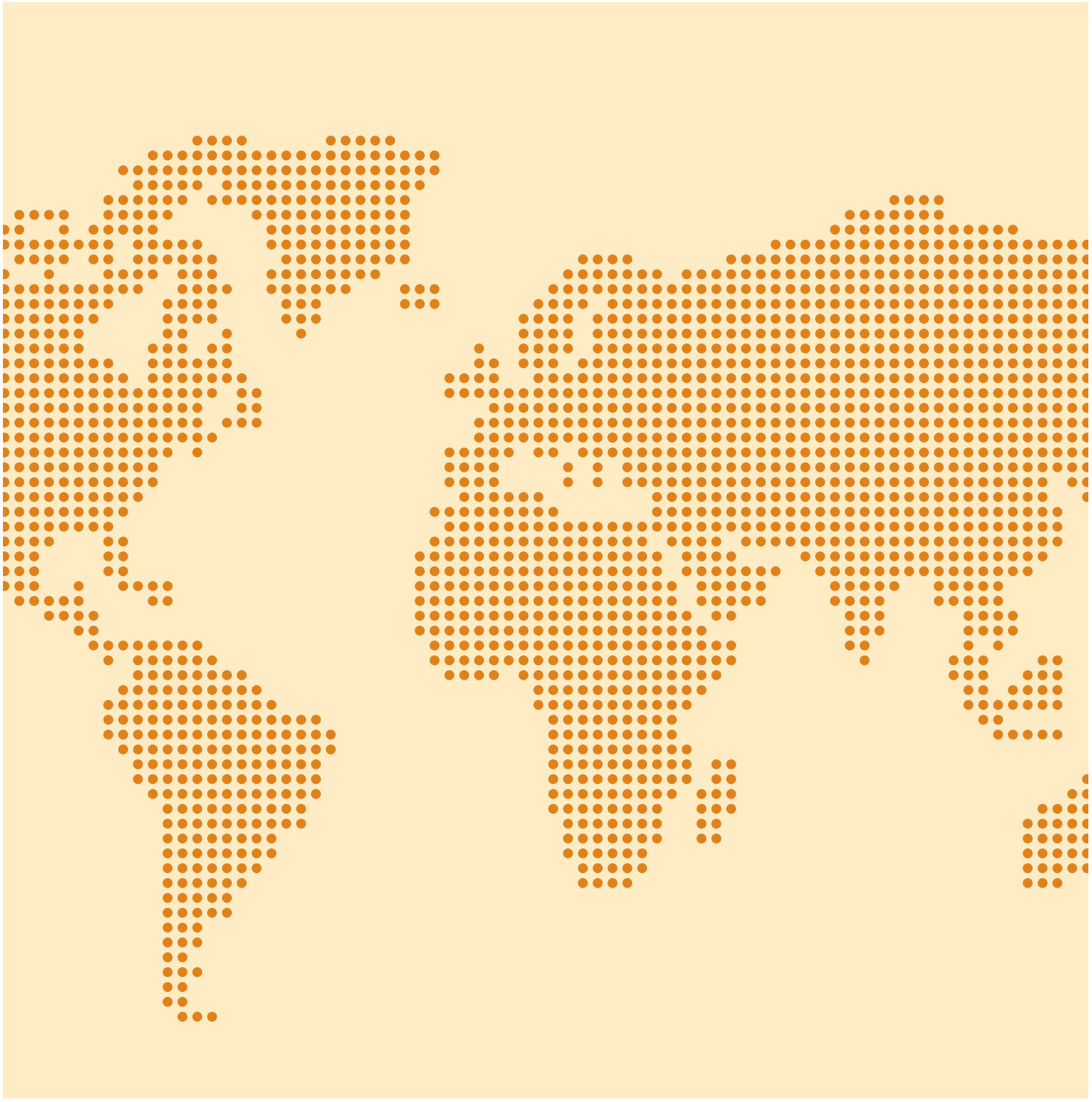

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Sida Decentralised Evaluation

Jonathan Crouch
Peter Bloch

Bio-Innovate Program Mid-Term Review Report 2013

Sida

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April 2013

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Authors: Jonathan Crouch and Peter Bloch

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SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

Address: S-105 25 Stockholm, Sweden. Office: Valhallavägen 199, Stockholm
Telephone: +46 (0)8-698 50 00. Telefax: +46 (0)8-20 88 64
Postgiro: 1 56 34–9. VAT. No. SE 202100-478901
E-mail: info@sida.se. Homepage: http://www.sida.se

Foreword

"The African Union-NEPAD Agency and the Governments in the region are increasingly seeking ways to harness Science, Technology and Innovation (STI) for boosting economic growth, alleviating poverty and attaining food security and environmental sustainability as reflected in the Africa's Science and Technology Consolidated Plan of Action (CPA). Regional initiatives such as the Bio-Innovate Program provide great opportunities for embedding STI in other sectors like agriculture and environment, and for stimulating entrepreneurship. The Bio-Innovate Program is addressing the need for integrated investments by providing a regional, broad-based biosciences research support system that links science and technology to the market place; being one of the regional development priorities conveyed in AU/NEPAD's Comprehensive Africa Agricultural Development Program (CAADP).

The approach the Bio-Innovate Program has taken is exemplary on how to bring together multi-stakeholder and multi-disciplinary actors with a focus on public-private partnerships to achieve a broad common goal. This model reinforces and provides a practical experiment for achieving the current goal for STI in the African Union, one of developing a strong innovation system that can be applied across the continent.

The purpose of this mid-term review is to evaluate the performance of the Bio-Innovate Program and supported projects for the implementation period covering 2010-2012 in meeting set objectives and milestones, and recommend adjustments that may be required to ensure successful implementation of the current phase of the Program and beyond. The report highlights that Bio-Innovate supported projects have made progress towards achieving "critical success factors" for establishing innovation systems capable of delivering sustainable and scalable impact, and emphasizes the critical importance of becoming more "entrepreneurial" at all levels and developing the ability to strategize from an inter-disciplinary perspective that covers science, innovation and commercialization.

This evaluation of the Bio-Innovate Program, financed by Sweden, was commissioned by Sida´s Regional Section at the Embassy in Nairobi, Kenya, together with the Bio-Innovate Program Management Office (PMO) at the International Livestock Research Institute (ILRI) through open competitive bidding process."

Prof Aggrey Ambali,
Director, Policy Alignment and Program Development
NEPAD Agency

Table of contents

Abbreviations and Acronyms

BIP	Bio-Innovate Program
CP	Consortium Project
CPL	Consortium Project Leader
MTR	Mid-Term Review
P2I	Pathway to Impact
PMO	Program Management Office
PS	Private Sector
TAC	Technical Advisory Committee
No. & Short Name	**Consortium Project – Full Name**
P1 Grains	Delivering New Sorghum and Finger Millet Innovations for Food Security and Improving Livelihoods in Eastern Africa
P2 Clonals	Enhancing Food Security through Improved Seed Systems of Appropriate Varieties of Cassava, Potato and Sweetpotato Resilient to Climate Change in Eastern Africa
P3 Beans	Value Added Bean Technologies for Enhancing Food Security, Nutrition, Income and Resilience to cope with Climate Change and Variability Challenges in Eastern Africa
P4 Waste	Sustainable utilization of agro-industrial wastes through integration of bio-energy and mushroom production
P5 Water	Integrated Process for Sustainable Agro-process Waste Treatment and Climate Change Mitigation in Eastern Africa
P6 Added-value	Use of Biosciences for Value Addition and Diversification to Enhance Commercialization of Sorghum and Millet Products
P7 Bio-control	Bio-enhanced seeds and seedlings for East Africa
P8 Enzymes	Industrial Enzymes for Sustainable Bio-Economy: Large Scale Production and Application in Industry, Environment, and Agriculture in Eastern Africa
P9 Policy	Biosciences Innovation Policy Consortium for Eastern Africa (BIPCEA)

Executive Summary

GLOBAL PERSPECTIVE

"To succeed in these efforts (create resource sustainability), both the public and the private spheres will need to make adaptation their top long-term priority. Governments will have to supply funding and research talent for projects that are not yet ready for commercial application; they will also have to establish the necessary regulatory framework … At the same time, because governments are major consumers in their own right, they are well placed to spur commercial innovation …

Corporations, for their part, must supply the entrepreneurial vigor and technological know-how to move promising experimental systems from the laboratory to the marketplace. Universities, non-profit organizations, and local communities will also play an important part by devising creative new solutions and supporting the introduction of new technologies"

The Race for What's Left

Michael Klare © Picador, 2013

EXECUTIVE SUMMARY

The design of the Bio-Innovate Program (BIP) was an innovative move to bridge the gap between research and end-user needs. Through the BIP, , Sweden through Sida has demonstrated the power and potential of Michael Klare's vision of sustainability in *The Race for What's Left* by creating a collaboration among universities, public research organizations, the private sector, government, and NGOs. The nine regional consortia that received grants under the Program address policy, improved crops and value chains, bio-controls, and remediation of industrial wastes.

Sweden has made strategic investments in science through Sida for over 15 years, gradually building a foundation for a level of sustainable impact that would be very hard to achieve through short-term investments. At each step in the process, lessons have been learned that have informed implementation of the work in hand and the design of the next phase. This review is well timed to contribute to both elements.

Bio-Innovate has already moved research outputs closer to end-users. Inevitably, as consortia progress along this pathway, projects need to adjust and correct their methodologies and processes. The projects, and the overall program, have been intentionally science-driven. This Review revealed, however, that application of entrepreneurial thinking and stronger, more balanced partnerships with the private sector would enable the Program to gain greater traction in satisfying its mission objectives.

Overall, we see the potential for a high success rate in achieving the Program goals. The majority of the challenges can be resolved, and we have made recommendations for addressing constraints in project design, problems with implementation, and enhancing pathways to greater impact.

The design and implementation of the program clearly required cultural change and the development of new methodologies for consortium members. Much credit is due to the Project Management Office (PMO) and the BIP science community for successfully initiating the transition from Bio-EARN to Bio-Innovate.

The in-depth analyses of the nine projects conducted under this Review revealed that some are already moving towards establishing successful pilot projects in collaboration with private sector partners; that some have the potential to generate sustainable and scalable impact on a national or regional level; and that several suffer from intrinsic challenges related to design or problems with implementation.

THE VITAL IMPORTANCE OF POLICY SUPPORT

The P9 Policy project (BIPCEA) deserves special mention: support for this thematic area indicates that the program architects understood the critical importance of the policy environment. The design envisioned that intensive management of policy issues could expedite impact for many of the projects. Although P9 has not met expectations, there is potential to redirect and reinforce its mandate and delivery mechanisms to the direct benefit of many of the other projects.

CREATING CHAMPIONS OF CHANGE IN PRODUCT DEVELOPMENT

The P5 Water project has made a fundamentally important step forward by building pilot facilities to test and refine its technologies at agro-industrial pollution sites. This provides a powerful demonstration of the technology package, allows realistic economic analysis, and is the foundation for establishing an innovation system with the potential to achieve the level of impact that the PMO desires for the whole Program. Meanwhile, several of the scientists in this project are developing and refining their entrepreneurial skills and thinking, and in so doing are becoming champions of change.

ESTABLISHING EXEMPLARY INNOVATION SYSTEMS

The P3 Beans project has developed an exemplary model of cross-border R&D collaboration and has created a strong and balanced partnership with the private sector in Kenya. Building on this foundation, the team has the potential to achieve significant impact and must now challenge itself to create equally strong public-private partnerships in other partner countries and forge strategic opportunities across the region.

HARNESSING THE POWER OF A REGIONAL INNOVATION PLATFORM

The P7 Bio-control project has linked to a highly progressive private sector partner in Kenya with established regional and international export business. The challenge for this consortium is to replicate its business model in other partner countries. Similar opportunities exist in the P2 Clonals project, where the expertise of a successful private sector partner company, again in Kenya, can be harnessed to drive parallel successes across the region.

ENHANCING CROP SEED SYSTEMS AND VALUE CHAINS

The P1 Grains, P2 Clonals and P6 Added-value projects have all aimed to enhance various elements of the delivery pathway for improved varieties of Africa's staple food crops. All three have struggled to create a well integrated consortium with a uni-

fied pathway to sustainable and scalable impact, primarily due to inadequate entrepreneurial thinking and insufficient interaction with delivery agents. Nevertheless, all three have the potential to achieve significant regional impact if problems with project design and implementation can be resolved.

CREATING EXPORT MARKETS FOR INDIGENOUS IP

The P8 enzyme project holds great promise for creating large-scale business opportunities based on indigenous IP. Although this project has been delayed by logistical problems and over-diversification, the team has an opportunity to focus its human and financial capital to fast-track a small-scale demonstration that successfully satisfies specific needs within the leather-processing sector.

GENERATING ECONOMICALLY SUSTAINABLE ENVIRONMENTAL IMPACT

The P4 Waste and P5 Water projects have taken the bold step of establishing pilot facilities in commercial settings in order to demonstrate and refine their technologies and to generate accurate economic analyses that can be used to guide scale-up and scale-out activities. These have also enabled projects to engage with local governments and gain a better understanding of how the national policy environment may stimulate or constrain widespread adoption of their integrated technology packages.

DEVELOPING AN INSTITUTIONAL LEARNING CULTURE

Most projects have made progress in one or more ”critical success factors” for establishing innovation systems capable of delivering sustainable and scalable impact. With this foundation the PMO can now start to establish an effective innovation platform — a mechanism to transfer and translate successes and lessons between projects. The Program must also create an effective mechanism to identify and internalize lessons learned from other, external programs. For example, the P1 Grains and P2 Clonals projects present excellent opportunities to build strong partnerships with parallel programs to fast-track its own success.

STRENGTHENING PROGRAM LEADERSHIP

The PMO is at a crossroads and can now transition to managing from the perspective of overall “portfolio rate of success,” bring additional resources to high potential projects and phase-out any project that is substantially under-performing. This transition should increase the potential impact of the most promising projects.

RELATIONSHIPS WITH HOST AND REGIONAL ORGANIZATIONS

Aspirations for the extent of added value gained from the hosting arrangement with ILRI have not materialized, and clearly need renegotiating to strengthen management oversight. Similarly, association with NEPAD has not yielded new sources of funding as hoped for. We recommend that the BIP takes a much more proactive and opportunistic approach to enhancing interaction with all regional organizations in order to access relevant skills and experience, funding and financing, critical mass and profile.

CULTIVATING A RAPID REACTION MODEL

We hope that the energy and enthusiasm for change that we have observed during the review period can be sustained through the next year. Maintaining momentum for change is hard, and so we recommend that entrepreneurs with broad experience and strategic vision be engaged in all components of the program, and most specifically to support and strengthen the role of the Technical Advisory Committee. Engaging such individuals will not only fill expertise gaps but will also help the program drive its agreed action plans towards greater impact, including development of economic analyses, pathways to impact and business plans.

DESIGNING THE NEXT PHASE FOR IMPACT

We recommend that the next phase focus more on creating partnerships to deliver sustainable and scalable impact, which would be the natural evolution of the Program. The BIP can most rapidly achieve its program goals by facilitating and supporting strong innovation-driven, user-oriented public-private partnerships. Moving from a science-driven to a collaborative innovation system model, in which researchers and deployment agents work closely together, creating the all important direct feedback loop connecting R&D to end-user needs. This will fuel the innovation engine that Bio-Innovate is building, and leverage Sweden's investments and efforts to date. It will also attract new partners, additional sources of donor funding and investor financing.

1 Introduction

OVERVIEW OF THE STRUCTURE OF THE REPORT

Section 1: This report begins with an overview of the BIP from a high level strategic perspective. We then provide a summary of the purpose and scope of this MTR before describing the methods we have used in the review process.

Section 2 & 3: The core of this report comprises our evaluation of the achievements and challenges of the BIP at two levels, split into two separate sections: at the program level; at the project level. Please note that there is further analysis of certain projects in Appendix A.

Section 4: The next section of the report provides a synthesis of the conclusions and recommendations.

Section 5: The final section of the report recommends an evolved model for the next phase of the program.

OVERVIEW OF THE PROGRAM

The BIP describes its foundation, strategy and partnership models as follows:

The Bio-resources Innovations Network for Eastern Africa Development (Bio-Innovate) Program was established in 2010 to support multi-disciplinary biosciences and product-orientated innovation activities in the eastern Africa countries of Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda. The Program promotes the use of modern biosciences to improve crop productivity and resilience to climate change in smallholder farming systems, and to increase the efficiency of the agro-processing industry to add value to local bio-resources in a sustainable manner.

The Program's vision is to be a model of how to transform research to innovation and ultimately pass these products to the end user, and in the process ensure that science, technology and innovation actively contributes to the socio-economic development and improvement of livelihoods in the region. To actualize this concept, the Program consortia projects are designed to include key actors along innovation value chains including scientists, private sector, and other market actors. In this regard, Bio-Innovate Program is collaborating with universities, national and international research institutes, private sector companies, regional initiatives, NGOs and other developmental actors.

The Program works closely with National Councils of Science and Technology in eastern Africa and the African Union – NEPAD Planning and Coordinating Agency (NPCA) in strengthening regional collaboration in science and technology and to push for the continent's ability to exploit opportunities afforded by modern biosciences in line with Africa's Science and Technology Consolidated Plan of Action.

The vision, mission and strategic goal statements of the BIP are as follows:

Vision: *To develop into a Program of excellence that contributes to sustainable and integrated utilization of bio-resources for economic growth and development of Eastern Africa.*

Mission: *To create and promote bio-resource based innovation systems in Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda for sustainable utilization and integration of the innovations into Eastern Africa's development processes.*

Strategic Goal: *Eastern Africa bioscience innovation systems mobilized and deployed to harness bio-resources, thereby promoting socio-economic development of the region.*

The program has delineated four thematic areas which provided the framework for two separate calls for proposals (see Table 1). Each call for proposals focused on two thematic areas. The proposals cover the most important staple crops in the region, and a diverse range of environmental, industrial and policy targets.

Table 1. Primary targets of the nine projects funded through the two calls for proposals and their relationship with the four thematic areas of those calls.

Thematic Area	***Projects Funded from First Call for Proposals***	***Primary Targets of Project***
Climate change adaptability, productivity and improvement for food and nutrition security	P1 Grains	Sorghum and finger millet genetic improvement
	P2 Clonals	Cassava, sweet potato, potato propagation and distribution
	P3 Beans	Breeding beans for the canning industry
Waste treatment, production of bioenergy from renewable bio-resources and securing freshwater resources	P4 Waste	Use of sisal and coffee waste for mushroom and biogas production
	P5 Water	Waste water treatment and provision of clean water
Innovation incubation and promotion of targeted value chains	P6 Added-value	Post-harvest processing of sorghum and finger millet
	P7 Bio-control	Various bio-control products
	P8 Enzymes	Various industrial enzymes
Bio-resource innovation policy and sustainability analysis	P9 Policy	Supporting project and industry needs

Seven of the nine projects emerged from project teams funded under the Bio-EARN program (see Table 2), through merging of teams and/or bringing in new public sector research partners. Three projects combined various types of delivery agents from the public and private sectors, and NGOs and informal seed sectors. Three projects partnered with established private sector companies to host pilot facilities. Two projects partnered with the private sector with established or emerging supply chains. And finally, one project established a network of policy specialists across government, NARS and NGOs.

Table 2. Key components of the design and structure of each project.

Project	***Important aspects of design***	***Includes Bio-EARN grantees***	***Product Delivery Partners***
P1 Grains	Merger of multiple concept notes on sorghum and finger millet breeding technologies and products	Yes	Various
P2 Clonals	Merger of multiple concept notes on micropropagation of clean planting material of clonal crops	Yes	Various
P3 Beans	Evolved from the sub-regional bean network with major goal to support bean canning industry in the region	No	Various
P4 Waste	Recycling of plantation waste with mushroom and biogas by-products	Yes	Private sector (pilot facilities)
P5 Water	Reducing water pollution from agro-industries with biogas and agricultural fertilizer by-products	Yes	Private sector (pilot facilities)
P6 Added-value	Increasing the demand for sorghum and finger millet through healthy convenience foods and beverages	Yes	Private sector (including incubator)
P7 Bio-control	Enhancing ESA biopesticide production and use for environmental benefits globally	Yes	Private sector
P8 Enzymes	Industrial products derived from local enzymes with global export potential	No	Incubator (pilot facilities)
P9 Policy	Social science guidance, advocacy and capacity building for the other projects and their target industries	Yes	Government science & technology ministries

PURPOSE AND SCOPE OF THE MID-TERM REVIEW (MTR)

The purpose and scope of the MTR are described in the ToR as follows:

The objective of the Mid-Term Review (MTR) is to measure and report on performance to date of the Bio-Innovate Program and supported projects in meeting set objectives and milestones, and recommend adjustments that may be required to ensure successful implementation of the Program The MTR is intended to interrogate the progress, achievements and challenges encountered thus far with reference to the

original stated objectives for both the Program and supported projects, and the extent to which the Program is fulfilling its mandate and delivery of expected results.

The lessons drawn from the MTR are intended to inform implementation of the Program in the remaining period and beyond. The MTR will also assess the appropriateness of the current Program design and operational procedures including the Competitive Grant Scheme (GCS), towards delivering on its mandate. More specifically the MTR will critically examine Project identification and selection process and the innovations being developed with particular attention on the uptake and dissemination of the technologies generated and the likelihood of the envisaged impacts being realized. It will also review the resource mobilization efforts for the CGS by the partners as per the agreements. Special attention shall be given to the role of ILRI and AU/NEPAD in mobilizing resources for CGS for bioscience research and innovation in the region.

SUMMARY OF APPROACHES USED IN THE REVIEW

The Mid-Term Review (MTR) of the Bio-Innovate Program (BIP) was initiated in early February 2013 based on a Situation Review of documents available via the internet, selected documents provided by the BIP Program Management Office (PMO) in electronic form and independent research by the reviewers. During the first week of the Field Research phase the PMO provided printed copies of various programmatic and project documents (listed in Appendix C).

The Field Research phase was carried out in Nairobi, Addis Ababa, Kampala, Arusha and Dar es Salaam during 17 February to 6 March 2013, and comprised a series of interviews with TAC members, PMO staff and project consortium partners (see Appendix D for a full list of our interviews and site visits). The reviewers placed particular emphasis on long interviews (generally 2-3 hours) with nearly all the private sector partners at their operational sites. Long interviews (1-2 hours) were also conducted with all available Consortium Project Leaders and key independent informants. In addition several partial-team meetings were convened and facilitated by the reviewers in Addis Ababa. We have also carried out detailed technical analyses where appropriate (see Appendix A).

The review team has evaluated past activities, structures and processes to the extent possible depending on the completeness and clarity of documents provided and the openness and honesty of those we interviewed. Our reports on individual projects have focused on issues of high importance to the future success of the program or individual Consortium Projects (CPs). In particular, we have evaluated the strength of the partnerships between research and deployment agents as key success factors for the future development of an effective pathway to impact (P2I - commercialization by private sector partners or analogous mechanisms for increasing impact on Africa's food security and environmental challenges). We have made a special effort to provide recommendations for actions that might enhance the success of on-going pro-

jects during the current phase, and/or start the process of a transition to the proposed next phase (as described in Section 5).

It was also agreed that the reviewers should instigate interventions during the Field Research phase wherever they considered they could facilitate progress in filling gaps and resolving problems. We acknowledge that this was a courageous move by the PMO that reflects dedication to progressing this initiative in the most rapid and efficient manner.

During our analysis, it quickly became apparent that interventions were required and justified in order to get the P8 Enzymes project up and running and to establish a viable way forward for the P4 Waste project. On this basis, we initiated a series of interventions during the Field Research phase (summarized below and described in detail in P4 and P8 components of Section 4). We believe that with the right kind of human and financial investment over the next year these two projects could realize great potential.

