.25	0.50	2.5	292902	8369
09 Coffee, tea, mate and spices	383099380	0.50	0.01	2.5	381183883	9577485
10 Cereals	-127450908	0.50	0.25	2.5	-111519544	-3186273
12 Oil seed, oleagic fruits, grain, seed, fruit, etc, nes	-4989975	0.50	0.75	2.5	-3118734	-124749
15 Animal, vegetable fats and oils, cleavage products, etc	-126549553	0.75	0.50	2.5	-79093470	-3163739
16 Meat, fish and seafood food preparations, nes	-453892	0.25	0.01	2.5	-452758	-11347

A number has been calculated in the column entitled 'Effect on exports from a SPS constraint assessed by likelihood and severity (US$)' from the numbers in A, B and C. This number is the potential impact in US$ of an SPS related event on exports. The number is to some extent arbitrary but does allow the inclusion of data for trade impact into the capacity building option cards in Appendix 3 more transparently and allows for discussion on the impacts of interventions to be debated in a more formal

[8] * 0= absolute trade barrier; 1 = no constraint
** 0= unlikely; 1 = likely
# an arbitrary number derived from (A/100) x D

context. The data in Table A6-2 is both positive and negative, reflecting net flows, but has been entered only as a positive number in the capacity building option cards.

Endnotes

[1] Kanyegirire, A., April 6, 2010, Uganda signs CAADP Compact. http://www.caadp.net/news/?p=639 . Website accessed 22 June 2012

[2] Anon 2010(?), Uganda CAADP Compact to support the successful implementation of the agricultural sector Development Strategy and Investment Plan (DSIP)

[3] COMESA and NEPAD, 2009, Comprehensive Africa Agriculture Development Programme (CAADP) BROCHURE 1 — OCTOBER 2009, Uganda, What does a CAADP compact offer Uganda?

[4] Henson, undated (but probably 2007), Review of case studies and evaluations of sanitary and phytosanitary capacity: Kenya, Tanzania and Uganda, Research work for the Standards and Trade Development Facility in mimeo format, 92pp

[5] EIF, 2012, Uganda country profile, http://www.enhancedif.org/EN%20web%20pages/Where%20we%20work/Uganda.htm, Website accessed 22 June 2012.

[6] WTO, 2006, Trade Policy Review, East African Community, WT/TPR/S/171, Report by the Secretariat, 20 September 2006 (06-4340), Trade Policy Review Body.

[7] OIE, 2012, PVS Evaluation missions, State of play - as at 6 February, 2012 http://www.oie.int/support-to-oie-members/pvs-evaluations/status-of-missions/. Website accessed 15 June 2012

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

[9] Ministry of Tourism, Trade and Industry, 2007, National Trade Policy, Trading Out of Poverty, Into Wealth and Prosperity, Mimeo, 22pp.

[10] Anon, undated, Strategy for agricultural marketing and agro-processing under the Plan for the Modernisation of Agriculture

[11] WTO, 2012, Membership in WTO and International Standard Setting Bodies, SPS INFORMATION MANAGEMENT SYSTEM, 22 June 2012

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

[13] Convention on Biological Diversity, 2012, Country Profile - Uganda http://www.cbd.int/countries/?country=ug. website accessed 22 June 2012.

[14] WTO, 2012, National Enquiry Points; List of national enquiry points foreseen in Paragraph 3 of Annex B of the SPS Agreement. 22 June 2012 WORLD TRADE ORGANIZATION SPS INFORMATION MANAGEMENT SYSTEM

[15] http://spsims.wto.org/ website accessed 22 June 2012.

[16] http://www.codexalimentarius.org/members-observers/members/detail/en/?dyna_fef[uid]=15597 website accessed 22 June 2012.

[17] Not on the WTO SPS website but on the IPPC website; https://www.ippc.int/index.pxp?id=nppouga , website accessed 22 June 2012.

[18] http://www.oie.int/en/about-us/our-members/delegates/ website accessed 22 June 2012

[19] Henson, S., & Masakure, O., 2011, Establishing priorities for SPS capacity-building: a guide to multi-criteria decision-making. Standards and Trade Development Facility.