A draft of our report was submitted to Sida and the PMO on 25th March 2013, for feedback on errors of fact. Based on subsequent discussion with Sida and the PMO, we agreed to restructure the report and add sections on program achievements and performance against objectives listed in the ToR in order to generate a more balanced overall view. This revised version was then submitted to Sida and the PMO on 12th April 2013 and discussed during the TAC meeting in Kigali 22-23 April. This final revised version of the report is based on discussions with TAC and further feedback from Sida and the PMO, and was submitted to the PMO on 30th April 2013.

We note from the minutes of the 15th November 2012 Sida-ILRI-BIP annual review meeting that "The results of the Mid-term review process will impact on the funds disbursement for the second half of the Program and beyond". Where appropriate, we have attempted to provide recommendations that we believe will be useful to the TAC and the PMO in this context. We also note from the same document "Mid-term report to be used as a selling point for the Program to the donor community". We have made no attempt to address this issue as we feel it would compromise the nature of the report. We recommend that the PMO arrange for an extraction of key conclusions and recommendations from the final MTR report, which can be collated and crafted into a brief standalone document for this purpose.

The PMO provided electronic copies of the consortium project progress reports July-Dec 2012, the project results summaries, and the report on the Bio-Innovate Africa Regional Scientific Conference on the 5th April 2013. Due to time constraints associated with restructuring and augmenting the report, we were unable to systematically review these documents and integrate findings into our final report. However, it is clear that the conference report contains a series of valuable recommendations and insights that were generated during the course of the break-out sessions. Many of these are also reflected in this MTR report. We recommend that the PMO arrange for

a consensus list of conclusions and recommendations to be generated from the conference report and the MTR report.

2 Program Achievements and Challenges

OVERVIEW

The design of the BI program was a bold and innovative attempt to bridge the gap between research outputs and uptake of innovations, and is firmly rooted in a commitment to sustainable development. The implementation of the program has clearly required a cultural realignment and the development of new methodologies for the various consortia. Much credit is due to the PMO and the BIP community for their achievements to date in this transition.

The program has built a vibrant community of highly committed, dedicated and hard working individuals across the PMO and the TAC, and in several of the CPs. We recognize the magnitude of the step change from Bio-EARN to Bio-Innovate and we acknowledge the substantial changes that the CP communities have already adapted to. We also recognize the vision and hard work on the part of the PMO, leading to the various systems of checks and balances that have been implemented.

In the first part of this section we evaluate the achievements of the Bio-Innovate program against its stated vision, mission and strategic goal statements:

VISION

To develop into a Program of excellence that contributes to sustainable and integrated utilization of bio-resources for economic growth and development of Eastern Africa.

The BIP is a bold attempt by Sweden through Sida to push the boundaries of its operational envelope in order to build on its investments in bioscience research in Eastern Africa and achieve a new scale and intensity of impact. The BIP proposal authors, the PMO and the TAC deserve great credit for conceptualizing this very ambitious program and creating a ground breaking initiative that has the potential to achieve sustainable and scalable impact across the region.

There are positive indications of movement towards the goals of the stated vision, particularly the development of the networks and the building of a foundation for various product development pipelines. It will only be possible to quantify impact on *'economic growth and development'* a number of years after the end of the current phase, but the potential to achieve this vision is clearly being established.

In order to accelerate this transition process, the BIP needs to be provide more explicit detail about what it wants to achieve, and to be much clearer about the niche it

wants to occupy. The BIP vision (and similarly the mission and strategic goal) are perfectly adequate for a general high level development audience. However, they do not clarify the fundamental components of innovation systems that the BIP aspires to foster in order to achieve the defined outcomes, including the mechanisms that it *will* versus *will not* deploy to achieve its goals. From an image perspective, this is what distinguishes it from other initiatives in the agricultural development domain, and making a strong statement and reinforcing this through repeated use is a good pathway to ensuring that individual projects stay aligned to the BIP principles. These operational principles are critical to link the high-level vision statement to individual project workplans, must be strongly communicated internally, and the consortia must understand that it is their responsibility to use BIP funds to further the core mission and support the vision. The mission and strategic goal statements are too general to serve this purpose. We recommend that the PMO develop a key pillars or fundamental principles statement to bridge the gap between the BIP vision (mission and strategic goal) and the aspirations of individual BIP projects. The Grow Africa program being coordinated by the World Economic Forum with AU-NEPAD provides a good example of how this can be done. In this way, the BIP can establish the criteria for assessing delivery against its vision, which should also help the project consortia better understand what is expected from them.

MISSION

To create and promote bio-resource based innovation systems in Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda for sustainable utilization and integration of the innovations into Eastern Africa's development processes.

At the February 2013 Bio-Innovate conference, Jane Morris, in her plenary speech, reminded us of the importance of a common understanding of terminology. We consider that the development community is using the 'innovation systems' terminology in a diverse range of ways, that the term has lost its clarity and its use has become ambiguous. For this reason, we wish to define an appropriate usage of *innovation system*[1] in the context of the BIP, discuss how this term will be used in this report and how that definition provides a useful operational framework for the critical success factors that the BIP need to address in every project. We believe that creating an effective innovation system as defined below is the essential prerequisite for BIP projects to move on to establishing effective pathways to impact in the next phase.

[1] Wikipedia, 5 April 2013

Innovation[1], means the development of new values based on solutions that meet new requirements, through more effective products, processes, services, technologies or ideas that are readily available to markets, governments and society. The BIP mission is squarely aligned with this definition as its overarching basis for achieving impact by delivering new bioscience-based technologies through a range of "delivery agents", the private sector, NGOs, governments and international development projects.

As Jane Morris underlined, innovation can involve adoption, refinement and modification of existing technologies; it does not necessarily need to be new technology and may focus on the translation of technologies developed elsewhere. Moreover, it does not need to be based on scientific breakthroughs; it may rely on technical or logistical advances or even a novel arrangement or interaction of products or processes. The BIP portfolio of projects is entirely consistent with this broad-based definition, and as such the novelty of science in the projects is of secondary concern; it is the *depth* of innovation that is critically important.

The definition of *Innovation System* in the BIP proposal is too general and leaves too many critical elements unstated, particularly the nature of the interaction between different actors in the system. **Innovation System**[1] describes the interaction between the actors who are needed in order to turn an idea into a process, product or service on the market. Here the critical issue is the need for *interaction* between all players in the system throughout the design and refinement process. It is important to recognize that high quality partnerships within innovation systems are very important, irrespective of the nature of the ultimate product deployment agent: public or private, formal or informal. Moreover, that these relationships must be in place from the product design phase, if critically important market-driven factors are to have a chance of influencing the nature of the product. This is probably the most critical flaw in the design of many projects led by the development community, and fundamentally influences the probability of achieving sustainable and scalable impact.

In order, therefore, for BIP to transform the current project portfolio into an innovation platform, or to create discrete innovation systems at the project level, the **quality, depth and "intensity" of interaction** between the technology developers and product delivery agents needs to be improved. The Kenya component of the P3 Beans project is probably the best example within the BIP of an emerging innovation system, but even this is still at an early stage in its development, and much remains to be done to replicate this at a regional level. For a good example of a comprehensive innovation system within the African agriculture arena that is being replicated across countries, please see the mobile cassava processing case study described in the P2 Clonals section in Appendix A.

Some of the projects have already made tangible steps towards delivering on the BIP mission, while others clearly hold potential to do so. Assessing the extent to which the program has achieved *'sustainable utilization and integration … into … develop-*

ment processes' may only be possible a decade after the end of the current phase. Nevertheless, the program is clearly making solid efforts to move towards its stated mission, which we believe is best evaluated in terms of the quality of the innovation systems being established in each BIP project. Only through high quality innovation systems will the BIP projects be able to develop technology packages which simultaneously address the three key dimensions of success: what is possible with the technology, what is desirable to the end-user, what is viable in the market.

STRATEGIC GOAL

Eastern Africa bioscience innovation systems mobilized and deployed to harness bioresources, thereby promoting socio-economic development of the region.

The conceptual basis of the design and implementation of the program certainly has the potential to deliver on this overarching goal. Most of the consortia have made important cultural changes in their operational practices that provide an essential foundation for the program to achieve its stated strategic goal. However, as with the other high level statements, measurement of tangible impact on *'socio-economic development'* will have to wait several years. The program has indeed started to build a solid foundation, and if the recommendations contained in this MTR are adopted, the breadth and depth of impact reflected in the strategic goal can, over time, be achieved. However, this will require the establishment of a systemic culture of learning and sharing within and amongst the consortia. This is essential for the success of individual projects but also a critical prerequisite for the BIP to deliver on its aspiration to become a regional innovation platform. The BIP has established an excellent model for bridging the gap between research outputs and impact. However, this will only have significant broader value across the region if the PMO can establish a strong culture of learning from failure and translate that learning into positive action. Once the BIP communities have routinely achieved this cultural transition they will have the confidence to share these lessons more broadly and establish a virtuous cycle with parallel initiatives across the region. This is the single most important tangible indicator for the BIP having established an effective **regional innovation platform**.

In the next part of this section we evaluate the performance of the BIP in terms of five key criteria defined in the ToR for the MTR: relevance, effectiveness, efficiency, impact and sustainability:

RELEVANCE

The Bio-Innovate Program was created through a demand driven approach

The BIP goals and objectives align well within all four pillars of the CAADP agenda, particularly in the context of CAADP's former alliance with DfID's Research into Use (RIU) program. Similarly, the BIP supports all nine focus areas of the AU-NEPAD Science and Technology Consolidated Plan of Action.

Historically, public research, especially in crop development, has been able to create new products that can serve the needs of small farm communities and contribute to increasing food security across the region. Many of these products have, however, failed to have sustainable and scalable impact and this has mainly been because of the inability of the research community to forge strong and viable partnerships with private sector entities that have the distribution chains needed to move these products. In this respect, BIP's focus on delivering research outputs to end-users is highly relevant, but the cultural changes required have only just started, and it is unrealistic to expect rapid results. P5 Water and P3 Beans have made strong starts and have both laid solid foundations for creating the kind of cross sector relationships that other projects must aspire to.

The program's ultimate vision is that private sector partnerships are critical to achieving the level of technology development and transfer desired. This is grounded in proven research about how both innovation and markets work. Two of the consortia (P5 Water, P3 Beans) have built strong private sector partnerships, but several consortia have only been able to develop very weak relationships with their PS partners. The PMO has had other priorities and was not in a position to engage in an "educational" program on PPPs with the CPLs, but this is an important consideration for the next phase. There are ample opportunities in the region for the creation of these partnerships, and BIP can now consider how to educate the PS about the opportunities (so that the science community does not have to take all the initiative), and reorient the science community on how to engage effectively with private sector partners.

EFFECTIVENESS - PROJECT AND PROGRAM DEVELOPMENT

BIP clearly invested considerable effort in designing the project development pipeline and in building the systems necessary to process promising concepts. This process consisted of a series of deliberate steps which can be summarized as follows:

- call for concept notes which clearly indicated the parameters, the need to engage with private sector partners and target regional impact;
- external review by experts;
- feedback to promising consortia;
- full proposal development;
- feedback and advice from the TAC;
- deliberation on final project selection.

This process was scientific and was designed and executed with the intention of only funding those projects which supported one of the two themes and showed a high probability of achieving targeted program goals.

The individual project analyses (Section 3) reveal, however, a series of challenges and setbacks which suggest that there was a flaw or shortcoming in the selection process. After careful analysis we have concluded that there are two key reasons for this disconnect:

• there was virtually no input or feedback from any entrepreneurs (or individuals working in business) as the selection process evolved;
• there was a lack of foresight that *in practice* it would be the CPL who was in charge, and that a CPL with passion for the project and strong leadership skills could improve the success rate significantly.

Both of these issues can be addressed in the next phase, and increased entrepreneurial input during the remainder of this phase can probably help to rectify many of the challenges that individual projects are experiencing.

EFFECTIVENESS - PROJECT AND PROGRAM IMPLEMENTATION

The PMO has a clear Program Management structure with defined roles and responsibilities, including a detail SOP Manual. We note in the minutes of the Sida-ILRI-BIP Annual Review Meeting (26 May 2011) that "ILRI-Sida is the decision-making arm of the BIP. The TAC makes recommendations to the Program and advises the management partner, while the PMO is the implementing arm of the BIP." We understand that the annual ILRI-Sida-BIP meetings were designed to serve the role that might otherwise have been filled by a governing board. However, these meetings (and their Annual Planning Meeting counter-parts in January and November 2011) appear to have been dominated by management, audit and administrative issues. Consequently, there appears to have been insufficient available time for ILRI to provide the type of leadership role that might have been envisaged by the original architects of this arrangement. Most importantly, these meetings do not appear to have been able to provide the type of guidance on strategic leadership issues that the BIP clearly needed and would continue to benefit from. We recommend that the BIP reporting line within ILRI be to a senior manager with business expertise who can commit at least 10% of his/her time to providing day-to-day oversight and guidance to the BIP manager. Only in this way can the current annual meetings of the ILRI-Sida-BIP group become an effective governance structure. If a senior ILRI manager cannot make this level of commitment then we recommend that ILRI contract-in this role through a special-assistant to the DG.

Over the short course of this review we have observed that the PMO consists of a small group of extremely dedicated, highly organized and hard-working people. However, their agenda seems to have been all too often overflowing with "system maintenance" activities. By this we mean managing relationships with the CPLs, processing various reports, coordinating M&E processes and organizing conferences, as well as an increasing amount of accounting, procurement and financial management tasks. Although much of this work is reactive, the PMO has been able to take remedial action by, for example, addressing the procurement challenge and launching workshops to provide specialized training when a need for that was identified. The increasing range of activities falling to the PMO, as well as additional activities proposed for them by the TAC or assigned to them by the ILRI-Sida annual meetings, appears to have become increasingly disproportional to their critical mass.

Consequently the focus of the PMO has been largely administrative, leaving insufficient time for strategic leadership and directive management. We believe that this administrative focus, necessitated by circumstances, has been to the detriment of the individual projects and that there has been a loss of hierarchy from the PMO through the CPL to the project partners. Maintaining an effective line of command takes a lot of time and energy, which the PMO has often lacked. This has been exacerbated by the limited time availability and/or management skills of some of the CPLs. We recommend that in future all CPLs should undertake tailored management training and orientation to ensure they have the necessary skills as well as a full understanding of the expectations associated with their responsibilities.

The TAC has invested a substantial amount of time in facilitating the design and implementation of the program and helping the projects become successful. This has resulted in a steady expansion of the role of the TAC, perhaps partly as a response to the gap in delivery of PMO management and ILRI oversight and leadership roles. We recommend that these gaps be filled by scaling-up critical mass at the PMO and ILRI levels in order that the TAC can focus attention on their core roles: providing technical oversight to the BIP through advising the PMO on technical and strategic issues. These include keeping the BIP in alignment with its mission, core objectives and guiding principles, as well as ensuring that funding decisions are consistent with core program principles (e.g., development of strong relationships with product delivery agents). The TAC should play a key role in ensuring that projects do not drift out of alignment with the program mission (e.g., regional impact), while providing guidance on the use of the carrots and sticks of grant-making to enforce the improvement or termination of underperforming projects.

In many instances reviewers, TAC members and the PMO have given tough feedback regarding specific projects. This has not always translated into action, and it has been difficult to determine whether this failure is due to lack of follow through by the PMO and/or CPL, or to the reluctance of project partners to make the necessary corrections. The PMO and the ILRI-Sida leadership should take action to correct this as it is eroding the effectiveness of the BIP governance and management system. The community must see that the PMO is acknowledging effective teams and taking tough action on failing teams. For a grant making body like the BIP, the provision of additional funding to high performance teams and the holding back of funding for poorly performing teams is undoubtedly the strongest mechanism that the program has under its control. The BIP must leverage this opportunity for driving projects in the appropriate direction.

If a project has stalled or has a flawed design, the PMO must help the CPL to implement a rapid resolution. Conversely, TAC recommendations should, when and where appropriate, be communicated with urgency and a response from the CPL should be required within a short time period. The consortia must understand that there is no room for complacency and that there will be serious repercussions for inaction.

As the BIP projects enter their final year of supported activity, we urge the ILRI-Sida leadership, the TAC and the PMO to each focus on their respective core responsibilities. This may require the PMO to recruit additional administrators and contract entrepreneurial expertise. The TAC membership should be adjusted to include significant entrepreneurial and business expertise, and ILRI should make a definitive commitment to providing business-orientated leadership. In addition, the PMO must develop an effective mechanism for ensuring the functionality of all CPLs. Establishing and refining these skill bases during the next year will provide a critically important foundation for the new challenges and transitions expected for the next phase of the BIP.

EFFICIENCY

Swedish funding through Sida aspired to launch a program that would be extremely efficient in terms of resource mobilization and achievement of goals. However, even private sector initiatives to create new structures are often dogged by problems, and conventional wisdom indicates that to translate a new design into an efficient and practical operational system takes both time and conscious ongoing evaluation. BIP is a new iteration, through Sida, of Sweden's underlying philosophy and represents a significant step forward from Bio-EARN. There are, and have been, inefficiences especially around communication. But the PMO is aware of this, and we have offered a number of recommendations which, if implemented, can help the PMO increase the overall efficiency of the program.

IMPACT

Performance of the BIP in this area has been discussed in the above sections on performance against the vision, mission and strategic objective statements.

Clearly BIP projects may have impacts on institutional, human, social and environmental parameters as well as on economic and commercial success factors.

The underlying goal of effectively linking research and development to markets accomplishes many subsidiary benefits including economic development and increased employment. P3 Beans has already had limited impact in this respect, and P5 Water shows tremendous promise. Other projects have great potential to achieve this goal, and if our recommendations are accepted, the probability of success will increase.

"Impact" is relative, and while neither the program nor any of the projects have yet had impact across the region consistent with BIP goals, we will again reference the need to view this as a process that develops slowly over time. The P5 Water pilots, and especially Modjo (which has been visited by the Prime Minister of Ethiopia) have had real impact on national dialogs about clean water and on other industrial polluters, and these are significant achievements. P3 Beans has demonstrated an exemplary model for both market-driven research and public-private sector collaboration which can be used to inspire and motivate other projects. It is noteworthy that this project is

also addressing the priority needs of rural development, based on delivery of tailored products through the informal seed sector.

SUSTAINABILITY

The Bio-Innovate Program is focused on driving research into use (RIU). The emphasis is on supporting scientists with novel research outputs that have the potential to be out-and up-scaled for wider regional impacts, including the creation of viable commercial products and services via business incubation in the next phase of the program.

New products and processes that satisfy an unmet demand and which can be developed and marketed in close collaboration with the appropriate delivery agents (business, government, NGOs) will achieve a high level of sustainability, especially if feedback processes are in place to enable researchers to refine innovations so that there is a better match between the supply (of products) and a specific end user need. The recommendations offered in the project analysis section will, if adopted, help the program and the projects move gradually towards a high level of sustainability.

In the final part of this section we expand on three other issues that are referenced above and which impact several aspects of the program and its ability to achieve the core objectives, as follows:

LEADERSHIP

In our interviews and analysis we have paid special attention to leadership because the BIP process seemed to assume that the CPL would, in addition to having the scientific and research skills required to deliver, also have the leadership skills necessary to manage a transnational project with many actors. P3 Beans and P5 Water emerge as the two BIP projects that are the most successful relative to both program and project goals, and the CPLs of both projects display exemplary leadership skills. This suggests that - were the current phase to be repeated - the TAC would be well advised to determine whether a putative CPL did have the skill set required to lead and manage the proposed project. Other CPLs allowed their projects to "drift", failed to build a strong communication link between the various partners, or allowed bureaucratic processes to stall progress.

ENTREPRENEURSHIP

The consortia are dominated by academics, and it is unreasonable to expect that they can also assume the roles of multi-sector project managers and entrepreneurs in such a short time. The absence of entrepreneurial expertise at all levels of the program has created a cascade of problems. We recommend that the TAC adds two members with entrepreneurial experience as soon as possible. In addition, if ILRI can not provide business-orientated leadership for the BIP, then we recommend that the PMO recruit an in-house ‘entrepreneur at large’ who would be mandated to assist any component or level of the program.

The program must become more "entrepreneurial" at all levels and it should develop the ability to strategize from an inter-disciplinary perspective that covers science, innovation and commercialization. To achieve this in time to significantly influence the outcomes of current projects will require a substantial injection of consultants and/or new team members with the necessary varied skillsets.

In the next phase the program will require a far greater involvement with PS actors across the region, and the composition of the PMO, TAC and consortia will need to be adjusted accordingly.

PRIVATE SECTOR FUNDING

Only one PS partner (P5) has made a cash contribution to their respective project, representing around 30% of the capital investment in pilot facilities at their site (see Table 4). It is a cause for concern that the other two PS partners in other countries within this project have not made any cash contribution. Given the large investments in pilot facilities at private sector sites, we believe that CPLs should have leveraged the BIP investments and negotiated for more appropriate cash contributions, particularly in P4 and P5. We recommend that the TAC and PMO develop a policy on this issue to guide negotiations with PS partners in the next phase of the program, and negotiators with relevant experience should be engaged to ensure that balanced deals are concluded.

In contrast, many PS partners have shown substantial levels of in-kind contributions, although about 30% of this is attributed to estimated costs of land used for the pilot facilities (see Table 4). Some of these land cost estimates appear to be inappropriate given the nature of respective projects (P2 and P3), or relate to land not owned by the PS partner (City Abattoir Traders in P5 and Lisha Products in P6), while many of the remainder lack credibility (in terms of the accuracy and/or precision of calculation). We do not believe that this is credible data on which to base a discussion. Moreover, we question the concept of using such costs in the assessing the PS partner contributions to these projects.

Most of the private sector partners have listed in-kind contributions associated with supplies and services (see Table 4). Some of these relate to parallel project activities funded by other donors (P2), which is quite acceptable as long as transparently declared. Others appear to lack credibility (in terms of the accuracy and /or precision of calculation); for example, it is not credible that the contribution from three different PS partners in three different countries could be the same (P4). Nevertheless, we feel sure that there is tangible in-kind value being brought to the projects by many of the private sector partners, which is definitely a step in the right direction. However, the PMO must require CPLs to follow a much more stringent process in calculating these costs. We recommend that the TAC and PMO develop a policy on this issue after surveying best practices amongst social investors and venture capitalists.

Finally, several PS partners have received BIP grant funds to carry out specific activities. In most cases these are of a similar magnitude to the stated in-kind contribution for services (see Table 4). If in these cases the in-kind land costs are removed, and it is assumed the in-kind services costs are substantially inflated, then most of the PS partners in these projects (P6 and P7) can not be considered to be making significant net contributions to projects from which they are gaining significant potential financial gain. We recommend that the TAC and PMO develop a policy on this issue to guide negotiations with PS partners in the next phase of the program, and negotiators with relevant experience should be engaged to ensure that balanced deals are concluded.

Table 4. Overview of private sector partner funding (UD$ '000) for a selection of companies where data are available.

		Private Sector Contribution				Grant from Project	
Company Name		**In cash**	**In-kind Land**	**In-kind Services**	**Total**	**PS Activity**	**Pilot Facilities***
Bio-Crops	P2	-	55	245	300	-	9
Trufoods	P3	-	-	75	75	13	-
Kilifi Plantations	P4	-	50	100	150	-	105
Coffee Plantations Development	P4	-	50	100	150	-	177
Mohammed Enterprises	P4	-	50	100	150	-	113
Banana Investment	P5	150	80	220	450	-	355
Modjo Tannery	P5	-	50	100	150	-	101
City Abbatoir Traders	P5	-	30	55	85	-	169
Lisha Products	P6	-	25	25	50	20	-
Morogoro Ben's Winery	P6	-	25	35	60	20	-
Adilo Complementary Foods	P6	-	30	30	60	20	-
Real IPM	P7	-	50	99	149	45	-
Alpha Seed	P7	-	45	74	119	44	-
Total		**150**	**540**	**1,258**	**1,948**	**162**	**1,029**

*including equipment (excluding $447,500 ear-marked for equipment purchases by P8)

ILRI HOSTING

ILRI hosting has clearly provided a critical level of back-office credibility and support to BIP. However, Sida's aspirations for the extent of added value that this relationship would bring have clearly not materialized, particularly in terms of management and leadership. This is probably due, in large part, to divergent missions and an absence of mutually agreed-upon objectives and milestones. In addition, the reviewers have found no evidence that ILRI has made any efforts to develop new funding streams for the BIP.

We recommend that a more detailed hosting agreement is negotiated for the next phase of the program, including specific details on issues such as provision of advice on leadership of innovation systems, maximizing synergy with other programs and organizations on the ILRI campus, and efforts to raise parallel funding. As mentioned in the Effectiveness section above, we believe that ILRI must provide routine senior level management oversight and guidance to the BIP manager in order for the ILRI-Sida-BIP team to evolve into an effective governance structure. If ILRI is not willing or able to provide such a commitment through internal or contracted expertise, then we recommend that the next phase of the BIP should establish its own governing board.

In addition, the BIP should proactively seek opportunities to enhance its interaction with ILRI during the remainder of the current phase. For example, the Uganda component of the P5 Water project has direct relevance to ILRI's research agenda, and the livestock sector clearly has a strong interest in clean water. We suggest that BIP provide a monthly one-page status report to ILRI's DG regarding progress in current and future activities that may be relevant to livestock systems.

RELATIONSHIP WITH NEPAD

Although Sida had hoped that the relationship with NEPAD would yield new sources of funding, the reviewers have found no evidence that NEPAD has made any efforts to develop new funding streams for the BIP. Although alignment with NEPAD priorities, and a close working relationship between BIP and NEPAD will lead to indirect benefits, NEPAD is not in a position to develop new funding streams for the BIP. We recommend that the PMO works with the NEPAD representative on the TAC to establish a functional partnership between the BIP and the Grow Africa initiative, led by the World Economic Forum with AU-NEPAD. G8 governments and companies working in Africa have pledged $20 billion to Grow Africa, which shares many aspirations with the BIP. It is likely that there are other NEPAD initiatives (pre-existing or likely to emerge in the near future) that offer BIP similar opportunities, and the PMO must be proactive and entrepreneurial in exploiting its linkages with NEPAD to help build partnerships as appropriate with other NEPAD supported programs.

COLLABORATION WITH OTHER INITIATIVES AND ORGANIZATIONS IN THE REGION

There are many other initiatives and organizations that overlap with the BIP mission including BecA, AATF, AGRA, ICIPE, IFDC and the CGIAR, to name just a few. We recommend that the PMO attempts to build programmatic alliances with funding initiatives such as AGRA and the new CGIAR-CRPs, while encouraging and assisting specific projects to build project-based alliances, for example with ICIPE (P1 and P7) and IFDC (P1 and P2).

Capturing synergy between the BIP and BecA has clearly been well below expectations. This is in part due to the desire of national programs to establish their own facilities for bio-science research. This type of capacity building has clearly been a high priority for the Bio-EARN and, to a lesser extent, the BIP. However, it is not just access to facilities that BecA offers, but also access to critical expertise, which could bring significant added value to the design of new research projects and the trouble-shooting of on-going research activities in, for example, P1 and P2. We recommend that a strategic alliance agreement is developed between BIP and BecA, to ensure ready access to their scientific expertise. In return, BIP can offer BecA access to important downstream expertise to help BecA build appropriate partnerships. This can support BecA to better orientate the design of their research projects and strengthen both their innovation systems and pathways to impact.

In the next phase we recommend that the BIP evolves to a more pragmatic model of funding research activities that encourages partners to design their projects in ways that emphasize financial efficiency, pace of outputs, and maximum access to public sector expertise. In this scenario, BecA will have increasingly valuable offerings for future consortia. In turn, the BIP can offer important insights into market-driven design of research activities, which would greatly enhance BecA research activities. The mutual synergy between BIP and BecA may also provide fertile ground for joint fund raising activities.

3 Project Achievements and Challenges

In this section we provide an in-depth evaluation of each of the nine projects. Please note that there is additional detailed analysis of certain projects in Appendix A. The MTR ToR provided five evaluation criteria for assessment of the projects.

We have scored the performance of each project across these five criteria, on a scale from 0 (lowest) to 10 (highest) in two dimensions. **Current**: projection to the end of this phase based on current observation and continuation of current methodologies. **Future**: projection of potential based on current observation, acceptance of and action on all recommendations, and continuation into next phase of BIP (data not shown). These scores were derived through aggregating individual scores from evaluation of the following components of the five evaluation criteria (paraphrased from ToR evaluation criteria 3.1 to 3.5):

Relevance: (i) Alignment with national and regional development priorities;
(ii) Appropriateness of project design to serve target development goals

Effectiveness: (i) Probability of impact; (ii) Degree of attribution to project;
(iii) Quality of implementation; (iv) PMO effect; (v) Probability of regional impact;
(vi) institutional gains

Efficiency: (i) Management; (ii) Alignment with SOPs; (iii) Technical backstopping,
(iv) Financial efficiency; (v) Output delivery; (vi) Budget appropriateness

Impact: (i) Long-term impact; (ii) Stakeholder perception,
(iii) Institutional strengthening

Sustainability: (i) Sustainability plan; (ii) Ownership outside the public academic partners; (iii) Alignment with NEPAD; (iv) Info exchange outside the BIP;
(v) Network sustainability

Taking a simple average across the scores from each of these criteria (data not shown) suggests that the projects can be clustered into three distinct groups based on performance against these criteria (see Table 3), as follows:

Table 3. Current and potential performance of the nine BIP projects based on aggregation of scores across five evaluation criteria: relevance, effectiveness, efficiency, impact and sustainability.

Current Performance		Potential Performance	
Good	P3 Beans P5 Water P7 Bio-Control	P3 Beans P5 Water P7 Bio-Control	**Excellent**
Variable	P1 Grains P4 Waste	P1 Grains, P2 Clonals P4 Waste, P6 Add-value P8 Enzymes, P9 Policy	**Good**
Sub-optimal	P2 Clonals, P6 Add-value P8 Enzymes, P9 Policy		

Table 3 reflects the probability of each project creating an effective innovation system during the life of the project that has the potential to achieve sustainable and scalable impact in the next phase. This is as far as it is acceptable to take this type of quantitative analysis and, in reality, each of the projects differ so significantly in many areas that it is quite subjective to apply a standardized scoring system. However, we are comfortable with the conclusions drawn from the aggregated scores. Nevertheless, we feel that a qualitative assessment provides much greater depth of analysis.

In the project reviews below, we provide a narrtive of the key issues highlighted by our analysis. Further analysis appears in Appendix A for selected projects.

3.1 P1 GRAINS

Project 1: *Delivering New Sorghum and Finger Millet Innovations for Food Security and Improving Livelihoods in Eastern Africa*

The justifications for research and crop improvement efforts on sorghum and millets are well established. There are clearly many constraints to production for such efforts to focus on, and the local germplasm of these crops in East Africa offers a promising pool of genetic variation to enhance these traits. The targets of this project are high priority within a development-based demand-driven agenda. However, the consortium is in danger of becoming largely technology-driven in its strategic planning, both in terms of new technologies for breeding programs and new varieties for farmers. We fully understand that the funding decision relating to this CP was largely driven by an eagerness to progress research and product development activities initiated through the Bio-EARN program. In this context, success in national variety release trials and validation of new breeding tools should be the target indicators for the intermediate products generated by this project. However, to increase the probability that these outputs will go on to achieve sustainable and scalable impact, the design

and internal review of the project must include the perspectives of public and private sector delivery agents.

The level of collaboration across countries in this project regarding germplasm development has been very limited, resulting in largely parallel outcomes. This is an unfortunate missed opportunity to achieve regional synergy in product development in-line with BIP aspirations. Although this might be due to factors beyond the control of the project partners, the TAC and PMO should have foreseen this potential problem and requested the P9 BIPCEA team to establish a dialogue with relevant ministries and launch advocacy activities. Moreover, similar challenges have been faced (and overcome) by other BIP projects, for example P3 Beans. The P9 BIPCEA team can play an important role in cross-project learning in this type of situation.

We understand that the P1 Grains project resulted from a joint decision by the TAC and PMO to ask five teams (who had submitted five separate competitive concept notes) to formulate a single joint proposal. The intentions of the reviewers, TAC and PMO during the formulation of this project were clearly laudable attempts to capture synergy and maximize funding efficiency. However, these aspirations did not materialize during project implementation, and the consortium has struggled to form a cohesive team approach. Although all groups were working in the same thematic area with similar broad goals (of developing improved varieties), they were not able to articulate a unifying delivery pathway connecting the diverse elements of the project. Consequently, the marker and diversity activities in particular remained highly disconnected from breeding pipeline activities. This is an important lesson for the BIP, as it highlights the constraints of a competitive funding process, the pivotal role of CPLs, and the limited power of the PMO to influence team dynamics.

Although the scientific challenges being addressed by this project are in themselves well justified, there are too many goals that are too ambitious and too diversified. Moreover, we have serious concerns regarding some of the experimental designs being used for mapping complex traits such as drought tolerance, which appear to be based on designs led by limited time availability rather than current best practices.

The national breeding programs are all highly experienced in developing new varieties and processing these through their national variety registration process. However, in P1 the pathway for research outputs to be adopted by a given breeding program seem too distant and undefined. There appears to be insufficient end-user orientation framing the biotech research strategies, creating concerns about the likelihood of adoption of the new tools from this research by sorghum and finger millet breeders in the region. This creates uncertainty regarding the likelihood that the research outputs will achieve significant impact on crop improvement in the near-term. Although the nature of this project precludes judgment of impact of new variety products, nevertheless there remains an important need for the development of intermediate products (breeding technologies) to be well orientated by the end-users (the breeders). This includes prior establishment of breeding populations for validating the power of se-

lection of candidate markers, prior establishment of breeding strategies for using diversity analysis results, and detailed cost-benefit analysis of developing and using such information.

The selection and breeding activities of this project are progressing well, although there appear to be too many diversified breeding targets. However, the pathway to impact for this material does not appear to be well designed for sustainable and scalable impact on a regional level. The direct farmer contact model through on-farm variety selection is a good way of obtaining feedback from the 'market'. However, there is insufficient detail on the proposed scale-up plan. We recommend that the P1 team liaise with the P3 Beans team in order to learn from their successes with coordinating networks of NGOs in order to reach hundreds of thousands of farmers. Nevertheless, this type of process has a constant and growing transaction cost. Given the nature of the BIP program, we recommend that P1 establish strong partnerships with private seed companies in target countries in order to design an effective pathway to commercialization for their material.

For the benefit of the consortium partners, the TAC and the PMO, we include a more comprehensive analysis of the technical aspects of the project in Appendix A. In this appendix we also discuss the potential of the biocontrol of sorghum chaffer, which we feel would benefit from closer proximity to scientists and businesses in allied areas in the P7 Bio-control project. The pest control technology is showing excellent potential in terms of scientific proof-of-concept (demonstrated control of the target pest), but significant work remains to carried out on the pathway to impact. Although national and international development agencies can assist with intermediate scale-up, it is unlikely that sustainable and scalable impact can be achieved without establishing a strong pathway to commercialization. An economic analysis of the product and the farmers' inclination to pay for it should be carried out as a priority, and we recommend that this is done under the guidance of Real-IPM, who can bring great expertise and experience to the process.

3.2 P2 CLONALS

Project 2: *Enhancing Food Security through Improved Seed Systems of Appropriate Varieties of Cassava, Potato and Sweetpotato Resilient to Climate Change in Eastern Africa*

The value of clean planting material of clonal crops has been consistently demonstrated over several decades (increasing yields by up to 100%), and there is a large global community working on optimizing the underlying technologies as well as the development and delivery of materials. Meanwhile, farmer demand and government awareness have been steadily increasing, and the provision of planting materials provides a ready route for introducing new, improved varieties. There are no substantial

scientific questions that need to be addressed in this area, although screen-house-based technologies generally require optimization in each target location, which should be a top priority activity for the public sector partners in the project. Nevertheless, it is clear that the public sector cannot meet the demand from farmers and there is, therefore, real potential to turn informal seed systems into formal ones and thereby scale up the entire delivery process. The private sector is the key to addressing this issue and several parallel projects have been funded to stimulate the production and distribution, including the USAID-funded 3G project (Kenya, Rwanda and Uganda) and Feed the Future project (across the region).

The real challenge is to devise strategies to help the PS create sustainable and scalable businesses that provide ever-increasing quantities of high quality material at lower and lower costs. The P2 Clonals project proposal states, as a primary goal, development and institutionalization of efficient seed multiplication and delivery systems. Undoubtedly this project has made progress in screening and promoting new varieties emerging from the NARS and CGIAR breeding programs. However, there is little evidence that this project has leveraged its funding towards the development of sustainable and scalable systems for uptake of those new varieties. In particular, the project needs to develop tailored and scalable strategies that complement and build on prior and parallel projects in micro-propagation of the three target crops.

The P2 consortium need to build strategies that match the best multiplication rates with technologies appropriate to the infrastructure and partner capabilities in each target situation. For example, the impressive multiplication rates of potato aeroponics are dependent on continuous power supplies and moderate ambient temperatures. For this reason, this technology may only be appropriate for major cities in sub-tropical or high altitude locations, as the electrical costs associated with using fans in these facilities would destroy the financial benefits of the high multiplication rate. Similarly, efforts to identify low cost tissue culture consumables may be insignificant in relation to the costs of electricity for lighting and cooling growth rooms. These are the critical success factors around which a scale-up and scale-out strategy must be built.

Similarly, the high multiplication rates of sweet potato vine propagation are again dependent on moderate ambient temperature, which is impossible to maintain within insect-proof screenhouses in many tropical locations. Alternative screenhouse arrangements require intensive pest management and random virus screening to ensure that the multiplied vines are still free of viruses. Although traditional screenhouse operations could be located in cool areas, the capital cost of such facilities may push the unit costs of planting material beyond what the current market can tolerate, given the much lower market value of sweet potato compared to potato. BIP capital investment might provide pilot facilities to demonstrate the potential of the process, but sustainable and scalable growth will only take place if the underlying economics can be readily adopted by a range of commercial providers. Again, these are the critical success factors around which a scale-up and scale-out strategy must be built.

The situation in cassava seems even more challenging due to low value of the produce and low multiplication rate of the propagation techniques. Nevertheless, linkage to a strong market pull (for example through linkage to SAB/Miller cassava beer processing) could create the necessary dynamic to drive widespread adoption of micro-propagated clean planting material. See Appendix A for further details on the SAB/Miller case study. Although national and international development projects can be a very useful way of helping companies get started in this micro-propagation business, sustainable and scalable growth must be based on a strong and preferably diversified market demand.

Creating sustainable and scalable seed systems requires the active participation of the private sector. The CP is collaborating with private seed companies in the region to produce and multiply planting materials, but only to the extent that current contracts with HarvestPlus, UNSPPA, CIP, IITA and others would have driven anyway. This is a good place to start but we believe that a lack of business expertise has led the consortium to miss the opportunity to develop and initiate a much more aggressive and sustainable scale-up model. The P2 team must develop strategies which will deliver significant outcomes in the near-term that are beyond what could have been achieved by PS partners on their own. We recommend that the P2 CPL be requested to develop a plan that *would* enable the project to move into the next phase, build a strong PPP, and achieve large-scale distribution for large-scale impact on small-scale farmers across the region.

Whatever the outcome of P2, clean planting material remains a promising target for future support by the BIP. For this reason, we recommend that the PMO sponsor a small workshop to bring the consortium together with the leading players in this area (from both the public and private sectors). The PMO should then commission key members of this group to integrate the outcomes from this workshop into the design of a new and different mechanism to stimulate the micro-propagation industry in eastern Africa. We expect that this new design will build on the type of thinking articulated in the USAID-funded CIP-authored roadmap for potato[2]. This might then form the basis of a new proposal for the next phase of BIP.

Most critically, this type of approach would give the BIP the time and opportunity to leverage co-funding from other donors with a long-term commitment in this area, and to articulate a strategy to attract social investors. Once the new design is finalized, the PMO can decide where there are activities that the consortium can carry out over the following 12 months in order to enhance the new plan. It is critical that during this

[2] http://cipotato.org/research/potato-in-east-africa/cip_roadmap-final.pdf

time the P2 team identifies established companies and start-ups across their target countries that can be included in such a future plan. Similarly, the CPL must build bridges to on-going initiatives that will create increasing premium demand for the three target crops. Here the scale of the demand and the associated network of producers will be critical factors for future success. For the benefit of the consortium partners, the TAC and the PMO, we include a more comprehensive analysis of the technical aspects of the project in Appendix A.

3.3 P3 BEANS

Project 3: *Value Added Bean Technologies for Enhancing Food Security, Nutrition, Income and Resilience to cope with Climate Change and Variability Challenges in Eastern Africa*

This project has a very clear and simple overall goal associated with enhancing the development and delivery of canning beans. These varieties have the potential to stimulate the canning industry in Eastern Africa, displace more expensive imported products and build premium markets for local producers.

The bean characteristics most important to the canning industry are water absorption rate and cooking time. Consumers also value varieties that require less cooking time and energy use[3]. Varieties with these characteristics also retain more of their nutrient value.

Performance has been very strong in some areas of this project, but weak in others. Sharing of germplasm for canning traits, for example, has enabled an exemplary level of regional collaboration on plant breeding activities. The project has, however, failed to capture similar gains downstream; linkages to the private sector as well as the strategic management of market drivers both need to be strengthened. The public-private partnership in Kenya has achieved great success, although we believe that this progress would have been made even without BIP intervention, since Trufoods had already reached out to the University of Nairobi (UoN) before the inception of BIP.

We understand that the Kenya team has recently established parallel alliances with Del Monte and Premier Foods, thereby effectively side-stepping any potential problems created by aligning with just one major company. Moreover, parallel breeding

[3] 30-40% less when compared with dried beans

programs have been established to separately feed new material to each company in an attempt to offset any conflict between the companies in the future. This now provides a strong foundation for the consortium to negotiate financial contributions from these private sector partners in order to sustain these breeding programs. In the first instance, the most important target should be to secure funding from the private sector partners to cover the costs of generating an adequate supply of basic seed for the next growing season. We expect that all three companies are financially capable of covering a significant proportion of research and breeding costs incurred by UoN in developing new appropriate varieties. However, it will be enlightening for the consortium to find out the level of value in the bean supply chain and thus the willingness of these companies to share some of their profits with public sector technology providers. We recommend that the consortium contracts a capable negotiator with experience in this sector, in order to drive strong outcomes from negotiations over PS financial contributions.

The match between market demand and value of the new technology in P3 has clearly generated strong momentum in Kenya. It is, therefore, an excellent time for the BIP to attempt to leverage greater added value to the overall program in terms of social impacts for resource-poor bean farmers. We also recommend that P3 (perhaps in collaboration with P9), quickly carry out a case study to highlight this success story to a broader audience as well as analyzing the situation to extract valuable lessons for other projects.

In addition, P3 is pursuing direct farmer contact through a network of NGO delivery agents, and has already reached one third of the target 220,000 farmers. The creation of this network of NGOs has been initiated over the life of the first half of the project, and although the performance of individual NGOs has varied considerably, this level of scale-up is a great success. We recommend that P3 (perhaps in collaboration with P9) carry out an evaluation of the NGOs in the network in order to better understand how to select more effective partners in the future. This study could also look into the feasibility of fostering a start-up company to take over coordination of this network of NGOs. The lessons from these case studies will also be of considerable value to other projects (such as P1 and P2).

Our greatest concern is the project's limited regional impact. It appears that the P3 Beans project has not been able to replicate the successes in Kenya to the benefit of bean value chains in other countries. The public-private partnerships in the other target countries have not yet developed in the same way (see Appendix A for further analysis). Additionally, the project has breeding targets for drought tolerance and disease resistance, as well as research activities aimed at developing molecular breeding tools. Unfortunately, these other activities are largely disconnected from each other and it is unclear whether their outputs will be integrated during the life of the project. The original proposal highlights an intention to convert informal seed systems to formal seed systems, but outside the already well-established value chain in Kenya, the project seems to have failed to define a clear strategy for achieving this.

Given the scale of bean exports from Ethiopia and the strength of associated PS players, it is of concern that the consortium has not been able to create a PS partnership that has the potential to stimulate the bean canning industry in Ethiopia.

The CPL can leverage the strong progress in Kenya to drive parallel progress across the rest of the consortium. We recommend that BIP convene a workshop with key players in bean value chains across the region to reach consensus on priority actions that can be carried out during the next twelve months to stimulate bean packing industries in Ethiopia, Uganda, Rwanda and Tanzania. This action plan would build on the type of thinking articulated in the USAID-funded "Business case for investing in the processing and canning of common beans in Rwanda"[4].

3.4 P4 WASTE

Project 4: *Sustainable Utilization of Agro-industrial Wastes through Integration of Bio-energy and Mushroom Production*

OVERVIEW

Projects to produce biogas and mushrooms from coffee and sisal waste hold tremendous potential for impact at several different levels, especially if they produce fertilizer from the same waste. The concept of growing mushrooms on agricultural waste is at least three decades old. There is a significant body of literature regarding optimization of the process for many diverse substrates globally, including in East Africa using coffee and sisal wastes.

Problems with the Kenya pilot and delays in construction of the pilots in both Tanzania and Ethiopia raise questions about the viability of this project relative to BIP's timetable. A rapid resolution of some of these problems has been inhibited by a lack of communication between the CPL and project partners in Kenya and Ethiopia, and between the CPL and PMO.

[4] http://growafrica.com/wp/wp-content/uploads/2012/04/Rwanda_Beans-Processing-Investment-Case.pdf

If for any reason any of the pilot projects fail to meet the requirements we propose below, we recommend terminating that component of the project.

KENYA

The Kilifi pilot project is located in a drought-prone region and appears unlikely to find a sustainable solution for its need for fresh water to wash the sisal waste. We recommend terminating this component of the project.

Kilifi Plantations, situated on the coast, is using water with high salinity to wash the sisal waste, but to achieve the required throughput it will need to use approximately 5 tonnes of fresh water for each tonne of mushrooms (est. output of 1 tonne/month). Kilifi Plantations is prepared to make an investment of about $30,000 to upgrade its existing fresh water infrastructure to obtain sufficient fresh water to dilute the salinity of the substrate. However, this is unsustainable and inconsistent with both the drought-prone nature of the region and with the underlying philosophy of Sweden's funding through Sida on environmental sustainability. The local team is looking for alternative solutions such as mixing the sisal waste with grass but this approach also suffers from a lack of sustainability within the broader ecosystem context, particularly in a scale-up scenario.

TANZANIA

There appears to be an unmet local and regional demand for mushrooms, but before proceeding with this pilot, we recommend another review of the preliminary economic feasibility study to determine whether there is a credible pathway to impact. The critical path is determining whether this type of project offers a viable return on investment.