[20] Henson and Masakure op cit

[21] Chemiphar, 2012, Chemiphar (U) Ltd., Chemiphar is accredited in accordance with the international standards ISO/IEC 17025:2005 ("General requirements for the competence of testing and calibration laboratories") as well as ISO/IEC 17020:2004 ("General criteria for the operation of various types of bodies performing inspection") by the Belgian Accreditation bureau BELAC, and ISTA (International Seed Testing Accreditation). http://www.chemiphar.com/nl/over_chemiphar/chemiphar_%28u%29_ltd-109.html, website accessed 14 August 2012.

[22] SIDA, 2012, Quality systems for better business, Published: Wednesday, April 18, 2012, Changed: Tuesday, April 24, 2012, http://www.sida.se/English/Countries-and-regions/Africa/Uganda/Programmes-and-projects1/Quality-systems-for-better-business-/

[23] Matsumoto, T., Yamano, T., Sserunkuuma, D., 2010, Technology Adoption in Agriculture: Evidence from Experimental Intervention in Maize Production in Uganda, mimeo, 26pp.

[24] Okoboi, G., 2011, Of what merit is improved inputs in Uganda's maize productivity? Contributed Paper presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010.

[25] Rich, K. M., Perry, B. D., Kaitibie, S., Gobana, M., Tewolde, N, 2008, Enabling livestock product exports from Ethiopia: understanding the costs, sustainability and poverty reduction implications of sanitary and phytosanitary compliance Final report for the Texas Agricultural Experiment Station, Texas A&M University Sanitary and Phytosanitary Livestock and Meat Marketing Program

[26] Odada, E. O., Olago, D. O., Kulindwa, k., Ntiba M., and Wandiga, S., 2004, Mitigation of Environmental Problems in Lake Victoria, East Africa: Causal Chain and Policy Options Analyses, Ambio Vol. 33 No. 1-2.

[27] Cassidy, D., Maurer, J., Yasman, J., 2011, Review of the Malawi Dairy Sector, Recommendations for Future USAID Investment under The Feed the Future Initiative, Review Team Report, USAID Bureau for Food Security, Washington DC.

[28] Grimaud, P., Sserunjogi, M. L., and Grillet N., (2007), An evaluation of milk quality in Uganda: value chain assessment and recommendations, African Journal of Food Agriculture Nutrition and Development, Vol. 7, No. 5, 2007, ISSN: 1684-5358 EISSN: 1684-5374

[29] Grout, T. G., Daneel, J. H., Mohamed, S. A., Ekesi, S, Nderitu, P. W., Stephen, P. R., Hattingh V., 2011, Cold susceptibility and disinfestation of *Bactrocera invadens* (Diptera: Tephritidae) in oranges. J. Econ Entomol. 104(4):1180-8.

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

[31] PASS: Agro-dealer Development Program, AT Uganda Ltd., Strengthens supply and demand for improved seed and other agricultural inputs among smallholder farmers through the development of an agro-input dealers' association with strong linkages to private sector importers, input suppliers, and smallholder farmers, Amount: US$1,296,323 Projected Duration: 1 Sept 2008 - 31 Aug 2011, source http://www.agra-alliance.org/grants/program-for-africa-seed-systems/pass-uganda/, Website accessed 15 August 2012.

[32] Vayssières, J. F., Sinzogan, A., Adandonon, A.,2009, Principal methods for integrated control of fruit flies in West Africa, LEAFLET 6 IITA-CIRAD.

[33] Kaaya, A. N., Harris, C., and Eigel, W., 2006, Peanut Aflatoxin Levels on Farms and in Markets of Uganda. Peanut Science: January 2006, Vol. 33, No. 1, pp. 68-75.

[34] Powerpoint presentation; Status of aflatoxin contamination of foodstuff in Uganda Archileo N. Kaaya (PhD) Assoc. Professor & Head, Food Technology & Nutrition Makerere University

[35] Source – World Cancer Centre

[36] Kaaya, N. A., 1 and Warren, H. L., 2005, A review of past and present research on aflatoxin in Uganda, African Journal of Food, Agriculture, Nutrition and Development Vol. 5, Num. 1, ISSN: 1684-5358 EISSN: 1684-5374

[37] Cassidy, D., Thomson, G., Barnes, J., 2013, Establishing Priorities through use of Multi-criteria Decision Analysis for a Commodity Based Trade approach to Beef Exports from the East Caprivi Region of Namibia. FINAL REPORT February 25, 2013

[38] Moenius, J., 2006, Measuring Comparative Advantage: A Ricardian Approach. Mimeo 33pp

[39] Accessed from http://wits.worldbank.org