The draft *Mushroom Marketing in Tanzania* report is well written and highlights the potential of the project. There appears to be an unmet demand for oyster mushrooms, especially in the urban areas and in Tanzania's hotel and restaurant industries, and there is a growing regional demand for both frozen and canned mushrooms. The report has made a number of recommendations that can be integrated into a future business plan; these include training, obtaining high quality spores for inoculating new batches of mushrooms for cultivation, and increasing consumer awareness of the nutritional benefits of mushrooms. However, there appear to be some flaws in the underlying analysis that potentially invalidate these conclusions. We have suggested to the CPL that the consultant review all calculations. This meta-analysis will enable the CPL, TAC and PMO to determine, in principle, the viability of the overall business case for this pilot.

Assuming that the decision is made to move forward with the pilot project, we recommend:

• Granting the Tanzania team a no-cost extension through the first quarter of 2014, which would include providing adequate funds for the consortium to contract external expertise to facilitate the timely development of a high quality business plan;

• Ensuring that the pilot generate six months of operational data before the end of the project;

• Starting construction of the pilot facility in April and completing construction in July 2013, assuming such a timeline is consistent with the construction contracts as executed or amended (the MoU between UDSM and Mohammed Enterprises has been executed, as have the construction contracts);

• Tasking the CPL to investigate contracting with a large processor and/or supermarket chain to streamline marketing and maximize returns; and

• Providing the Tanzania team with all possible human and financial support to fast-track getting their pilot fully operational as quickly as possible. This may neccessitate some additional funding support.

ETHIOPIA

We believe that mushroom cultivation using coffee waste in Ethiopa should be viable and that this pilot project appears on track to be successful. However, given the problems with the other two pilots that comprise this project, we recommend that the PMO require the CPL to provide monthly progress reports. We also recommend:

• Tasking Dr. Assefa to deliver, as soon as possible, a short overview of the mushroom market in Ethiopia and a one-page grid showing the cost of the facility and the anticipated revenue streams, as a precursor to a full economic analysis, and

• Granting a no-cost extension through the first quarter of 2014.

Based on our interview with Dr. Assefa, we understand that the MoU with Coffee Plantations Development Enterprise has been executed; that negotiations with the contractor are well advanced and that construction will have started by the end of March; that lab tests have shown that coffee waste is indeed a viable substrate; and that there are no unresolved challenges to the project at this time. Based on this information and reports of successful mushroom cultivation on coffee waste elsewhere, including Brazil, Mexico and India, we believe that production in Ethiopia should be feasible.

The following recommendations apply to all three pilots:

CONSORTIUM PROJECT LEADER (CPL)

The CPL has not been taking a leadership role, and is now aware of this. Ongoing personal problems may have distracted her, and she was recently out of the country for three months. We anticipate that she will assume this role from now forward, and will aggressively pursue resolution on all fronts. However, we recommend that the PMO carefully monitor and manage this situation.

ECONOMIC ANALYSES

A variety of factors determine mushroom growers' income (e.g., season and market size) but it appears that growers generate income of between $3 and $6 per kg of mushrooms. This is encouraging and further justifies a full economic analysis of the entire waste processing and mushroom cultivation package.

The mushroom market growth potential and retail price increases (doubled since 1995) suggest that there is indeed an opportunity for the pilots to engage with an entrepreneur who would contract with the plantations to manage the installation and operation of the entire waste processing and mushroom cultivation package. However, a compelling case for plantation owners would need to deal with a larger proportion of their waste, which the pilot facilities clearly do not. The level of scale-up of mushroom cultivation to achieve this must then be compared with the absolute level of market demand and growth for those mushrooms. It appears that the pilot facilities will only be using a small proportion of the total plantation waste and face a dramatic scale-up scenario in order to achieve significant environmental impact at a given location.

Preliminary financial analyses for each pilot should enable the CPL, TAC and PMO to determine whether this project has the potential for a reasonable ROI to plantations that can invest in commercializing their solid waste stream, maximize their profits and reduce greenhouse gas emissions. It will be particularly important to fully assess the economics and scale of biogas production.

We recommend that each pilot be required to provide a 1-2 page preliminary economic analysis at the earliest opportunity. The analysis should include costs and revenues for a technology package with the capacity to produce 1 tonne of mushrooms per month. Costs would include all construction costs, equipment purchases, installation and monthly operating costs (including labor). but would exclude R&D costs. Revenue streams would include wholesale revenue from mushroom sales, the market value of any electricity generated, and estimated revenue from any sales of used substrate as fertilizer. Three production scenarios should be analyzed:

- mushrooms only;
- mushrooms and biogas; and
- mushrooms, biogas and electricity.

This would be followed by a credible and full economic analysis that reflects experience at each of the pilots.

We recommend that the teams obtain estimates of the national and export markets for mushrooms for each target country. This should include past trends and future projections. The data should be obtained from a number of sources and/or methods in order to establish a credible conclusion.

In addition, current estimates of return on investment do not appear to be attractive. The team should investigate all possible options for reducing the capital investment requirement while at the same time ensuring that they have estimated all relevant sources of expenditure and revenue, including estimation of the cost of otherwise disposing of the waste.

ENVIRONMENTAL AND FOOD SAFETY ASSESSMENT

A thorough environmental and food safety assessment is essential to measure the level of contaminants in wastewater generated by the projects, as well as to ensure that mushroom crops are not contaminated with toxic substances derived from the growth substrate. This testing should be carried out using samples from the pilot facilities and not extrapolated from lab-based studies.

ASSESSMENT OF POLICY ENVIRONMENT

In order to better understand the P2I the CPL needs to understand whether there are tax or other incentives to encourage the private sector to invest in remediation strategies and renewable energy. The P9 BIPCEA team (or a consultant) could be asked to advise on an advocacy effort to improve national energy policy and tasked to develop an analysis with clear conclusions and recommended action plans.

The challenge here is that plantation owners must be encouraged to install an entire system; although the mushroom farming alone could be quite profitable, more incentives may be necessary to encourage investment in the entire technology package so as to jump start renewable energy production. A comprehensive analysis and synthesis of the policy environment, together with a detailed set of predictions and recommendations, will be an essential complement to the economic analysis when attempting to gain the interest of plantation owners in this new technology.

PATHWAY TO COMMERCIALIZATION (P2C)

The revenue stream generated by the full waste processing and mushroom cultivation technology package could return a sufficient ROI to attract plantation owners, especially if feed-in-tariffs or other incentives were available, or if owners could use the biogas to produce electricity to reduce their own power bills. Plantation owners are more likely to be interested if a service provider assumes responsibility for planning,

installing, and operating the mushroom farming operation and maximizing profits from all revenue streams (mushrooms, biogas/electricity, and used substrate for fertilizer). The CP should identify potential entrepreneurs who have the skills and interest to take on the service provider role and to deliver a turnkey system. The perspectives and needs of such entrepreneurs can be addressed in the business plan that must be produced by the CP if third-party investment or support is going to be successfully solicited. The TAC and PMO should endeavor to make additional funds available to support the development of this business plan.

However, it is unlikely at this stage that a strong business case can be made for the plantations' investment in biogas or power generation - unless the plantations can use the biogas themselves to reduce their own power bills.

CONCLUSIONS

The challenge will be to develop and implement a plan that stimulates adoption of the entire technology package. We recommend that the P4 team liaise with the P5 team to learn from their experiences and successes, including the building and use of biogas plants.

The preliminary business analysis in Tanzania is encouraging and, while there are many questions that need to be answered, we can see a potentially credible pathway to commercialization evolving. It is critical to get the pilots up and running in Tanzania and Ethiopia. If the pilot projects meet the requirements described above, including delivery of the proposed economic analyses, we recommend that BI provide no-cost extensions including all necessary external support to fast-track business plan development.

The involvement of energetic service providers who can deliver a cost effective and complete technology package and optimize the revenue streams will be one of the most important factors in building a viable and scalable P2I. The EMRC Agribusiness Forum offers an opportunity to connect with the right kind of entrepreneurs.

Should our proposal for the next phase of the program be adopted, this project would be high on the list for carry-over. With the right entrepreneurship, there is great potential.

3.5 P5 WATER

Project 5: *Integrated Process for Sustainable Agro-process Waste Treatment and Climate Change Mitigation in Eastern Africa*

OVERVIEW

The P5 Water consortium has devised a highly innovative package of interventions to reduce the cost of wastewater treatment by generating revenue from treatment by-products such as biogas, electricity and nutrient-rich fertilizer for crop production. The individual elements of this system were developed in past Bio-EARN projects but the real innovation lies in combining these and building the entire system within the context of an economically viable package. The consortium has chosen to address some of the most highly polluting agro-industries in the region (tanneries and abattoirs), although many others (fish farms and fertilizer factories) also represent important future targets.

This is, perhaps, the most entrepreneurial project in the BIP portfolio with the potential for the greatest impacts. Although there is a clear pathway to impact for each of the three pilots, they are all heavily subsidized and significant cost reductions must be achieved if the project is to realize its potential for sustainable and scalable regional impact. This is part of the anticipated transition from pilot facilities to commercial availability, but the time required to achieve such cost reductions should not be underestimated. In addition, the pilot facilities are only processing a fraction of the total waste production at each location. Thus, scale-up strategies will need to be finalized that include significant co-financing by the host company.

CONSTRUCTION OF PILOT FACILITIES

The pilot plants in Modjo and Arusha are on track to be fully operational by June 2013. The pilot plant in Kampala is already up and running but requires some modifications to achieve the desired environmental impact. Establishing the Kampala facility was falling behind schedule due to problems with local contractors, but the Makerere University team took an exemplary entrepreneurial approach that enabled them to quickly turn the situation around and create the foundation for a spin-off company to drive future scale-out activities across the country.

The consortium has done an excellent job in securing PS partners with a high level of commitment to the program, and both Redman (Modjo) and Adolfo (Banana Investment Ltd.) indicated that they see an opportunity to make a contribution to the public good. In contrast, the project in Kampala seems to be motivated more by survival

instincts in response to aggressive action by the National Environmental Management Agency to shut down heavily polluting industries.

ECONOMIC ANALYSIS

At the time of this review, little real economic analysis had been carried out on any aspect of the process at any of the locations. We have asked each academic partner to prepare a summary of actual investments to date so that the CPL and PMO can clearly understand the financial model for replicating the package in each target country. Each project team must compare the value of the biogas, electricity, sludge, and high-nutrient water generated by the facility with the cost of the power consumed in producing these by-products.

The P5 Water team needs to investigate the opportunities to reduce costs by using local materials. We have asked the Uganda team to compare the costs of different types of construction materials; initial estimates are very encouraging, suggesting potential revenue generation of several thousand US$ per month.

It is clear that all of the PS partners have significant capacity for capital investment. Yet the BI program appears to have all too readily covered most of the costs of building the facilities. Apparently, the academic partners were not motivated (or sufficiently skilled) to negotiate better terms but, as contracts have already been agreed upon, it is too late to rectify this. However, we believe that private sector partners must be able to contribute a significant share of capital investment, and recommend that the TAC and PMO start reviewing more effective strategies for creating these public-private partnerships in preparation for the next phase.

The subsidies may have created a problematic situation by making it difficult for other local businesses to compete with the subsidized projects, especially in Uganda, as discussed in Appendix B.

PATHWAY TO IMPACT (P2I)

We assume that many polluters will simply be looking for a turnkey system that will enable them to satisfy national regulatory requirements, and to this end we have promoted the idea of identifying service providers who would have the commitment, skills and capacity to:

- identify the specific needs and opportunities of each polluter;
- tailor the basic design to each specific situation;
- accurately track and analyze the installation costs, and constantly introduce lower cost innovations;
- manage all aspects of the construction through to full operation.

A start-up company, WWS Design & Development Co. in Arusha, intends to become a service provider and already acts as a consulting engineer on constructed wetland projects. In addition, two local NGOs in Arusha (AGENDA and ENVICON) have taken on the task of disseminating information on the project, and have produced a short video on the wetland component.

It would take several years for service providers to become fully autonomous, and in the meantime we recommend that the BIP should support the P2I by funding:
• necessary support services (legal, IP management, business plan development);
• production of a video to promote the technology package to prospective PS partners as well as potential parallel donors and social investors.

This might most easily be achieved by making the service provider a formal partner of the project. It is essential that service providers are cultivated in each target country and that some type of umbrella structure (alliance, joint venture, parent company structure) is established to ensure that emerging best practices, refinement experiences and economies of scale are fully and rapidly shared across the region.

We also recommend that the PMO provide additional funding to support a meeting of the entire P5 Water consortium team from the three partner countries during the second half of 2013. The purpose of this meeting would be to:
• stimulate dialogue on the regional scale-out of the P2C;
• present the IP challenge and proposed solution (see below);
• discuss media relations and communications strategies;
• generate consensus on legislative priorities in the partner countries and better understand policies in other potential target countries;
• review technology issues, especially ideas for reducing the cost of all elements of the process including electricity generators;
• identify "best prospects" (e.g., sectors) for technology dissemination, especially those where the energy generation capability would be most valuable.

CREATING A REGIONAL TRADE ASSOCIATION (RTA)

The commitment of the PS partners suggests it would be advantageous to form a coalition or regional trade association (RTA) involving the science partners and PS partners, including the PS service providers. The RTA could help set professional standards, promote the technology and protect the IP by applying for a trademark. It could also collect fees from members, which could be used to provide training for new members and represent members' interests with government officials at the highest level. Because regulatory enforcement is unlikely to be comprehensive, the RTA might lobby for tax concessions and other incentives to encourage other polluters to comply.

A key benefit to the consortium of engaging with selected PS partners is that scientists and service providers will have ongoing access to business owners whose expe-

rience will be helpful in disseminating the technology package. Another benefit will be the opportunity for service providers to set up a group purchasing program to reduce system installation costs by purchasing specialized components in bulk and negotiating discounts.

INTELLECTUAL PROPERTY (IP)

Based on experience in other sectors, the success of the clean water technology package will encourage unscrupulous entrepreneurs to offer discounted services that are unlikely to be effective. This could undermine qualified service providers' efforts to build their own reputation. It is essential to protect the IP, and in all likelihood a trade mark needs to be secured.

CARROTS AND STICKS

In order to achieve the goal of improving water quality and encouraging renewable energy production, as well as to better understand the P2I, the PMO should task BIP-CEA (or a consultant) to prepare an analysis of the target countries' water quality standards and energy policies, including existing incentives for private sector investment in remediation and renewable energy production.

For example, in Uganda, we understand (per. comm. Joseph Kyambadde, interview) that regulatory standards have been in place since 1999 although they had not been seriously enforced until the last few years when there was a change in management at the regulatory agency, the National Environment Management Agency (NEMA http://nema-ug.org). Over the past few years, NEMA shut down several tanneries, a soap factory, and at least one abattoir for violations of water quality standards. NEMA is apparently threatening to close down other facilities if they do not improve. City Abattoir reported that it probably would have been shut down without the BIP project.

Most companies will try to limit their investment by opting for the least expensive package capable of reducing their pollution to a level acceptable to the national regulators. The next level of investment would include biogas investments by users like Banana Investments Ltd. and Kampala City Abattoir, which can use the gas from wastewater without converting it to electricity.

The most expensive option includes installing a generator to produce electricity. The capital investment required for biogas collection and electricity generation may need to be encouraged in some way by government incentives, donor subsidies or social investor support. Project teams will need to carry out a full economic analysis.

Both P5 Water and P9 Policy projects (if refocused) can play major roles in building green economies in the region, and for this reason Sweden should consider long-term

strategic support of them. This will require increased funding over the next year to ensure that momentum is maintained and that essential business planning activities are carried out to maximize opportunities for parallel funding and some private financing of the forthcoming scale-out phase. Entrepreneur engagement in these tasks should be encouraged to maximize outcomes.

CONCLUSIONS

The Water project, with 10 years of development, is in the right place at the right time. As governments in the region start to enforce clean water regulations, demand for sustainable solutions will grow, and the pilots will demonstrate viable technologies. The economic analyses that are in development will help to create a business plan and offer private sector polluters several pathways to compliance.

The key to dissemination, however, will to be secure the involvement of energetic and entrepreneurial service providers who can act as the commercial link between the science community and potential end-users: people who have the technical and business skills to promote the benefits and work with the PS on delivering appropriate and cost-efficient solutions. EMRC offers an opportunity to connect with the right kind of entrepreneurs, and the 2014 Agribusiness Forum could play a key role in securing the kind of engagement needed. In any event, the environmental impact of this project will take time to manifest and BIP would be well advised to view technology dissemination as an integral component of the next stage (see Section 5 below). More urgently, the CPL and PMO should ensure that the consortium maintains momentum and that all the necessary analyses are conducted.

In the longer-term, the CPL should investigate the opportunity of working with local governments to establish integrated solutions for multiple polluters based in neighbouring locations, as a possible route to reducing unit costs by capturing economies of scale.

3.6 P6 ADDED-VALUE

Project 6: *Use of Biosciences for Value Addition and Diversification to Enhance Commercialization of Sorghum and Millet Products*

There is undoubtedly huge untapped potential for adding value to sorghum and millets, particularly given the increasing awareness of their nutritional value. The sorghum-based health/snack bar and instant sorghum porridge mix for babies offer opportunities for import substitution, and the malt beverage is an excellent source of nutrition. These product concepts are compelling, providing indigenous versions of popular products and safe urban versions of rural favorites.

There are no fundamental scientific issues that need to be resolved, and we would have expected the project to focus on pursuing aggressive and innovative pathways to develop large-scale production of these products. The CP has, however, chosen to engage with small, under-capitalized businesses, which have limited (or non-existent) distribution networks. This type of company has limited capacity to refine products and limited experience in the market place. Moreover, at this level, increasing demand through the commercialization of added-value products does not necessarily significantly improve the economic situation of resource-poor producers. Without a major revision of strategy, we believe this project is unlikely to achieve sustainable and scalable impact.

Encouraging the formation of small and micro-enterprises may be a laudable deliverable from a development point of view, but the business case is far from compelling. Without subsidies these small enterprises cannot afford to purchase the necessary equipment, and they lack the distribution networks required to penetrate markets to the extent required to achieve any measurable impact on small farm economies. Moreover, it will be extremely difficult for these small companies to create strong brand identities. Due to widespread procurement delays, the PS partners in both Tanzania and Ethiopia do not yet have the specialized processing equipment in operation, and it seems highly unlikely that the stated objectives can be achieved within the life of the project. The team reports difficulty in attracting the interest of large companies. It is essential that the team extract and analyze feedback from these companies to better understand the problems with their proposed product concepts and the broader dynamics for such products in the market place.

We recommend that the project secure at least one major PS partners for each product in each target country. In order to achieve any real impact, PS actors must have large-scale production capability and an extensive existing distribution network, as achieved in the other BIP crop-based projects: GTIL in P2 Clonals, Trufoods in P3 Beans and Real-IPM in P7 Bio-control. Only in this way can the P6 Added-value project hope to stimulate a sustainable and scalable sorghum and millet added-value industry across the region. We recommend that the consortium reach out to major producers of analogous products[5] and leverage the product R&D conducted by the CP to secure partnership agreements. The public sector partners of the consortium should

[5] For example: for the sorghum snack/health bar, important criteria for a valuable analog would be companies that make products using mixers/blenders, moulding units, and packing units. In this case, a biscuit company might be most appropriate.

also build alliances with institutes and departments dedicated to researching added-value options for sorghum and millets in Africa.

If any of the teams are unable to achieve promising progress on this by the end of June, we recommend phasing out that component of the project, by country and/or product, consistent with results. Our exposure to the project suggests that the CPL does not have the leadership skills or business expertise required to manage a project of this nature, and one possible outcome of the proposed action plan is that BIP may decide to terminate the entire project. If the project does continue, the PMO will need to address the lack of strong leadership.

For the benefit of the consortium partners, the TAC and the PMO, we include a more comprehensive analysis of the technical aspects of the project in Appendix A.

3.7 P7 BIO-CONTROL

Project 7: *Bio-enhanced Seeds and Seedlings for East Africa*

There are an increasing number of bio-control success stories across the world, including in Africa. Tightened regulations on pesticide residues and increased pesticide resistance in pest populations are also driving increased market opportunities for bio-control agents. This trend has spawned a growing number of acquisitions of bio-control companies by multinational pesticide companies. Production of bio-control agents is often labor and space-intensive, so production of bio-control agents in Africa is becoming an increasingly cost-effective option. There is potential for companies in Africa to build strong business plans around import displacement, regional export and even export into Europe, the Middle East and North America. The EU does not require registration of bio-control predators, but it does have a time-consuming and expensive process for registration of fungal bio-control agent seed dressings (which costs about half a million euros per application).

This project is in the right place at the right time, but the CP structure is weak, especially in PS partnership. We recommend that the Kenya team establish a partnership with a major seed company at the earliest opportunity. We also recommend that the consortium expand to include Ethiopia, especially given that IITA-Uganda has effectively dropped out. It appears (tbc by BIPCEA) that Ethiopia has a far more "friendly" regulatory environment for these products than Uganda, and, therefore, should have been included in the consortium from the outset.

REGISTRATION PROCESS

The greatest constraint on the expansion of the bio-control industry in Africa is that the regulatory environment for these products is poorly developed in most countries. If the BIPCEA team had led the analysis of the regulatory environment for different classes of bio-control agents across the region, it would have been of great value to those designing the P7 Bio-control consortium. It appears that Kenya is most advanced in this area, followed by Ethiopia and then Tanzania. However, this has not been reflected in the design of the consortium. We recommend that Real-IPM be requested to work with the P9 BIPCEA team to carry out a comprehensive analysis of the policy environment relevant to this project, if necessary contracting a specialist consultant to fast-track the analysis, which should include analysis of the current situation and assessment of the prospects of changes in the near future, in each of the six target countries of the BIP.

Alpha Seeds is a relatively small player in the African vegetable seed industry. They do, however, have an agreement with Real-IPM for use of selected bio-control products. Unfortunately, at the time of the review visit, no progress had been made in registering these products. It seems that there has been a lack of leadership and mentoring in this area, as Alpha Seeds clearly needs assistance. We believe that the CPL should have recognized this and addressed the issue from the project's outset. Real-IPM has substantial experience in this arena in both Kenya and Ethiopia. We believe the BIPCEA team (or a consultant) should work with Real-IPM and selected seed companies in each of the six target countries of the BIP to ensure that rapid progress is made on this issue over the next month. Although it will take two years to secure a temporary operating permit in Tanzania, starting the process would be an important prerequisite for expansion during future phases.

SEED COMPANY PARTNERS

If this project is to make a tangible impact, the community must build alliances with large seed companies in each of the target countries: Kenya, Ethiopia and Tanzania. Real-IPM has already agreed to pursue discussions with seed companies in Kenya, and the CPL should ensure that parallel action is taken in the other two countries. We believe that this project has an important window of opportunity during the next 12 months to demonstrate the potential for substantial scale-out across the region. If achieved, this project can have considerable regional impact during the next phase.

A QUESTION OF PHILOSOPHY

Real-IPM has achieved excellent growth through its base in Kenya, has already expanded its footprint into Ethiopia and is probing Tanzania. With the present consortium structure, the BIP is primed to actively support Real-IPM's regional expansion. However, the TAC should consider whether this is the most appropriate route (with respect to the BIP mission) to achieving regional impact. We recommend that the P7 consortium should foster the establishment of parallel bio-control agent production

companies in Ethiopia and Tanzania (and ultimately elsewhere). If necessary, the TAC might consider commissioning a strategic analysis on which to base its final decision. In either case, we recommend that the TAC finalizes a proposed policy statement by the end of May, which can be refined as required and ratified as quickly as possible by the Sida-ILRI-BIP group so that the consortium can move ahead with regionalization activities. Once a clear long-term strategy is agreed, we recommend that the CPL strongly negotiate the financial and in-kind contributions to be made by Real-IPM. It is critical that the PMO provide the CPL with all necessary support during this process.

FORMULATING BIO-CONTROL AGENTS IN SEED COATINGS

An exciting part of the project is developing seed dressing formulations for bio-control agents so that they can compete directly with conventional pesticide seed dressing. There has been increasing research on this issue over the last two decades in the public and private sectors, particularly in USA and Asia. A number of patents have been granted in this area, and a number of companies across many countries are pursuing biological control agents as seed treatments. However, it requires a considerable amount of work to optimize formulations for every new bio-control agent, crop and target national regulations. P7 researchers urgently need to fast track their efforts in this as well as working with the P9 team to ensure they are building strategies based on the best policy environment information.

Certain Real-IPM products have been formulated for farmer-application of fungal bio-control agents to farm-saved seed, and this has been validated on-farm. We expect that this approach is not appropriate to commercial scale production prior to seed distribution (and storage) and recommend that a pilot scale seed dressing process and facility be accessed or established immediately. Real-IPM should optimize the seed dressing process with a major seed company in Kenya that has a large pre-existing seed distribution system. Since this is likely to be a significant unbudgeted activity, we recommend that the PMO provide the necessary additional funding so that this work can proceed as soon as possible. Given the commercial opportunities that could arise from this work, we expect that Real-IPM would be willing to provide a reasonable level of co-funding. All possible effort and ingenuity should be applied to making use of existing facilities rather than building them. We recommend that the team investigates the value of bringing an additional research partner into the consortium from USA or Asia with significant relevant experience in formulating new bio-control seed dressings.

Once the methodology has been optimized in Kenya, it can be transferred, adapted and refined in the other countries using a similar process. The consortium can then reconsider the relative cost-benefit of finding and using, versus building, pilot seed dressing facilities in each target country.

SEED DRESSINGS FOR FARMER-SAVED SEED

The system that Real-IPM has developed for application of bio-control agents to farm-saved seed is an excellent initiative and should be continued in parallel with efforts targeting the formal seed sector. The delivery pathway is facilitated by a network of 400 agridealers in Western Kenya through an alliance with AfricaHarvest, One Acre Fund and FIPS. In addition, from mid-2013 forward, Real-IPM will be distributing "GrowPlus" (for striga management) in Ethiopia using a similar model. We recommend that BIP investigate the opportunities for developing similar systems in the other countries. In addition, we recommend that the BIPCEA team investigate opportunities for stimulating governments and large development donors to support the scale-up of this system.

CONSORTIUM STRUCTURE AND FUNCTION

This product concept has substantial potential for triple bottom line impacts. However, we struggle to see where BI's investment has brought substantial added value to activities that the PS partners would have proceeded with on their own. In addition, the consortium composition does not seem to reflect the most balanced and logical set of partners, has insufficient seed industry partners and seems to be lacking a business-driven perspective. However, P7 Bio-control has an opportunity to graduate from a national success story to a program achieving substantial regional impact. The immediate challenge for the P7 Bio-control team is to devise a strategy for scaling-out through consortium-led translation of the Kenya model towards achieving impact at a regional level. In addition, the consortium has an important opportunity to play a major role in developing a bio-control agent seed dressings. If the team can make substantial progress in this area there is a real possibility that the project could develop pivotal IP underpinning this technology. Both of these issues offer the project the opportunity to graduate from a promising emerging national innovation system to sustainable and impact on a regional level.

To capture these opportunities the CPL must convince several large seed companies to join the consortium, initially in Kenya but subsequently in Ethiopia and perhaps Tanzania (depending on the outcomes from the P9-led policy environment analysis). It is critical that the consortium leverages the expertise of these seed company partners in the design of the action plan. Entrepreneurial skills should be engaged in these activities as there may be opportunities to secure outside investment.

Critical priorities for the next 12 months include:
• optimizing the seed dressing formulation, and apply for IP protection as appropriate;
• registering all the products in all the target countries, following policy analysis study;
• completing a thorough FTO analysis and
• finalizing the business plan for a regional scale-out strategy.

Achieving these goals will require a network of alliances that would form the foundation of a proposal for the next phase as well as the basis for approaching social investors. It is notable that in Kenya, new registrations can take up to 3 years, whereas extension of label applications take about 18 months, the latter needing two seasons of independent testing.

SUSTAINABLE AND SCALABLE REGIONAL IMPACT

If BIP decides to proceed by helping Real-IPM to regionalize their business, which appears to be the shortest pathway to success, BIP will need to evaluate the long-term strategic implications. Such a decision would set the scene for the next phase of Bio-Innovate and establish a policy whereby key PS actors would receive significant support in scaling up effective national programs to achieve regional impact. This type of proposition should also be presented to major social investors interested in triple bottom line impacts. Alternatively, BIP might prefer to play a facilitation role with very modest funding.

3.8 P8 ENZYMES

Project 8: *Industrial Enzymes for Sustainable Bio-economy: Large Scale Production and Application in Industry, Environment, and Agriculture in Eastern Africa*

OVERVIEW

This project proposed fostering large-scale production of enzymes for local use (displacing expensive imports), with the potential to expand into regional and international trade. Many promising enzymes have been identified from the region, and at least one has already been adopted by a multinational corporation. This project has the potential to jump-start and build a significant indigenous enzyme industry in East Africa, but at the commencement of this review it was completely stalled[6]. In light of the substantial potential, both Sida and the PMO were keen to revive rather than terminate the project - if a viable pathway could be identified - and encouraged us to intervene.

[6] The PI had moved from AAU to NMU, which wasted a lot of time.

SCOPE VERSUS PROBABILITY OF SUCCESS

Independent reviews of both the original concept note and the final proposal concluded that the project was far too ambitious and should be scaled back. There were too many enzymes and too many target industries. The consortium did not make any substantial changes to their plan, but the project was still funded.

During the Addis Ababa conference, we initiated several meetings between the CPL and the available consortium members. The CPL soon recognized the gravity of the situation and agreed to lead the formulation of major revisions to the plan. We proposed that the project focus on a very small number of enzymes and exclude any products that were already commoditized (e.g., enzymes for the paper sector). By the end of the conference, the team members had agreed to focus on enzymes for the leather processing industry, a sector in which the CPL has extensive contacts and expertise.

The target sector has relatively low international competition, and the products offer the potential for impact in Ethiopia, Kenya and Tanzania. This focuses the scope of the project down to three of the seven groups of enzymes listed in the original proposal: alkaline proteases, neutral proteases, and hydrolases. However, given the further delays experienced since the conference, and the need for formulation and stabilization research, we recommend that the targets are focused further to maximize the probability of achieving success with one enzyme during the remaining period of the project. For this reason, we strongly recommend that the TAC and PMO take a business-centric approach when evaluating the new proposal.

IP MANAGEMENT

Now that a smaller number of target enzymes have been agreed upon, the immediate priority must be to carry out FTO analyses and build IP management strategies. The project needs clarity regarding its right to develop businesses based on these indigenous materials, and it is imperative that these analyses are completed during the first half of 2013[7]. We recommend that the CPL retain a world-class legal expert. In addition, the PMO should be prepared to take rapid action to fund whatever IP management strategies are recommended as a result of these analyses.

[7] An example of IP-related risk: http://www.just-style.com/news/wildlife-service-seeks-fee-for-stonewash-enzyme_id71227.aspx

FAST TRACKING ECONOMIC FEASIBILITY TESTING

Given the one-year delay in this project, we recommended that the consortium seek alternatives to building its own pilot plant. If the CPL cannot immediately optimize pilot scale production of the target enzyme at NMU, then the consortium should identify an alternative pre-existing pilot facility, perhaps in Sweden. We also recommend that the consortium be restructured to address the current over-dependence on a single person (the CPL).

The CPL has the necessary entrepreneurial spirit but has recurrently failed to deliver on action plans throughout the life of this project. Nevertheless, the prospect of developing a new business focused on delivering effective and competitively priced enzyme products to the leather processing industry remains highly compelling. Should the TAC agree that the PMO continue to support this consortium, we recommend that the PMO take a highly robust approach to directing the CPL through the next year's activities. This should include monthly milestones linked to grant payments and may require the PMO to contract a specialist consultant to ensure a strong ramp-up in activities over the next twelve months.

PATHWAY TO COMMERCIALIZATION (P2C)

The pathway to small-scale commercialization is clear. The consortium should produce an early stage market analysis by July 2013 and a preliminary business plan by December 2013. If the CPL can build a small business, a solid foundation (sales, staff, delivery record, balance sheet, reputation) can be established. Should this new company then decide to expand its offerings into other sectors that consume commoditized enzyme products, potential investors will be in a position to gauge the likelihood of success based on the company's track record with enzymes for the leather industry. This could also provide a valuable demonstrator for other start-ups on how to build a solid base before approaching investors for ramp-up financing.

The Leather and Leather Products Institute (a semi-private institution established to assist development of the leather sector in Ethiopia) can play a key role in product testing, which would otherwise have been a burden on the project. Recommendations by the Institute to the private sector regarding new products and processes that they have tested and approved, carry real weight. The insights of Prof. Mattiasson (Lund University) will be of inestimable value to the consortium, especially in developing cost and time effective production methodologies.

CONCLUSIONS

We recommend that the PMO continue to support this project but with greatly increased management oversight regarding timely delivery of key milestones. We recommend that the PMO fund access to external expertise that will assist the consorti-

um with the development of a compelling and credible economic analysis, IP management strategy and business plan development. The business plan will enable the PMO to determine whether there might financing potential.

Should our recommendations for the phase of the BIP program be adopted, the nascent enzyme business would be high on the list for carry over, if they can meet agreed on milestones.

3.9 P9 POLICY

Project 9: *The Biosciences Innovation Policy Consortium for Eastern Africa (BIPCEA)*

The BIPCEA team has clearly carried out a wide range of valuable activities that have the potential to contribute to a gradual shift in the culture and skill base of the broader community. The project has not, however, addressed any of the immediate needs of many of the projects, particularly with respect to alignment with regulatory frameworks. Some of these needs (business/implementation, planning and economic analysis) were clearly highlighted by the reviewers of the full proposal, while others (detailed analysis of regulatory constraints and incentives) were not. These same reviewers also recommended that the project give greater emphasis to supporting the broader regional community. With limited capacity, BIPCEA team could not have effectively responded to requests for greater depth *and* increased scope.

Rather than encouraging the BIPCEA team to focus on high level policy issues and broad-based regional training activities, they should have been directed to focus on the immediate needs of the individual consortium projects, many of which are now suffering from design flaws that could have been corrected by the BIPCEA team.

While the overall objectives of BIPCEA are valid and well articulated in the proposal, the lack of entrepreneurial experience in the BIPCEA team resulted in a lack of clarity on how to achieve those goals and in a neglect of specific issues that the consortium projects most urgently needed assistance with.

The original concept note specifically identified “Action-orientated analysis and advisory services will be emphasized, directly benefiting ongoing projects supported by Bio-Innovate” as a priority, but this emphasis was lost during the proposal development. This has resulted in numerous missed opportunities to use regulatory analysis and advocacy to help the other projects.

REGULATORY ISSUES

All the projects urgently need a comprehensive overview of the regulatory carrots and sticks related to their technology areas for each of the six countries, including: current laws and levels of enforcement (examples of actions), details of emerging laws and foresight on what should be expected when and where in the future. This should include regulations on release of wastewater for P5; registration of bio-control agents in different formulations for P7; feed-in-tariffs, and tax incentives or other rewards for generation of renewable energy from biogas or solar panels for P4 and P5.

We understand that there are laws in place in all six countries pertaining to water pollution, but that these are often subsumed in the national environmental legislation (pers. comm. Nicholas Ozor, interview). However, we understand that, in both Uganda and Tanzania, several industrial polluters have been shut down by NEMA (pers. comm. Joseph Kyambadde, interview). It is a priority that this level of information be collated and validated for every project, product, scenario and country. The projects urgently need detailed analysis of their policy environment that goes far beyond a synthesis of existing policies, to cover assessment of actual enforcement (including examples of measures taken against major polluters, for example), as well as prospects for changes in the near-term.

In addition, we recommend that the BIPCEA team should focus time and energy on developing reviews based on experience with similar technologies in other countries and then advocate for adoption of appropriate policies across the East African region, based on the lessons learned elsewhere. In addition, case studies from other countries may assist project consortia to predict likely future trends in East Africa. The BIPCEA team has strong expertise in the general area of science and technology policy analysis and advocacy that can serve both of these activities and which will bring long-term added value to consortiums where a synthesis and recommendations approach can be taken.

In some cases the lack of necessary regulatory information has been detrimental to project conceptualization and planning. This type of information would have had the greatest impact if it had been available at the time of finalizing the full proposal. Even if the information had been sourced during the first year of project operation, some level of adjustment would still have been possible. Now it is urgent that the information be provided immediately, to offer primary criteria for determining whether or not a given project should be continued.

By way of example, the structure of P7 Biocontrol should have been based (or subsequently refined) on a deep understanding of the regulatory environment for biocontrol agents in East Africa. On this basis, Ethiopia would probably have been chosen as a major target country alongside Kenya where immediate progress is possible (whereas Ethiopia was not represented in the consortium at all). In contrast, activities in Tanzania and Uganda might have been made contingent on appropriate progress in the regulatory environment within these countries, and the BIPCEA team might have been requested to focus on strong advocacy activities.

CONSULTANTS

The scale and the specificity of need for policy analysis in many of the projects, and the urgency to address these issues will inevitably result in the engagement of consultants with, for example, specific expertise in waste water treatment policies and registration of bio-control agents across the region. The CPL and the PMO should work together to develop a realistic assessment of where the BIPCEA team has the necessary expertise and availability for timely delivery of specific tasks versus where the team needs to be augmented with highly skilled and experienced consultants who can work in parallel with the P9 project members. However, it will be important for BIPCEA team members to retain overall coordination of activities in order to ensure that all possible institutional experience and institutional memory is captured from these activities. A similar approach should be taken to fast track the FTO analysis for each consortium by engaging commercial IP experts with specialist experience in the area of the target project.

RECOMMENDATIONS

BIPCEA should substantially refocus its workplan and move with all possible speed to address the specific issues raised herein.

A consultant should be engaged to conduct a reorientation workshop for BIPCEA which, among others subjects, would position regional policies within a global context. For example, BIPCEA should be aware of how progressive environmental and energy regulations works in other countries as there are lessons and examples which can be used to help build progressive legislation in the region.

The consultant/facilitator would be someone with a legal background, policy experience and an understanding of how enabling legislation varies from country to country, especially in the environmental subsector. The workshop would be tasked to deliver a set of appropriate and relevant actions.

4 Main Conclusions and Recommendations

We believe that there are three key priorities in funding this program:

- *Science* – support for novel research outputs
- *Innovation* – emphasis on the pathway to impact
- *Regional Impact* – sustainable and scalable social and economic benefits

These priorities have framed our approach to this MTR. In addition, we have focused on evaluating how all elements of a given project contribute to a pathway to impact for each product or technology.

Some projects will achieve impact through commercialization with private sector partners, while others will rely on NGOs or national and international development programs. Irrespective of the nature of the delivery agent, it is the *quality* of the relationship between those developing new technologies and those deploying products based on those technologies that will, to a large extent, determine the success of any innovation program.

Traditional research-for-development projects have consistently demonstrated low quality linkages with supply chains and, as a result, recurrently suffer a shortfall in realizing potential impacts. Improving the relationships will improve the impact. However, the nature of the delivery agent is also a major determinant. Establishing a strong pathway to commercialization is the most effective means of achieving sustainable and scalable impact.

GENERAL CONCLUSIONS

As we have spent more time with the BIP, we have become increasingly passionate about the potential of this initiative. The program is driven by an exciting vision and is serving a critical need by addressing the question of how to move innovation out of the lab and into the marketplace. Several projects appear to have real commercial potential, at least in certain components. If the CPLs and the PMO can actively apply the lessons learned from the successes and the failures to date, a solid foundation will have been created that will enable some of these projects to move ahead in the next phase of the program and eventually achieve Sweden's goals for its funding through Sida.

The BIP community has already made good progress in its cultural change from the research-driven Bio-EARN projects to the private-sector-partnership model of BIP. This was clearly evident during plenary and group discussions at the Addis Ababa conference. The change process needs to continue - in community attitudes to busi-

ness processes, risk analysis and the associated management processes required to deal with these.

In order to better capitalize on past investments and to gain better traction, the BIP should start moving towards a culture of managing for maximum portfolio success. This will require the development of clear exit plans for specific projects and project components as this will enable a tighter focus on maximizing progress in those projects with the greatest probability of success.

The PMO and the TAC have an important opportunity to lead by example as they select which of the recommendations in this MTR to implement, how to articulate messages from this review to the BIP community, and which mechanisms they deploy to ensure action on those selected recommendations. The window of opportunity for action is narrow and we believe that bringing entrepreneurial expertise into each project is the only way to achieve the pace of change required.

Several projects are developing a viable business case, some appear to have potential for sustainable and scalable impact, a few have exemplary CPLs who are moving ahead in a highly entrepreneurial way. **BIP should highlight these successes to the broader internal community, creating champions of the type of cultural change that is required across the program**. These pockets of great potential must be translated into a sea change across the BIP. If the scientists, the TAC and the PMO can learn from the experiences, successes and failures to date, the BIP will reasonably be able to claim that it has built the foundations of an innovation platform.

We have been critical of areas where we believe significant improvement should be made. However, our criticisms are coupled with constructive feedback and solutions aimed at creating a stronger and more sustainable future evolution of the program. We hope that the community will receive our feedback in the spirit with which it is intended.

MAXIMIZING SUCCESS OF INNOVATION SYSTEMS

The first phase of the BIP should be viewed as a learning experience which can inform an evolution in both design and execution that will be more likely to generate the kind of impact the architects had in mind. Our analysis has identified a series of lessons which can provide valuable guidance in launching the next phase of the program. We also provide a number of recommendations regarding how to help struggling components of projects get back on track. If rapid recovery cannot be demonstrated, the TAC should consider terminating these failing elements and provide additional funding to more promising initiatives to give them a greater chance of success.

Notwithstanding the progress that has been made, all of the CPs are suffering from flaws in design or challenges in implementation that threaten the key goal: creating viable innovation systems on which to build strong PPPs that can, in the future, deliv-

er sustainable and scalable impact on a regional level. In some cases, we believe that immediate robust action may recover the situation, in others we recommend minimizing losses through a rapid exit plan, while for the remaining projects we propose that taking a chance on continued support of a restructured project may be justified.

Although this might seem a harsh synopsis, given the nature of BIP's mission to incubate new business opportunities, this profile of success and failure seems entirely consistent with the global success rate of business start-ups. Venture capital investment in start-ups considers a success ratio of 1:10 as acceptable, and 90 percent of all cash returns are produced from 10 percent of the companies supported. In this context, we cannot overstress the need for the PMO and the TAC to focus on the *overall* BIP portfolio success rate, rather than attempting to continue all the individual projects. If just two of the BIP CPs are successful on a regional level, the program will have achieved double the average venture capital success rate.

CRITICAL ROLE OF BUSINESS INPUT

In reviewing the procedures and processes adopted by BIP to select, facilitate and manage the development of the nine projects it was apparent that there had been little input from people with on-the-ground business experience, and that overall there was insufficient focus across the entire program on moving towards the creation of strong partnerships with the private sector. An important factor in this is that the TAC, the PMO and the CPs are all staffed by academics or public sector officers[8]. Thus, although objectives have often been well articulated by the community, the lack of entrepreneurial experience across the BIP program resulted in a lack of clarity on the essential requirements for building an innovation system that could move towards sustainable and scalable impact. This lack of application of business expertise also led to higher subsidies for many PS partners than we believe was necessary, as well as several projects failing to secure the involvement of an *appropriate* PS partner or any real matching funding from the PS partner (beyond notional in-kind contributions). We recognize the willingness of the TAC, PMO and consortia teams to enhance their skills in entrepreneurial thinking. However, we consider that the window of opportunity for making effective changes in the current phase is so short that it is only through accessing external expertise in this area that sufficient progress will be made in the time available. Nevertheless, we recommend that these external individuals and nominated internal champions of change are utilized to help drive community-wide

[8] Although there are several individuals with extensive experience in innovation systems: Victor Konde (TAC), Julius Ecuru (P9-CPL) and other BIPPCEA team members, this was insufficient for the task.

cultural change in this area during the next phase of the BIP. The program should then ensure sufficient entrepreneurial input throughout all BIP processes: project conceptualization, design, development, assessment, implementation and evaluation.

NEED FOR HOLISTIC MANAGEMENT OF INVESTMENT IN FACILITIES

One of the great successes of the BIP concept is that it is taking research outputs out of the controlled conditions in public sector research organizations and testing them in real world situations. On-farm participatory variety selection activities in P1 Grains can be considered as an out-sourced evaluation of new products in target environments. The pilot testing of new technologies in P4 Waste and P5 Water cannot, however, be viewed in the same light, because PS investment has been modest. BIP actions can cause reactions in their respective market places and target industries, and the P9 BIPCEA team (or consultants) should have been helping the P4 and P5 consortia come to terms with these issues from the outset.

We have observed a lack of effective negotiation in matching PS capital investment in facilities across all projects. In many cases, PS partners should have been able to make a greater contribution, yet academic partners seemed to lack the skills or motivation to leverage additional matching funds. In some cases this represented a missed opportunity while in other cases it threatens to undermine the scale-up process. The TAC should appreciate that in the area of business incubation, grant-based investments in facilities at private sector locations (irrespective of the mechanism by which the capital flow was managed) must be very carefully planned if they are not to create apparent subsidies and resultant marketplace distortions that can jeopardize the future potential of the projects.

INCREASING THE POWER OF PROGRAM MANAGEMENT

We have observed a recurrent management issue that impacts all aspects of the program and most of the projects. Throughout this review we have read thoughtful analyses from those involved in writing the BIP proposal, calls for concept notes, guidelines to reviewers, comments from reviewers, TAC meetings, and the 2012 M&E process. However, in many cases this guidance or feedback has not been translated into effective action by the consortia. In many cases it appears that both the PMO and the TAC assumed that each CPL had the time, leadership and management skills to take on responsibility for implementation, but this was often not the case. It is completely understood that the PMO has been highly pre-occupied during the first two years of the BIP: getting processes and system in place and trying to fill gaps in CPL performance. However, the senior members of the PMO must now focus time on playing a more proactive leadership role with respect to individual projects. This will require the provision of additional resources and support to the PMO to ensure that routine program maintenance functions can still be carried out.

Many of the recommendations in this MTR are implied or have already been explicitly stated in at least one of the documents we have reviewed. For BIP to succeed, the

PMO and the TAC should be decisive so that rapid action on those of our recommendations considered worthy of attention can be taken. Given the narrow window of opportunity to elicit change in the current CPs, we consider it essential that each project access and empower entrepreneurial expertise to invigorate and drive its last year of activities. This will require a robust level of management that utilizes all available incentives to ensure timely delivery of action plans that focus on achieving key strategic goals, even if these are scaled back.

Throughout this review process we have recurrently found ourselves in the middle of significant misunderstandings between all levels of players in the BIP. On this basis, we assume that much of the inaction or misaction at the consortia and CPL level is due to passive misunderstanding and *not* active attrition. This points to an urgent need for the PMO to move to a greater level of clarity in its directions to the consortia and CPLs, and for better communication to become a priority in all BIP activities. Simplification of the reporting process is one of many small changes that could support this.

ALIGNING PROJECTS TO MAXIMIZE IMPACT

During our analysis, it became apparent that interventions were required and justified in order to get the P8 Enzymes project up and running and to establish a viable way forward for the P4 Waste project. On this basis, we initiated a series of interventions during the Field Research phase (see P4 and P8 components of Section 3). Based on the outcomes of these interventions, we believe that with the right kind of human and financial investment over the next year these two projects could realize great potential.

P1 Grains and P2 Clonals are clearly struggling to establish a coherent team approach capable of established a unified pathway to impact and coordinating all consortium activities. We believe that both projects need to be restructured to address these issues. We recommend that each consortium is tasked to convene a small workshop to address these challenges and that these workshops should be facilitated by someone with broad entrepreneurial experience in seed system development of the target crops. The participants should include one senior manager representing each potential product deployment agent: private sector, government, international, NGO, farmer group etc. With a refreshed approach, both of these projects have the potential to establish demonstrators in the next phase that could effectively test the feasibility of building sustainable and scalable pathways to impact.

Meanwhile, P3 Beans, P5 Water, P6 Added-value and P7 Bio-control are all showing strong progress in some areas but facing challenges in at least one fundamental aspect: insufficient scale or regionality of impact, or missing economic analysis, or lack of a scale-up impact model. We believe that with the appropriate facilitation each of these projects has the potential to correct design flaws, restructure teams and/or de-

sign pathways to regional impact that will enable them to move towards their targets in the next phase.

SUMMARY OF CROSS-PROJECT RECOMMENDATIONS

There are two separate yet connected sets of recommendations:
• Those intended to increase the probability of success of projects; in this section we do not reiterate specific suggestions targeting each project (which are listed in Section 3), but highlight the more systemic issues.
• Those that can start the process of transitioning into the next phase and be driven by the needs of the pathway to impact.

RECOMMENDATIONS FOR CURRENT PROJECTS

• All projects should be required to deliver an economic analysis within the next two months and a business plan by the end of the year. Some may need help in implementing these business plans to the desired standard, and the PMO should ensure that continuing consortia have sufficient funds to contract the necessary expertise.

• At least one, and preferably two TAC member positions should be replaced by entrepreneurs with a multi-disciplinary and business-centric skill set.

• The TAC and the PMO should work together to create a more proactive environment, and urgent "recommendations" from the TAC should be presented to CPLs as "mandatory", with the threat of financial holdbacks for non-delivery. These requirements must be presented with time-bound, quantifiable and verifiable indicators.

• All projects should reconsider their relationships with the product delivery agents and extend their connection with end users by increasing involvement with delivery agents.

• Frequent reference to the deployment of outside experts in the project analyses should be considered integral to BIP strategy through to the end of 2014, and beyond.

• BIP should take an entrepreneurial approach to pursuing stated goals for all active projects (irrespective of whether the primary delivery agents are public, private, government, NGO, formal, informal sector), consider a range of opportunities for collaboration and joint funding, and not get locked into a set of specific "approved" pathways: one of the hallmarks of the effective entrepreneur is flexibility.

• Facilitation of the development of service providers for P2, P4 and P5 should be considered a priority, and a strategic plan should be developed to maximize the proliferation of these technology and IP packages. A presence at the 2014 EMRC Agribusiness Forum should be considered as part of this strategy.

RECOMMENDATIONS FOR CREATING AN IMPACT PATHWAY-DRIVEN BIP MODEL

- Using feedback from all parties, a program description should be developed, reviewed, discussed and finalized as soon as possible so that "connections" between the current phase and the next phase can be defined and current impetus exploited.
- A transition plan, based on an agreed approach, should be developed that describes a pathway for each high potential project.
- The entire BIP management structure (PMO and TAC) and the various management processes should be revisited and modified to reflect increasing involvement, over time, with the private sector, and a transition to greater focus on entrepreneurial activity, maximizing impacts, and taking advantage of what may be narrow windows of opportunity.
- Sweden's proposed role through Sida funding as a supporter of business incubation should be carefully developed and a plan evolved that will take advantage of existing investments (e.g., relationship with incubators at NMU[9] and Makerere, potential alliances with other programs and/or donors, role of social investors).
- The role of business and innovation centric facilitators to accelerate the rate of incubation and to guide businesses towards outside investments should be stressed in any such plans

[9] Should this emerge from its start-up phase as a viable partner.

5 Recommendations for the Design of the Next Phase

DEVELOPING A PRODUCT-DEPLOYMENT-DRIVEN MODEL:

MATCHING MARKET OPPORTUNITIES WITH PUBLIC SECTOR INNOVATION CAPACITY

While some of the BIP projects are developing promising demonstrations of technology deployment potential, the program has been largely science-driven. Analogous agricultural development programs have been most effective at delivering a positive impact on rural farming communities when they are demand-driven[10], and we propose that the next evolution of BIP tap into private sector expertise with its understanding of markets, end-user needs and outside financing capacity. In this context, we are not alluding to the importance of a thematic area within the regional priority setting agenda acting as a driver of demand. We believe that there must be tangible demand in the target market that will drive the pipeline whether that be through public, private, formal, informal, international, national, government or commercial delivery agents.

For example, when we hear from project partners that the biggest constraint to a given project is farmer demand, and that more effort must be put into farmer sensitization programs, we conclude that the product development in that project has not been 'market-demand-driven' but rather 'development-agenda-demand-driven'. We have recognized that the BIP portfolio is well aligned with the regional development agenda needs as articulated in the AU-NEPAD-CAADP. As such, the targets of the program can be considered as high priority and demand-driven at this level. However, in the context of the BIP framework for driving research through innovation to impact, individual projects must become highly demand-driven from a market-pull perspective.

[10] e.g., Hope Project introduction and adoption of improved sorghum varieties in Tanzania driven by demand from brewers for consistent and high quality grain.

For projects to successfully create effective innovation systems capable of progressing to sustainable and scalable pathways to impact, they must be market-driven, even if those target markets are new market creations or growth market expectations. We often hear about technology companies creating new markets that appear to be entirely technology-push. However, these are generally based on substantial market research and long-term experience at the leading edge of the market. Researchers should not imagine that there are realistic opportunities for short-cuts to such successes based on a purely science-driven or purely development-driven strategy. The most assured route to achieving sustainable and scalable success is for projects to develop balanced and effective partnerships between the technology developers and the product deployment agents. On this basis, project members will then be able to iteratively brain-storm on the relative balance of the critical success factors from diverse perspectives: in particular, what is possible with the technology, what is desirable to the end-user, and, what is viable in the 'market'.[11]

The program has already identified several PS entities (e.g., Real-IPM, GTIL, Trufoods) that could be the source of ideas for innovations that are informed by a knowledge of the relevant market, are consistent with Sweden's goals for funding through Sida, but for which the PS actors do not have the necessary resources for the development of appropriate technologies. Conversely, P4 and P5 are creating new service business opportunities, and if companies cannot be found that are interested to move into this area then either the delivery strategy, the financing structure or the technology package should be reviewed.

In the proposed new model, Sweden's funding through Sida would invest in a mechanism that facilitates and nourishes the concept of partnership between the regional science community and the product deployment agents (including the private sector). Moreover the design of the next phase would be based on addressing all the major lessons learned from Bio-Innovate and Bio-EARN as this will enable the BIP to evolve a blended and flexible investment program tailored the specific needs of the best opportunities as and when they arise and evolve.

We propose that the PMO brings together public sector innovation teams and product deployment actors on a regular basis to interrogate innovations and investigate opportunities that have evolved from observing end-user needs and market trends. This would provide the PMO and the TAC with horizon-scanning information regarding promising opportunities from both science-driven and market-driven perspectives.

[11] 'market' here relates to any formal or informal, commercial or not-for-profit collection of end-users

When promising matches are found, respective teams would be provided with modest proposal development grants that would then be externally reviewed and screened through a similar process to that applied in the current phase. However, since these would be commissioned grants, the PMO would have full powers of influence and facilitation to ensure that teams have access to and are influenced by the right profile of expertise and information.

Where all appropriate preparations fall into place in the right timing, these facilitated bids could then apply through the next call for proposals. However, where promising opportunities failed to finalize some aspects of a business case, the BIP should have the opportunity to provide small commissioned start-up grants to enable these consortia to make some progress ahead of the next competitive call. Small one-year commissioned start-up grants could also be used where the PMO is uncertain about the strength of the consortium leadership, thereby providing a period of evaluation prior to decisions regarding long-term large-scale funding.

This approach would enable the BIP to move away from the constraints of having to make large batches of competitive grants, yet retain the benefits of an open competitive call for proposals. If Sweden can commit to 7-10 years of funding for the next phase (rather than 5 years) then the matching and proposal incubation period could be extended to a longer period (perhaps the first three years) and the BIP could move to a rolling approach of making grants when opportunities justified investment (over the first five years).

The program would need to start this horizon-scanning and matching process during the last year of the current phase. The PMO might then have a moderately sized competitive call in the middle of every year for the first five years (if a 10 year funding commitment is obtained). However, the program should not plan to commit more than 60% of its funding base through competitive grants. On this basis, the program could assign 20% of its funding base to commission proposal development and start-up grants. In addition, the program would hold back 20% of its funds for the unplanned needs of high potential projects during the last three years of the 10-year phase.

The program must institutionalize the culling of poorly performing projects, which will liberate additional funds for new grants or augmentation of existing grants. This will of course require Sweden’s funding through Sida to adopt a much more flexible approach to financial planning and program accounting. In addition, the PMO should be constantly attempting to attract additional parallel funders and investors. As these come on board, the scale and scope of subsequent competitive calls for proposals will need to be adjusted.

In the next phase, all PS partners must provide some level of cash co-financing, and commit the time of a senior manager to play an active role in the overall management

of the consortium. Processes must be put in place (and their effectiveness routinely monitored) to ensure that there is a balanced partnership between public and private sector partners, and that the expertise and experience of the private sector partners is utilized in the consortium decision-making process. In general, the PS probably has a greater sense of urgency, cost efficiency and product-orientation than the academic community, and must be empowered to leverage those skills for the success of the project.

The program would be designed in such a way that entrepreneurs who had not yet started a business could, under certain circumstances, participate. But the business incubation role would be out-sourced to existing incubators at key universities. The emphasis, however, would always be on the development and delivery of new products and processes that provided regional economic benefit and had measurable impact on food security and rural incomes and/or on the environment and/or climate change mitigation.

BIP was of course an evolution from Bio-EARN, and projects with this heritage have naturally dominated the program. In the next phase the scope of the program could be substantially broadened so as to attract a much wider spectrum of science providers as well as innovations from other research areas such as livestock systems, agri-processing and farm mechanization. The former category would open up opportunities for real and meaningful collaborations with ILRI[12], and the latter would both broaden the BI "community" and directly address productivity issues that have not received the same level of attention from donors as crop research. By way of example, a simple, low cost and very smart peanut sheller, which was developed in Malawi, has had measurable impact on the seed sector and delivered subsequent benefit to small farmers.

The unique selling proposition for this approach is that, from the first phase, the BIP program has gained a great deal of experience in identifying the "right" collaboration model and pathway to impact for a wide range of technology-market opportunities. The next phase can build on this experience and credibility to incubate selected projects for sustainable and scalable impact on a regional level.

Engaging agribusiness entrepreneurs: In discussing this type of approach with a small number of project partners and TAC members, several interviewees asked how we would propose to communicate with the PS and how we would identify appropri-

[12] This would enable the BIP-ILRI relationship to develop in the direction that Sida wishes it would.

ate entrepreneurs. The clearest pathway is through EMRC which hosts an annual African AgriBusiness Forum where entrepreneurs can meet up with banks, investors and potential collaborators[13]. Sweden could provide co-sponsorship through Sida for the next Forum (along with Rabobank, AECF and others) and announce the launch of the next phase of BIP in EMRC's advance promotional material. PS actors with proposals would be asked to submit a short concept note in advance of the Forum. These would be assessed and those of interest would qualify for a meeting with a BIP representative at the Forum. This would act as a short cut to the selection process and enable BIP to gauge leadership skills, vision and commitment in addition to the quality of the underlying proposal. The PMO would make a keynote presentation at the Forum, describing the next phase of the program. If this proposal is considered by Sida and the TAC to have merit, we recommend that the program manager attends the next EMRC Forum in June 2013 in order to become acquainted with the workings of the event and to start exploring the concept with participants and organizers.

This type of approach would enable the next phase to avoid some of the constraints of a traditional competitive grant call by having some early stage commissioned grants. The next phase of the BIP must also use more aggressive contracting methods to leverage performance and rapidly terminate under-performers.

BIP has only scratched the surface of the public-private science-innovation-commercialization nexus. The key to our proposed next phase is to widen the funnel of opportunities, to increase the proportion of successful matches, and to intensify the process of selecting the best teams with the most innovative and highest performing concepts for development impacts. We believe that multi-sector inter-disciplinary teams have a higher probability of generating step-change innovations for complex challenges than single sector efforts. This is the high potential niche on which BIP can focus its future funding and expertise: providing a unique blend of rigorous private sector processes with strong indigenous science and innovation.

Partnering with other types of agents of product deployment: The lines seperating "development" and "investment" have blurred considerably over the past ten years and, by way of example, both USAID and DfID have made "investments" in vehicles designed to stimulate social enterprises that support more traditional development

[13] EMRC objectives: To create the optimum environment for the matching of sustainable business partnerships; encourage public-private partnerships (PPPs); attract new investment to the African continent by improving the dialogue between sectors; promote local, regional and international trade; mobilize innovation towards industrialization in Africa; stimulate knowledge sharing and capacity development.

agendas. At the same time, multinationals are engaging in non-traditional activities such as SAB/Miller's development of cassava supply chains in Mozambique and Mars Corp's focus on cacao supply chains in West Africa. As the BIP evolves it will be in an increasingly strong position to leverage support (which might come in many different forms) from a wider and larger choice of partners. In addition to developing an understanding of the opportunities, it will also be increasingly important to be more aware of how the BIP agenda, and specific projects, can take advantage of synergistic opportunities.

Continuation of existing projects: It is expected that the projects with the greatest potential from the current phase will be selected for continued support in the next phase. On this basis, existing projects have around 12 months to refine and validate their pathways to sustainable and scalable impact on a regional level.

Moving away from a competitive grants system: The competitive grant-making process is and was integral to the design of the BIP. Without elaborating on the benefits (or the downsides) of this methodology, moving to a model that is more demand-driven will inevitably need an adaptation of the traditional grant-making approach.

Improving reporting efficiency: The style and format of many of the progress reports confounds an understanding of who has achieved what in which period. Sometimes it is not clear which outputs were achieved through BI program funding versus prior or parallel projects. This has created a smoke screen to effective monitoring and management. We strongly recommend that the PMO shifts to a space delimited template for progress reporting that is specifically structured to highlight key time-bound and quantified milestones, outputs and outcomes.

Co-funding: The direction described above will, we believe, be of real interest to other donors. The two environmental projects will, if promoted, also attract attention from environmental groups that have an interest in African development. This has the potential to generate added value to both projects, especially around promotion of the technology packages and service providers by aligned third parties.

Co-financing: It is too early to explore the options, but it is common knowledge that both traditional and non-traditional investors are looking to Africa to provide investment opportunities as the economic climates in both the USA and EU remain anemic. Although many of these are looking for levels and speeds of return beyond what the BIP projects could achieve, some of the BIP projects may be of interest to social in-

vestors[14]. Social investors seek a balance between economic and social or environmental returns. By way of example, the Gatsby Trust (the UK based Sainsbury family foundation) established Aquifer Ltd. to make social investments in the Mozambican agricultural sector. A total of $40 million was invested in building Mozfoods, its seed company Mozseed and MIA, its vertically integrated rice production and marketing company. The P5 Water and P7 Bio-control projects look particularly promising in this respect.

Media: While BIP's web site is well designed and highly informative for peer-to-peer exchange, the PMO should consider the benefits of launching a blog to support the ongoing evolution of the regional science/R&D community and to encourage ongoing dialog between scientists and the PS. We have suggested (above) that BIP support the design and production of short videos that would be used to promote adoption of the Water and Waste technology packages. We also propose the production of a longer video, which would document the evolution of Sweden's investment in this area, from Bio-EARN through BIP and on to the proposed new phase. There is an opportunity here to document a visionary process that, over time, has the potential to generate cost-effective, long-term sustainable impact in the region. This can be used to inform the donor community but also as a mechanism for attracting co-funders of the new program.

[14] The term "impact investing" is gaining currency, but the precise definition of this is a moving target.

6 Annex

6.1 APPENDIX A: DETAILED ANALYSES OF SELECTED PROJECTS

P1 GRAINS

Consortium structure: We are concerned about the lack of breeding expertise to frame biotechnology research goals in this project. For example, even though ICRISAT is a partner there are no ICRISAT breeders directly involved in this project (probably due to budget restrictions). In addition, we were recurrently faced with significant uncertainty regarding who was a formal partner in this project (as opposed to who was collaborating and using funds from other sources). Although this was probably a compromise forced by budget restrictions, it seems to have further diminished the inter-disciplinary synergy within the consortium.

Thus, those who should be driving strategic decisions (crop breeders and delivery agents) appear to have only a very distant role in the project. Similarly, there is a lack of evidence of real demand from breeders for the target molecular breeding tools, and no clear cost-benefit analysis to stimulate uptake by breeding programs. Although the associated breeders may have research students working on genomics projects, we are not aware of any that are routinely using MAS in their breeding programs, and no information is presented to indicate the probability that these markers will be adopted by the breeders, even if they can be shown to provide good power of selection. Moreover, mistakes in experimental design appear to have limited the degree to which expected research outputs from the finger millet diversity analysis will be readily transferable between programs.

Pathway to impact: Participatory landrace selection does provide an opportunity for rapid delivery direct to farmers. And the proposed village-based seed multiplication for smallholders using local micro-enterprises does provide some level of demonstration of this delivery pipeline. However, the current scale of operation is very low and we believe that this approach is highly constrained in terms of scope and sustainability of scale-up, unless the project can cultivate a large network of passionate entrepreneurs and NGOs to proliferate these products through local micro-enterprises and informal seed systems to reach hundreds of thousands of farmers, as appears to be well underway in the P3 Beans project.

Pathway to commercialization: We understand that other breeding products will be entered into national variety testing processes, which clearly offers the opportunity to engage in detailed discussion with seed companies to formulate potential scale-up and scale-out plans. In these cases, we encourage the consortium to establish strong partnerships with a number of seed companies for both crops in each target country.

The analogous development of sorghum and pearl millet in India over the past two decades shows that hybrid varieties can offer the potential to kick-start an entire industry based on these coarse grain crops. Several Indian seed companies are already expanding into West Africa with hybrid sorghum. We encourage the CPL to seek a private sector partner from India that could bring strong market-driven experience to this project. This type of partnership could be facilitated by one of the ICRISAT breeders based in India.

Relevant prior and parallel work: There is a substantial body of work on the proposed target traits in sorghum from research and breeding groups in the USA, ICRISAT and Australia etc. However, there is insufficient evidence that this project has been built on lessons learned from those groups and/or is actively filling the gaps between these projects. We encourage the P1 Grains team to access prior and on-going research outputs through collaboration. We also recommend that the PMO and respective CPLs foster greater interaction between P1, P6 and P7, which could yield important synergies.

Evaluation and improvement of sorghum and finger millet germplasm
The participatory selection of sorghum stay green varieties is based on progress made during the Bio-EARN project, which screened around 500 sorghum landraces to identify better sources of this trait. However, the best selections being presented to farmers for selection have not been screened for deleterious pleiotropic traits, which is potentially the greatest constraint to any new source of this trait. This is a fundamental omission that may present a major road-block to future developments during the scale-up phase, as indeed it had for ICRISAT sources of stay green.

There are some promising results from phenotypic selection of sorghum landraces for Striga tolerance, but these need to be validated in multi-location trials and seem to be largely satellite breeding activities. We recommend that the CPL makes stronger efforts to connect breeding efforts in the same crop across organizations and countries.

Developing blast resistance and drought tolerance research and breeding programs in finger millet requires a large long-term investment that we believe is inconsistent with the BIP. New variety selections from P1 activities are not yet entered into variety registration trials. The project is currently pursuing a direct farmer contact model for deployment of new germplasm, but as mentioned above this must be substantially scaled-up if it is to achieve significant impact. In addition, government restrictions on germplasm exchange in some partner countries have apparently reduced the scope for exchange of material for breeding purposes and significantly reduced the value of

multi-location evaluation trials. This has, in turn, limited the level of regional impact from investments in this project. Moreover, it is unclear to what extent this work complements, synergizes or duplicates prior and parallel projects funded by McKnight and BMZ etc. Finally, although it is clear how the outputs of the diversity analysis will drive future research efforts, there seems to be no clear plan regarding how these results will be used in breeding programs, and certainly no clear plan to do so during the life of this project, and (due to mistakes in experimental design) limited options for sharing findings across breeding programs in different partner countries. We recommend that the P1 Grains project makes all possible efforts to learn from the success of the P3 Beans project in many of these areas.

Development of genomic tools for sorghum and finger millet breeding
Diversity analysis, candidate gene identification, association mapping and comparative mapping are each in themselves substantial long-term basic research goals. We recommend that the P1 team immediately pursue a detailed cost-benefit analysis of the use of markers in breeding programs, and economic feasibility analysis for those breeding programs to adopt such a technology intervention.

The stay green trait is theoretically a good candidate for marker-assisted selection as breeders find it difficult to select for the trait using phenotypic evaluation as the methodology is highly complex and time consuming. The project has created F2 mapping populations for mapping this trait but will now need to spend several years creating RIL populations in order to accurately map this complex trait. It is unrealistic to expect that adequate quality of data for mapping this complex trait can be collected from phenotyping F3 families. In addition, we understand that there have already been serious problems with the drought phenotyping and with screening the diversity panel for blast resistance. In addition, there are no parallel activities by the breeders to develop half-sib and/or backcross breeding populations for validating any markers identified from this mapping activity. Without such studies there is no way to demonstrate the power of selection of the candidate markers within or beyond the life of the project. Breeders will not commit to the use of such markers until multi-generating validation is available.

The activity to develop cDNA libraries in order to identify candidate genes for target complex traits is still at a very early stage (RNA extraction). We question the appropriateness of such strategic research activities in this program, which do not appear to have been included in the original research plan.

Biocontrol of sorghum chaffer and finger millet blast: The sorghum chaffer work is based on over a decade of research on attractants and bio-control fungi through previous Sida/SAREC funded projects. These have provided the foundation for a highly innovative and elegant ‘lure and kill’ package. This work is now ready for pilot testing, and the team would greatly benefited from interaction with the P7 Bio-control project (particularly Real IPM) during this phase.

The main flaw in this component of the project is the absence of any economic analysis for product development. Although some innovation on developing low cost alternatives to expensive Japanese (imported) traps has been carried out, there has been very little business-related cost analysis of other components of the package. For example, the current best bet attractant appears to be a relatively expensive fine grade chemical, so the team should investigate the feasibility of using cheaper mass-produced alternatives with analogous effects. In addition, there is an absence of any detailed market analysis or convincing ex ante economic analysis. There is anecdotal evidence of its increasing importance in Ethiopia since the early 1990s, but this needs to be quantified in detail. In addition, we understand that the same species affects other crops across the region, such as sunflower, banana, orange and safflower etc. There is also an urgent need to evaluate the readiness of farmers in chaffer-affected areas to pay for this technology. We recommend that these analyses are carried out within the next two months so that the prospects of national and regional commercialization of the technology can be fully assessed.

We understand that there is a fungal biocontrol registration process in place in Ethiopia that requires independent efficacy validation, which will take at least one year. Initiating this registration process should be made a top priority.

We have linked Emiru Seyoum (Addis Univ – not listed as official partner but actively involved in the project) to Henry Wainwright (Real-IPM) to discuss potential collaboration including on a preliminary market assessment.

Sorghum and finger millet marketing and value chain analysis: We recommend that activities in this area are intensified, broadened, and fully aligned with the expected outputs from the rest of the project. However, we understand that there may be complementary activities ongoing in the ICRISAT-HOPE project that overlap with some or all of the P1 project activities in this area. It is urgently required that the CPL rationalize this part of the project in close collaboration with other parallel initiatives in the region. RESTART

P2 CLONALS

Project development: We understand that the P2 Clonals project resulted from a decision by the TAC and PMO to request at least three separate teams (who had submitted competitive concept notes) to formulate a single integrated proposal. As with the P1 Grains project, this approach left the consortium struggling to establish a coherent plan and an integrated team. In addition, the project has been constrained by a lack of entrepreneurial input and/or insufficient empowerment of strategies from established PS partners. The consortium has also struggled to establish functional col-

laboration across countries and capture synergies across crops. Since each of the partner countries seems to have complementary weaknesses, the project has missed an opportunity to collectively create an action plan that is more than the sum of the parts. Moreover, the inevitable and significant reduction in budget forced by the merging of concept notes, led to some highly relevant and important activities being dropped. Most notably, the cassava added-value activities were dropped, that could have helped drive the all-important farmer demand for clean planting material in this crop. Although in the absence of this activity, no attempt has been made to link to other cassava market development initiatives on-going in the region. The activities in this project are largely operating in parallel while many of the objectives are far too ambitious in relation to the available budget. Finally, there appears to have been little attempt to establish quantified production targets on which to base scale-out strategies.

Consortium structure: We have observed a lack of entrepreneurial oversight in this project that has led to insufficient PS partner participation and, as a result, the project has not been able to design and test a progressive P2I. A viable P2I would have established functional partnerships with several delivery agents for each crop in every target country. If this was to include start-ups, they needed to have been driven by aggressive production targets from the outset of the project. We do not believe that public sector hosting is an appropriate way to stimulate scale-up in this sector. The emphasis on this approach has led to an inappropriate imbalance in the capital investment strategy of the project, and insufficient linkages with prior and parallel activities. The reviewers of the proposal *explicitly* identified or alluded to many of these issues and, had these flaws in the vision been recognized at the proposal formulation stage, they could have been addressed.

End user-driven approach

In order to develop a viable P2I the project needed to take a more demand-driven approach to stimulating the development of clean planting material seed systems, and should have adopted an "engage the market and work backwards" model. The successful case of SAB/Miller's cassava beer, Impala, in Mozambique and the impact that this has had on small farm income is a new driving force and an example of this approach. During Year #1 the brewer bought 2700 tonnes of cassava from 500 small farmer groups. Similarly, the introduction of DADTCO's mobile cassava processing machinery[15] into Nigeria and Mozambique (driven by SAB/Miller demand) has played a major role in creating new markets (e.g., chips, flour) for cassava. With a pipeline to market established, it is then easier to orchestrate technology interventions

[15] Packed into a 40ft shipping container, this $1m machine cleans and processes raw cassava and outputs a paste that has a 3 month shelf life.

such as the use of clean planting material. This type of innovation was included to some extent in at least one of the concept notes but got lost during proposal development. However, to be successful the project needed a series of passionate entrepreneurs to build micropropagation services for each crop in every target country. Only in this way could the consortium hope to build a foundation for substantially scaling-out the model in the next phase. Under the current project structure there is a real danger that many advances made to date will struggle to survive between the end of the project and the beginning of a next phase.

Many of the commercial micropropagation success stories in Africa established their businesses off the back of contracts from development projects and then gradually built the majority share of their business serving the needs of farmers directly: for example, through IITA and CIP for GTIL, and through HarvestPlus for BioCrops. Although the P2 consortium may have played an important role in linking HarvestPlus to BioCrops, there has been a lack of parallel efforts to link private sector partners (and prospective partners) to other major development projects in the region. Traditionally many of these development projects were coordinated by CGIAR centers and NGOs, but more recently governments in the region have also started to fund large-scale programs for individual crops. There is a tremendous opportunity for the P2 CP to proactive leverage public sector procurement budgets to drive the establishment and expansion of micropropagation companies in the region. However, in addition, transitional plans to gradually move to more diversified and sustainable customer profiles must be implemented at the outset to ensure sustainable growth of individual companies and the industry as a whole, as governments (and development agencies) move away from direct support to embrace the use of policy frameworks to drive developments. The P2 Clonals project has a unique opportunity to play a pivotal and leading role this nexus, however, it will require a substantial level of proactive networking and entrepreneurial opportunism.

Both of the private sector partners in this project believe that farmers understand the need for clean planting material and that demand is not the primary constraint for scale-out. In contrast, some of the public sector partners reported that initiatives to build awareness among farmers were critical to demand creation. The perspectives of the commercial partners, who are closer to the end user, should be given priority in strategic planning.

Economics analysis of private sector scale-up and scale-out: Genetic Technologies International Ltd. (GTIL) in Kenya has established a well-optimized medium throughput micropropagation facility (> 250,000 units per year). It is unclear what added value the BIP project has brought to this partner to assist their scale-up (beyond facilitating access to public information and public germplasm). It seems that GTIL has substantial business experience in optimizing cost structures, but that this expertise has not been harnessed by the project to help drive the development of an economic cost analysis for increasing production across crops and countries. In addition, we understand that the establishment of BioCrops was substantially assisted by the

Dutch NGO BiD Network which helped them develop their business plan. This seems to be a clear model that the PMO might have attempted to emulate or access through collaboration, in order to assist the growth of nascent business partners in its projects. Similarly, the project should have supported aeroponics fabrication companies that could play a major role in driving the scale-out of this technology based on the technical expertise of the research partners to identify optimum sites, promising teams and tailored methodologies. These are the type of opportunities that a progressive P2I should have harnessed.

Government Policy: The regulatory environment is a powerful driver for the clean planting material market, as recently seen in Kenya for potato, although it is clear that this is in itself heavily influenced by the end market for the produce, i.e. chips in Kenya. This is an area where the BIPCEA team could have been playing a major role in the assessment of existing regulations, level of enforcement, foresight regarding probable changes in the near future, and advocacy activities to encourage target countries to follow exemplary developments by other countries in the region (for example, the Rwandan government's 2012 investment in nearly one million micropropagated sweet potato cuttings). In addition, the project needed to have developed a strategy for cassava, which seems to be experiencing the greatest level of combined constraints to scaling-up the adoption of clean planting material.

Meta-analysis of regulatory issues pertinent to each crop in all the target countries would have been a great help to those developing and refining the vision for this project. This remains an urgent task for the BIPCEA team. It is notable that the USAID-funded CIP-authored road map for seed potato in eastern Africa 2011 includes such a meta-analysis for potato in all five of the target countries of the P2 Clonals project (Table 3.2, page 24) – from which it is immediately clear that Kenya is the leader in the region in terms of regulatory support for clean planting material of potato, followed by Rwanda and then perhaps Ethiopia, whilst Tanzania and Uganda are significantly trailing.

Aeroponics: The use of aeroponics for potato micropropagation is perhaps the most exciting aspect of this project, given the very large potential increases in multiplication rate and dramatic reductions in cost of planting material to farmers. As the cost of planting material represents such a large proportion of the total production cost, this technology has the potential to have a significant impact on potato farmers. Consequently there has been considerable interest in commercial use of this technology in Asia and Latin America over the past decade. More recently CIP has been actively promoting the system in Africa, and KARI has developed a major program based on it in Kenya. From this experience, many important lessons have been learned and disseminated. For example, temperature sensitivity, dependence on constant energy supply and need for specialist training of staff operating the facility are all well established, and should be the framework for selecting optimum locations and partners for scale-out of this technology. For example, south-west Uganda provides a promising location in terms of climate and intensive potato farming. However, the necessary

local infrastructure and the required level of technical expertise amongst the relevant entrepreneurial community suggests that this is not a prime target. Instead, this location is likely to be better suited to the needs of screenhouse based sweet potato vine propagation, where BIP capital investment and P2 research partner expertise (in vector control and virus screening) may be able to resolve critical gaps for this type of start-up. Although clearly a detailed economic analysis and market assessment should be carried before proceeding.

Aeroponic systems had been established in the PS partner in Kenya and the public sector partner in Uganda prior to the initiation of the BIP. However, at the time of the review there was still no clear strategy regarding the P2 project's strategy for using this technology. We understand (pers. comm. Samuel Kyamanywa, interview) that the Rwandan government is heavily investing in aeroponics for potato micropropagation, but it is unclear how this situation is being leveraged for the overall benefit of the P2 Clonals consortium. The aeroponics aspect of the project seems to be suffering from a lack of strategic and business-orientated leadership, resulting in a lack of vision regarding how to stimulate the scale-out of this technology. In addition, there also appears to be insufficient interaction between those working on this system within and outside the project.

Aeroponics is not appropriate for cassava and unlikely to provide the same level of gain for sweet potato (compared to optimized vine propagation). In addition, the current market value of these two crops may be insufficient to drive capital intensive approaches. Thus, this approach appears to be very much a standalone activity for potato, and BIP investment devise ways of bringing added value in collaboration with other programs in the region that are focusing on this technology.

Regulatory support: The newly introduced regulatory framework for clean planting material of potato in Kenya will substantially stimulate the micropropagation industry in that country. The pest and disease status of material is tested by KEPHIS and a large number of propagation companies have been registered following the government's realization that public sector organizations will not be able to satisfy demand. It is hoped that other countries will follow a similar approach for potato and sweet potato. However, the BIPCEA team needs to research the underlying prospects in detail and where appropriate launch advocacy campaigns. The situation for cassava is clearly less well developed due to inherent issues related to the crop and less well developed high value markets for the product. However, that situation is rapidly changing and the potential gains are as great or greater than for potato or sweet potato. We recommend that the P2 project increases emphasis on cassava through proactive opportunistic alliance building with on-going cassava market development initiatives across the region.

IP Management

We understand that the consortium agreement covers ownership of IP generated by the project, but not necessarily the IP brought into the project. There is a considerable amount of IP being brought to this project as improved germplasm from NARS and CGIAR breeding programs, and the CPL must prioritize a careful IP analysis of the material being moved around within the consortium.

Capital investment: We have serious concerns about the strategic value of many of the investments in facilities which have been made by this project. It is not clear that the capital investments at BioCrops have enhanced their business model. The academic partners in this project (as with all others projects) were not well skilled in negotiating with the private sector regarding these investments and appropriate levels of PS partner matching funding. Conversely, the development of facilities at the public sector locations is not the best approach to stimulate this industry.

Conclusion: Although there are many flaws and gaps in this project, we believe that the overall goal remains a very valid target for BIP investment. We recommend that the PMO invests in mechanisms to help the P2 Clonals community improve their strategy and tactics. With a stronger approach we feel sure that the community will be able to attract substantial financial support that will in turn enable them to greatly enhance their regional impact.

P3 BEANS

Project development

This consortium did not evolve from any Bio-EARN projects but greatly benefited from most of the partners having previously worked together within the regional Eastern and Central Africa Bean Network (ECABREN, created twenty five years ago). The network is coordinated by CIAT, funded by Sweden through Sida together with DFID and SDC, and claims to have facilitated more than 50% of the bean cropping area in Eastern Africa to adopt improved varieties. The network generated a substantial pipeline of new varieties prior to the inception of BIP.

The Kenya example

There are many reasons for the success of the Kenyan portion of this project including:

• Trufoods approached UoN well before the start of BIP, showing good intent by sending their agronomists to evaluate UoN material;

• Trufoods built-up goodwill early in the project by helping the university set-up their pilot plant;

• a successful and highly motivated PS partner with an excellent distribution network whose R&D was, in effect, paid for by Sweden through Sida;

• a highly motivated and entrepreneurial CPL with good leadership skills and a tight focus on deliverables by the Kenya team;
• use of old varieties to build the seed systems pending release of newly developed targeted varieties;
• The Trufoods business model is focused on reducing production costs, competing in a crowded market and improving both quality and consumer benefits (e.g., reduced cooking time and product cost).

The fact that Trufoods is importing large quantities of beans from Ethiopia suggests that there is an opportunity for improvements in local production to displace international imports. This might appear to have limited net gain for the region, in fact exports from Ethiopia to Europe are unable to support demand, so there is clearly scope for scale-up of production across the region. Although the cost remains a primary determinant, Trufoods current import strategy is based more on issues of reliability of supply than quality product. Trufoods prefers to work directly with local producers so they can control the quality and availability. For this reason, they will contract smallholders in Kenya to produce beans to a minimum standard in return for a 30-40% premium, and will provide the required seed and inputs. The new canning varieties from KARI will only be provided to farmers contracted to produce for Trufoods, and similar arrangements are being established with Del Monte and Premier Foods in Kenya. This is clearly the beginning of an important contract business for KARI.

Regional collaboration
There are four breeding programs in Kenya, Ethiopia and Rwanda that are sharing material related to the desired canning traits. This is a major achievement in comparison with the other crop-based projects, and reflects the type of regional collaboration BIP is striving for. We understand that germplasm exchange is on a simple PBR-style arrangement, but we recommend that the P9 audit of intellectual assets carefully study ownership of this germplasm.

Regional impact
This project suffers from a flaw in terms of its strategy to achieve regional impact and has not leveraged the regional dominance of Kenya's canning industry for the benefit of other countries in the consortium.

Ethiopia is by far the largest bean exporter in the region, followed by Uganda and Tanzania. A large proportion of this is for the canning type of beans, and this market has increased by an average of >10% per year for the last decade. Export is to Europe, the Middle East, Asia and elsewhere in Africa, led by international companies from Italy (ACOS), UK and Turkey. These agricultural commodity trading businesses have made large investments in Ethiopia but only to export fast cooking bean varieties as dried beans. Clearly these companies clearly do not want to establish canning facilities in Africa as this will unnecessarily inflate their shipping costs. However, there is huge potential to capture more of the profit margin locally by carrying out the added-value canning of the beans in Ethiopia for sale across the region.

Since Tanzania has three canning companies and Uganda has at least one, these countries are to some extent ahead of the curve compared to Ethiopia. There has also been an interesting development in Rwanda where they are pre-cooking and sealing beans in foil packets as a cheaper alternative to canning. We believe that the P3 Beans project should strive to devise a plan to stimulate the bean value chain in all four of these countries based on strategies tailored to each country.

Although Trufoods was asked for input on criteria for canning, the consortium seems to have missed the opportunity to leverage Trufoods expertise when designing a plan to stimulate the industry in other countries. The project currently has a heavy reliance on participatory farm selection and NGO delivery partners in target countries. Although an impressive network has been established to reach over 200,000 farmers, we believe that this approach will soon become limited in terms of sustainability and scalability. The creation of cooperatives and stakeholder platforms linked to seed companies and industrial processors has merit. However, we recommend that the project proactively devises an innovative and effective approach in collaboration with local seed companies which can be pilot tested during the remainder of the project.

Disconnected research activities

The project includes an array of research activities that are individually quite justifiable. However, there is a lack of interconnection between these research activities both in collaboration during implementation and in integrating the subsequent pathway to uptake and impact.

Progress towards Objective 1 (selection of canning bean varieties) and Objective 4 (strengthen bean value chain) in Kenya seems to be excellent with an exemplary relationship between Trufoods and UoN. In contrast, in Ethiopia the proposal suggested a systemic interaction with ACOS, but at the time of the review there was no clear indication of their significant involvement. In addition, progress in meeting the other objectives by country targets seems to be highly variable and fragmented.

The goal of developing improved, well adapted canning bean varieties tolerant to major biotic and abiotic stresses appears to have become highly fragmented, and it was not at all clear that all the elements would be brought together before the end of the project. In addition, the objective of developing agronomic management practices to enhance yield and nutritional value appears over ambitious.

Demand

Canned beans are more expensive than dried beans, and increasing local demand for processed foods is a reflection of the growth of a middle-class. Kenya, and particularly Nairobi and its urban perimeters, has seen a dramatic growth in its middle class over the last decade when compared with cities in other target countries. The trend is, however, noticeable in both Kampala and Dar Es Salaam and the proposed bean workshop should include some attention on projecting how demand for processed

foods, and beans in particular, might be expected to grow over the next five years. If available market research data indicates that demand for processed food is increasing in some or all of the other countries, there will be more of an incentive for local canneries to invest in meeting this projected future demand. However, the workshop must include representatives from the canning industries in each country so that the consortium can fully understand the nuances in their perceptions.

P5 WATER

Kampala pilot

Sweden's support for this project through Sida could create resentment among competing local businesses or donor dependencies across the target industries. For example, now that the largest abattoir in Kampala has started to clean up its operation (made possible by the large capital investment from the BIP), some of the competition may have to shut down due to their inability to invest in similar facilities. The BIP program, and the BIPCEA team in particular, needs to work hard to make sure this promising project does not become a public relations problem.

We recommend that P9 CPL takes the lead on discussions to understand what help the Ugandan government can provide to other abattoirs and similar polluters in the next phase of this program, and what joint action can be taken to effectively raise water quality standards.

Design Flaws

The pilot facility at Kampala City Abattoir is suffering from a major design flaw that should be addressed. The wastewater treatment facility is processing only a small part of the total flow and therefore is having only a small impact on the pollution flowing into Lake Victoria.

In the current set-up, all waste from abattoir activities is washed into a channel that ultimately flows into the lake. Although the volume of the flow from the abattoir seems to have been calculated relatively accurately, the design of the treatment facility did not take into account that a major stream feeds into the channel upstream of the abattoir waste injection point. In addition, car-washing activities on this site also feed into the channel before the point at which the wastewater treatment facility extracts. As a result, most of the flow escapes facility processing.

We understand that since the time of the site visit for this review, the Ugandan team has already installed a pipeline to route the abattoir waste directly to the treatment plant within the City Abattoir site. This system remains to be validated and opti-

mized but clearly shows the motivation of this team to quickly resolve problems by developing innovative solutions. However, the team must collect accurate data on the proportion of the abattoir's daily discharge that is now being treated by the pilot facility, and the level of scale-up (and additional investment) that will be required to treat the entire daily amount.

In addition, the Kampala City Abattoir facility relies on most of the solid waste being consumed by the large population of Marabou Storks living in and around the abattoir. The current wastewater treatment design provides no alternative to this aspect of the process, but the large bird population creates a public health risk. Presumably, some sort of grinding step early in the pipeline together with a change in abattoir practices regarding the birds could resolve this issue. We recommend that this issue be investigated as a matter of urgency.

Legal Issues
We understand from website news articles that the Kampala City Abattoir Traders Development Association is subleasing the property from the former Bassaajjabalaba Hides and Skin, and that the local municipality is challenging this subleasing. We recommend that the CPL investigate this issue to confirm who has title to the facilities that the program has funded.

P6 ADDED-VALUE

Sorghum snack/health bar
This is still in the product development phase, and is not yet ready for mass marketing. In particular, the quantity of sticking agent (honey or sugar) needs to be optimized so that the product retains its structure during distribution while maintaining a broadly acceptable level of "crunchiness".

At the time of the review visit to Lisha Products Ltd. (Lisha) no product had yet been sold. However, predicted retail costs were one half to one third of competitive imported products. If accurate, this product concept holds promise. However, the group should carry out a thorough analysis to ensure that their pricing estimates accurate include all relevant costs.

Clear malt drink

This product is a non-alcoholic drink made from sorghum and/or millet and sold in plastic bottles. The origin of the concept is based on the rural counterpart sold in plastic bags and infamous for its lack of sterility.

The scale-up of this product by Lisha is challenged by seasonal availability and by the quality of sorghum and millet supplied for manufacturing, and Lisha is currently trying to create a farmer network in order to resolve these issues. They plan to offer premium prices to contract farmers in return for guaranteed quality and quantity. Lisha is also struggling to recreate the "original" (rural product) taste of the product which seems to be influenced by the more sterile and industrial process being used. Based on our interviews we believe this product is in trouble and needs the attention of a multidisciplinary team (perhaps working across countries). We recommend that the CPL is tasked to design a strategy so that appropriate actions can be taken over the next four months as it is imperative that Lisha be able to generate six months of data from full-scale production.

Meanwhile, Lisha has shifted to bottling fruit juices, which certainly provides very favourable profit margins, especially for mixed juice products. However, scale-up of this product may be constrained as they will be competing with some very large companies. Nevertheless, they *are* gaining valuable experience in operational and supply chain issues. Although this product is clearly out of the scope of the project proposal, this type of change must be expected when incubating start-ups. We recommend that the TAC and PMO develop a policy statement on how they wish to manage this type of issue now and in the next phase. Our perspective is that incubating start-ups should not be a major focus of BIP but that if it is justified, the PMO should provide strong but flexible support and management. At a certain point some start-ups may drift an unacceptable distance from the BIP vision and the association must be terminated.

Instant sorghum porridge for babies

We understand that the production of instant porridge has been effectively outsourced to Peak Value Industries who are already selling the product to local supermarkets in Kampala. However, having made this decision, the consortium should formalize Peak Value Industries as a partner in the project and ensure they leverage the expertise in this company for the benefit of parallel developments in other countries.

Uganda

Lisha Products Ltd. is based at the Makerere University, Department of Food Science and Technology, Business Incubator, which was established four years ago based on Norad and Rockefeller Foundation funding with Ugandan government support. The facility is very impressive and intensively used, and is clearly capable of self-funding its own capital investment program. They are currently in the process of buying a Tetra-Pak machine and a plastic bottle blowing plant. In addition, the Food Science and Technology Department runs a course jointly with the business school and about 5% of students go on to start-up their own businesses, often in the incubator. This

facility and its managers are highly capable on all levels, and the consortium should restructure their activities at this location in order to maximize synergy.

The roles of BIP and the incubator are heavily overlapping in the P6 Added-value project. In contrast, there is a gap in investment to help successful start-ups graduate from the incubator and set-up and scale-up their own facilities. Makerere University is hoping to establish a science park for this purpose. BIP would, however, be well advised to re-focus the P6 Added-value project on more downstream activities rather than duplicating the efforts of the incubator. We believe that this is an important shift in niche that the BIP should investigate during the coming 12 months, as it will provide important conclusions regarding how the next phase of BIP should interface with national incubators.

Tanzania and Ethiopia
We were not able to visit the PS partners in these two locations. However, the reports from the M&E process appear to suggest a similar set of issues to those highlighted in Uganda. In addition, there appears to be very limited synergy between teams in different countries; sometimes the target crops have been changed and it is not clear that activities in P6 are building on all the work done in this area by others, including in related Bio-EARN projects as well as research departments and institutes across Africa focusing on added-value activities for sorghum and millets.

Moreover, due to the lack of association with experienced businesses, there has been very limited market analysis, consumer preference analysis, demand-driven planning and supply chain design. Finally, due to the limited scale of operation of most of the PS partners in this project, it is difficult to see that the project will make a significant impact on small farm economies.

6.2 APPENDIX B: LIST OF DOCUMENTS REVIEWED

Bio-Innovate Program Proposal (2010-2014) – 29th January 2010 version.

Bio-Innovate Sida-ILRI Agreement - 1 February 2010 version.

Bio-Innovate First Call for Full Proposals – Instructions for Peer-Reviewers of Full Proposals – September 2010 version.

CVs for TAC members and project proposal reviewers.

Project documents:

	P1	P2	P3	P4	P5	P6	P7	P8	P9
Proposal	☐	☐	☐	☐	☐	☐	☐	☐	☐
Reviewers' comments	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jan-June 2011 report	☐		☐		☐	-	-	-	-
July-Dec 2011 report	☐	☐	☐	☐	☐	☐	☐	-	-
Jan-June 2012 report	☐	☐	☐	☐	☐	☐	☐	-	☐

Project concepts for some projects were accessed.

Bio-Innovate 2012 M&E Reports – Summary document 31 January 2013 version, and, individual project reports provided in printed copy.

Minutes of 1st, 2nd, 3rd, 4th and 5th TAC meetings.

Minutes of Annual Review Meetings: 26th May 2011, 12th July 2011, 10th & 18th May 2012, 15th November 2012,

Minutes of Annual Planning Meetings: 14th January 2011, 22nd November 2011,

Bio-Innovate website documents.

Publications on allied research areas were accessed via the internet.

6.3 APPENDIX C: LIST OF INTERVIEWS CONDUCTED

Name	Organization	Role in BI program	Comment
PROJECT 1			
		Private sector partner	No private sector partner
Prof. Masresha Fetene	Addis Ababa University	Consortium Project 1 Leader	Telephone interview pending
Dr. Kassahun Tesfaye	Addis Ababa University	Project 1 Scientist	Interview in Addis Ababa
Dr. Belayneh Admassu	Ethiopian Institute of Agricultural Research	Project 1 Scientist	Interview in Addis Ababa
Dr. Emiru Seyoum	Addis Ababa University	Project 1 Scientist	Interview in Addis Ababa
Dr. Damaris Odeny	ICRISAT, Nairobi	Project 1 Scientist	Interview in Nairobi and Addis
Dr. Appolinaire Djikeng	BecA	Hosting Project 1 students	Interview in Addis Ababa
PROJECT 2			
Dr. Geofrey Arinaitwe	Biocrops Ltd., Uganda	Project 2 Private Sector Partner	Site visit and interview
Mr. Edward Mbugua	Genetic Technologies International Ltd., Kenya	Project 2 Private Sector Partner	Site visit and interview
Prof. Samuel Kyamanywa	Makerere University	Consortium Project 2 Leader	Site visit and interview
Dr. Settumba Mukasa	Makerere University	Project 2 Scientist	Site visit and interview
Dr. Namugga Prossy	National Agricultural Crops Resources Research Institute, Uganda	Project 2 Scientist	Interview in Kampala
Dr. Ruth Amata	Kenya Agricultural Research Institute	Project 2 Scientist	Interview by phone
Dr. Elmar Schulte-Geldermann	International Potato Centre – Nairobi	Project 2 Scientist	Interview in Nairobi

Name	Organization	Role in BI program	Comment
PROJECT 3			
Mr. Mwangi Njiru	Trufoods Ltd, Kenya	Project 3 Private Sector Partner	Site visit and interview
Mr. David Karanja	Katumani Research Centre, KARI	Consortium Project 3 Leader	Interview by phone and discussion in Addis Ababa
Mr. Kidane Tumsa	Ethiopian Institute of Agricultural Research	Project 3 Scientist	Interview in Addis Ababa
Prof. Paul Kimani	University of Nairobi	Project 3 Scientist	Site visit and interview
PROJECT 4			
Mr. Warren Wilson	Kilifi Plantations	Project 4 Private Sector Partner	Site visit and interview
Mr. Teferi Gedlu	Coffee Plantations Development Enterprise	Project 4 Private Sector Partner	Team meeting in Addis
Prof. Amelia Kajumulo Kivaisi	University of Dar es Salaam	Consortium Project 4 Leader	Interview in Arusha
Dr. Berhanu Assefa	Addis Ababa University	Project 4 Scientist	Team meeting in Addis
Dr. Suhaila Omar Hashim	Pwani University College, Kilifi	Project 4 Scientist	Site visit and interview
Dr. Anthony Manoni Mshandete	University of Dar es Salaam	Project 4 Scientist	Team meeting in Addis
PROJECT 5			
Mr. Muhamad Nsubuga	City Abattoir Traders Development Association	Project 5 Private Sector Partner	Site visit and interview
Mr. Adolf Olomi	Banana Investment Ltd.	Project 5 Private Sector Partner	Site visit and interview
Mr. Rediman Bedada	Modjo Tannery Share Company	Project 5 Private Sector Partner	Site visit and interview
Mr. Leonard Lugali	WWS Design Co.	Project 5 Private Sector Partner	Team meeting in Arusha
Mr. Silvani Mmg'anya	AGENDA	Project 5 NGO Partner	Team meeting in Arusha

Name	Organization	Role in BI program	Comment
Dr. Karoli N. Njau	University of Dar Es Salaam	Consortium Project 5 Leader	Team meeting and interview, Arusha
Dr. Joseph Kyambadde	Makerere University	Project 5 Scientist	Interview in Kampala
PROJECT 6			
Mr. Abbas Kisambira	Lisha Products Limited	Project 6 Private Sector Partner	Site visit and interview
Ms. Barbara Byarugaba	Lisha Products Limited	Project 6 Private Sector Partner	Team meeting in Addis
Ms. Jasmine Bunga	Morogoro Ben's Winery	Project 6 Private Sector Partner	Team meeting in Addis
Prof. Jovin Mugula	Sokoine university of Agriculture	Consortium Project 6 Leader	Team meeting and interview in Addis
Dr. Yusuf Byaruhanga	Makerere University	Project 6 Scientist	Interview in Addis Ababa
PROJECT 7			
Dr. Henry Wainwright	Real IPM Company	Project 7 Private Sector Partner	Site visit and interview
Dr. Hussein Omari Mongi	Alpha Seed Company Ltd., Tanzania	Project 7 Private Sector Partner	Site visit and interview
Wilson Marandu	Alpha Seed Company Ltd., Tanzania	Project 7 Private Sector Partner	Site visit and interview
Prof. Esther Kahangi	Jomo Kenyatta University of Agriculture and Technology	Consortium Project 7 Leader	Site visit and interview
Dr. Losenge Turoop	Jomo Kenyatta University of Agriculture and Technology	Project 7 Scientist	Site visit and interview
PROJECT 8 [others tbc]			
Dr. Amare Gessesse	Nelson Mandela African Institute of Science and Technology	Consortium Project 8 Leader	Several meetings and discussions in Addis Ababa
Prof. Bo Mattiasson	Lund University	Project 8 Scientist	Team meeting and discussions in Addis Ababa

Name	Organization	Role in BI program	Comment
PROJECT 9			
Mr. Julius Ecuru	Uganda National Council for Science and Technology	Consortium Project 9 Leader	Discussions in Addis Ababa
Dr. Marie-Christine Gasingirwa	Rwanda Ministry of Education	Project 9 Scientist	Discussions in Addis Ababa
Dr. Ivar Virgin	Stockholm Environment Institute	Project 9 Scientist	Several discussions in Addis Ababa
Ms. Linda Opati	ILRI	Project 9 IP Lawyer	Interview in Nairobi and discussions in Addis Ababa
Dr. Nicholas Ozor	African Technology Policy Studies Network	Project 9 Partner	Interview in Addis Ababa
Dr. Margaret Karembu	ISAAA Africenter	Project 9 Partner	Discussions in Addis Ababa
TAC, Sida, ILRI & PMO			
Dr. Theresa Sengooba	Regional Coordinator PBS East Africa	TAC Chair	Interview in Addis Ababa
Dr. Jacob Mignouna	AATF	TAC member AATF representative	Interview in Addis Ababa
Dr. Segenet Kelemu	BecA (now AGRA)	Former TAC member BecA representative	Interview by Skype
Dr. Victor Konde	Scientific Affairs Officer UNECA	TAC member	Interview in Addis Ababa
Dr. Karin S. Tonderski	Associate Professor Linkoping University	TAC member	Interview in Addis Ababa
Dr. Kevin Chika Urama	Executive Director ATPS	TAC member	Interview in Nairobi (by phone)
Dr. Gity Behravan	Senior Research Advisor, Sida	Sida Project Manager	Several discussions in Nairobi and Addis Ababa

Name	Organization	Role in BI program	Comment
Dr. Jimmy Smith	Director General, ILRI	Program host	Interview in Nairobi and discussion in Addis Ababa
Mr. Martin Van Weerdenburg	Director, Corporate Services, ILRI	Program host	Discussions in Nairobi and by Skype
Dr. Suzanne Bertrand	Deputy Director General, Biosciences, ILRI	Program host	Interview in Addis Ababa
Dr. Seyoum Leta	Program Manager		Several discussions in Nairobi, Addis Ababa and by Skype
Dr. Allan Liavoga	Deputy Program Manager		Several discussions in Nairobi and Addis Ababa
EXTERNAL INFORMANTS			
Prof. Aggrey Ambali	Director, Policy Alignment and Programme Development, NEPAD		Interview in Addis Ababa
Dr. Jane Morris	Independent Consultant, Steps Science Training		Interview in Addis Ababa
Dr. Gabrielle Persley	Research Study Director, Crawford Fund Director, Doyle Foundation		Discussions in Nairobi and by Skype
Prof. John Muyonga	Dean, School of Food Technology, Nutrition & Bio-Engineering, Makerere University	Host of Food Science Incubator, hosting private sector partner of Project 6	Discussion in Kampala
Prof. Agnes Mwan'ombe	Principal, College of Agriculture & Veterinary Sciences	Host of public sector partner of Project 3	Discussion in Nairobi

6.4 APPENDIX D: TERMS OF REFERENCE FOR BIO-INNOVATE PROGRAM MID-TERM REVIEW

1.0 Background

The Bio-resources Innovations Network for Eastern Africa Development (Bio-Innovate) Program was established in 2010 to support multi-disciplinary biosciences and product-oriented innovation activities in the eastern Africa countries of Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda. The Program promotes the use of modern biosciences to improve crop productivity and resilience to climate change in smallholder farming systems, and to increase the efficiency of the agro-processing industry to add value to local bio-resources in a sustainable manner.

The Program has so far sent out two calls for proposals on "*Adapting to Climate Change in Agriculture and the Environment" and "Technology Incubation and Policy Analysis in eastern Africa*" that brought forth the nine consortia projects funded for a period of three years from 2011 to mid-2014. Currently the Program comprises of nine innovation and policy consortia projects involving 57 partnering and collaborating institutions drawn from the six countries and outside the region. Bio-Innovate Program is supported by the Swedish International Development Cooperation Agency (Sida) for five years from 2010 to 2014. In addition, complimentary private sector players have been identified and invited to "invest" through matching funds as partners within respective consortia projects.

The Program's vision is to be a model of how to transform research to innovation and ultimately pass these products to the end user, and in the process ensure that science, technology and innovation actively contributes to the socio-economic development and improvement of livelihoods in the region. To actualize this concept, the Program consortia projects are designed to include key actors along innovation value chains including scientists, private sector, and other market actors. In this regard, Bio-Innovate Program is collaborating with universities, national and international research institutes, private sector companies, regional initiatives, NGOs and other developmental actors.

The Program works closely with National Councils of Science and Technology in eastern Africa and the African Union – NEPAD Planning and Coordinating Agency (NPCA) in strengthening regional collaboration in science and technology and to push for the continent's

ability to exploit opportunities afforded by modern biosciences in line with Africa's Science and Technology Consolidated Plan of Action.

Article 7 (7) of the agreement between ILRI and Sida signed on 29 January, 2010 to implement the Bio-Innovate Program stipulates that a mid-term review of the Program shall be conducted in 2012 with the purpose of evaluating the progress made in Program management including implementation of supported Projects. The mid-term review will also assess the role of ILRI and AU-NEPAD in mobilizing additional resources for competitive funding of bioscience research and innovation.

The recommendations from the Mid-Term Review will be used to improve Program implementation and if necessary reorient or change the management and/or implementation approach at present or in the next Program phase.

1.1 Program Objectives

The key results areas of the Bio-Innovate Program are:

- To strengthen crop innovation systems to improve productivity and enhance food and nutrition security in the region.
- To develop and promote innovations on sustainable waste treatment and on securing freshwater resources, on producing bio-energy from renewable bio-resources and on mitigating climatic change.
- To deliver innovative agricultural, environmental and industrial techniques which stimulate sustainable transformation, utilization, and productivity of the region's bio-resources.
- To develop and promote innovation policies for sustainable harnessing of bio-resources.
- To strengthen and operationalize an enabling mechanism for mobilization, catalysis and nurturing of a strong bio-resource and science-led economic growth agenda for eastern Africa.

1.2 Program Thematic Areas and Projects

The Bio-Innovate Program is being implemented through the results-oriented thematic approach under four thematic areas:

a) Climate change adaptability, productivity and improvement for food and nutrition security – Projects 1 to 3 under this theme, are working to improve the productivity of

sorghum, millet, cassava, sweet potato, potato and bean farmers and to help smallholder farmers adapt to climate change.

b) Waste treatment, production of bioenergy from renewable bio-resources and securing freshwater resources – Projects 4 and 5 feed into this theme as they aim to improve the management of sisal and coffee processing wastes in the production of mushroom and biogas and to better treat wastewater generated in leather processing and slaughterhouse operations.

c) Innovation incubation and promotion of targeted value chains – The aim is to take near-market products generated by the Bio-Innovate Program and their partners along the value chain in thematic areas 1 and 2 to end users. Under this theme Projects 6 to 8 will apply pilot-level testing for economic feasibility, marketability and acceptability

d) Bio-resource innovation policy and sustainability analysis – This theme focuses on providing a supportive policy environment for the ultimate development, promotion, and ultimately uptake of bio-resource innovations. Project 9 on biosciences innovation policy consortium for eastern Africa falls under this theme.

1.3 Program Management

The Bio-Innovate Program is hosted and managed from the International livestock Research Institute (ILRI) as per the agreement signed between ILRI and Sida on 29 January 2010 to implement the Bio-Innovate Program. The day-to-day management of the Program is undertaken by a Program Management Team (PMT) with the support of the technical advisory committee, which provides oversight on implementation, review of the competitive grant scheme and monitoring and evaluation of activities. Technical input is also provided by the project consortia leaders responsible for their respective projects at the lead implementing institutions within the region.

2.0 Purpose and Scope of the Mid-Term Review

2.1 Objectives

The objective of the Mid-Term Review (MTR) is to measure and report on performance to date of the Bio-Innovate Program and supported projects in meeting set objectives and milestones, and recommend adjustments that may be required to ensure successful implementation of the Program. The MTR is intended to interrogate the progress, achievements and challenges encountered thus far with reference to the original stated objectives for both the Program and supported projects, and the extent to which the Program is fulfilling its mandate and delivery of expected results.

The lessons drawn from the MTR are intended to inform implementation of the Program in the remaining period and beyond. The MTR will also assess the appropriateness of the current Program design and operational procedures including the Competitive Grant Scheme (CGS), towards delivering on its mandate. More specifically the MTR will critically examine Project identification and selection process and the innovations being developed with particular attention on the uptake and dissemination of the technologies generated and the likelihood of the envisaged impacts being realized. It will also review the resource mobilization efforts for the CGS by the partners as per the agreements. Special attention shall be given to the role of ILRI and AU/NEPAD in mobilizing resources for CGS for bioscience research and innovation in the region.

2.2 Scope of Work

The mid-term review shall include, but not necessarily limited to:

- Evaluate the overall progress and achievements (successes and challenges) of Bio-Innovate Program from inception in January 2010 to December 2012, in relation to objectives, targeted milestones and implementation plans and make recommendations accordingly.
- Evaluate the outcome, impact, sustainability, and indicative cost-effectiveness of project activities by comparing outputs in relation to the inputs provided.
- Assess the original designs of the projects in relation to the approved financial resources in achieving set objectives.
- Review strengths and weaknesses of the current organizational and management structure of Bio-Innovate Program.
- Assess the institutional arrangements for the management, implementation, and the M&E functions of the Bio-Innovate Program.
- Evaluate the process of identifying and forming partnerships and the effectiveness of these partnerships in delivering bioscience innovations to the market place and end users.
- Evaluate the value-addition of the partnerships to respective partners and the regional approach of the Program.
- Assess the regionality of the projects and sustainability of the networks beyond the Program life.
- Evaluate the sustainability of the innovations developed beyond project life.
- Assess the relevance of the Bio-Innovate Program in light of the continental programs such as AU-NEPAD Science and Technology Consolidated Plan of Action and

the Comprehensive Africa Agriculture Development Program (CAADP) and other regional initiatives.

- Assess the efforts made by the ILRI and AU-NEPAD in mobilizing additional resources for biosciences innovation funding in the region through competitive grant scheme.
- Assess the ownership and sustainability of Bio-Innovate Program beyond 2014.

3.0 Content of Evaluation Process

3.1 Relevance

Evaluate the extent to which the Program design and interventions conform to ongoing regional initiatives, regional priorities, strategies, and programs in science, technology, and innovation:

a) Are the Program and its consortia Projects consistent with food security and climate change strategies, policies and programs both at national and regional levels?
b) Is the Program and its consortia Projects in tune with the national, regional and continental development strategies in the agriculture and environmental subsectors?
c) Is there clarity and adequacy of Program and supported Project designs with respect to logical consistency of inputs, activities, outputs, and progress towards achievement?

3.2 Effectiveness

Assess the extent to which the Program and supported Projects have achieved their goals and objectives:

a) Assess to what extent the Program and supported Project have or will contributed to improved food security, and environmental management in the region,
b) To what extent are the identified or anticipated outcomes the result of the Program/Projects rather than external factors?
c) What are the reasons for the achievement or non-achievement of outputs or anticipated outcomes?
d) Was the established monitoring and evaluation system effective in directing implementation of Program supported projects?
e) What could be done to make the Program and or supported Projects more effective?
f) Do the innovations developed have potential for replication and/or adoption both at national and regional level?
g) Does the Program add value to implementing partner institutions and/or countries?

3.3 Efficiency

Assessment of the extent of output delivery in relation to inputs including assessment of expenditures viz-a-viz activities:

a) Have the Program and supported Projects been managed with reasonable regard for efficiency? Have Bio-innovate standard operating procedures and Sida's guidelines for project management helped project implementation? Was technical backstopping ensured in a timely and effective manner?
b) What measures have been taken during the planning and implementation phase to ensure that resources are efficiently used?
c) Were the Project outputs delivered as agreed?
d) Could the same outputs be achieved by other means at a lower cost in the same or shorter time?
e) Are the original designs of the projects still valid in relation to the approved financial resources? Is there need to reassess the scope of the projects or mobilize additional funding to achieve set objectives.

3.4 Impact

At this stage of Program implementation, the assessment of impact will be restricted to the likelihood of impact being realized.

a) Is the Program/Projects likely to contribute towards their respective long-term goals? If not, why?
b) What is the perception among the beneficiaries and other stakeholders of the progress being made by the projects and do they anticipate benefiting from the outcomes?
c) To what extent will the Program contribute to the strengthening of institutional capacities of partners.

3.5 Sustainability

Assessment of how far Projects benefits continue in the long term:

a) To what extent is the sustainability of the Program and its supported Projects being addressed by other donors besides Sida?
b) Is there ownership of the Program activities at institutional, community, national and regional level?
c) Is the Program and its consortia Projects in line with the national and regional agriculture and environmental programs and priorities, and will it contribute to and be a part of the AU-NEPAD and CAADP agenda?

d) Is the Program sharing experiences with other similar initiatives?
e) Are the networks formed sustainable beyond Program life?

4.0 Methodology, Review Team and Time Frame

4.1 Methodology

The task shall be carried out as a combination of desk reviews; interviews and field visit to selected partner countries. The desk reviews will involve studies of Program relevant documents including contracts, technical reports, manuals, guidelines, web-based information, newsletters, and any other relevant documents. Interviews will be carried out with relevant Sida personnel, Bio-innovate Program Management Team, partners, and stakeholders in participating countries. This will entail visiting selected partners and project sites in the six participating countries of Burundi, Ethiopian, Kenya, Rwanda, Tanzania and Uganda.

Bio-Innovate Program and the consortium project leaders will assist in setting up meetings and make all necessary preparations. The consultant(s) will be granted access to all relevant documents and records from Sida, PMO and the implementing institutions. The consultant(s) will study any relevant background material and make a record of all data used in the review. The review will seek inputs from other key Bio-Innovate stakeholders including donors, councils for science and technology in the participating countries, and regional initiatives such as the Biosciences for eastern and central Africa (BecA)-ILRI hub, AATF, ATPS as well as AU-NEPAD Agency.

4.2 Review Team

The review team shall consist of two or three consultants/experts from a consulting firm with relevant professional and experiences as described in section 7 below.

4.3 Timeframe

It is expected that the Mid-term review process will last for 4 weeks beginning 18th February, 2013 within which time the consultant will submit the Draft Final Report to the Program Management Office (PMO). An initial/inception briefing meeting will take place between Bio-Innovate-ILRI-Sida and the consultant upon award of the contract and before the commencement of the assignment. The consultant will have a week to peruse through all relevant Program and project documents. This will be followed by a week of interaction with Project implementers and partners and other stakeholders during the Bio-Innovate scientific conference scheduled for 25-27 Feb-

ruary 2013. The consultant will have an additional week during which time the consultant may need to visit implementing institutions and/or project site as the case may be. The fourth week will be used to consolidate the information gathered, finalize and submit the Draft final report to the PMO on or before 15th March 2013.

5.0 Reporting Requirements

5.1 A Draft Final Report outlining in details results of the review of Bio-Innovate Program and supported Projects in the period January 2010 to December 2012 shall be prepared and submitted to Bio-Innovate PMO – ILRI and Sida electronically by the consultant at the end of the assignment and not later than 15 March 2013.

5.2 The Draft Final Report shall, in addition to a detailed account of the evaluation of progress, elaborate on lessons learned, conclusions, and recommendations.

5.3 The Bio-Innovate PMO-ILRI and Sida will be provided comments on the Draft Final Report within two weeks after receiving the Final Report and not later 30 March 2013. The consultant shall resubmit the report to the PMO taking into account the comments provided within one week and not later than 07 April 2013.

5.4 The consultant(s) will be required to make an oral submission of the draft report to the Technical Advisory Committee during the 6th TAC meeting scheduled for 22-23 April 2013.

5.5 A Draft Final report based on these terms of reference shall be submitted to ILRI and Sida not later than 30 April 2013.

5.6 Sida will provide its comments within two weeks after receiving the draft report and not later than 15 May 2013, and the consultant will in turn resubmit one soft copy of the Final Report (and 4 hard copies) to the PMO within one week of receiving comments and not later than 22 May 2013.

5.7 The report should be written in English and not exceed 40 pages and must include:

- An executive summary
- Structured content
- Other relevant information in annexes
- Reference to literature and documentations used

6.0 Payment Schedule

Half of the payment to the consultant will be made upon signing the contract and the remaining balance will be offset upon submission and approval of the Final Report.

7.0 Skills and Experience

The review shall be carried out by a professional consultant(s) with regional experience in Program/ Project monitoring and evaluation. The Consultant(s) must have at least 10 years of professional experience in the Monitoring and Evaluation and/or Program/Project review of donor supported Programs at regional and international level. The consultant(s) must also have the following:

- Demonstrable theoretical and practical experience in Program/Project implementation, as well as monitoring and evaluation.
- Hands-on knowledge and experience in biosciences innovations and use of results from research and technological development projects to address developmental challenges in agriculture and the environment including up-and-out scaling of innovations;
- Clear understanding of biosciences innovation systems and policy analysis in agriculture and the environment;
- Strong understanding of regional approach and international collaboration and networking for promoting innovations for socio-economic and sustainable development;
- Sound knowledge of eastern Africa science, technology and innovation systems
- Well acquainted with Sida's innovation funding and support policy. Knowledge of other donor policy will be an added advantage;
- Solid understanding of policy environment for biosciences innovation and policy advocacy, as well as regional innovation and policy platforms;
- Proven ability to assess a complex network of partners and processes and analyze diverse sources of information synthesizing it produce a concise and articulate report with well-founded recommendations;
- Working experience in monitoring and evaluation of programs/projects in Africa and particularly eastern Africa is an added advantage;
- Flexible and with the ability to meet stipulated timelines;
- Ability to communicate effectively and proficiently in English is necessary.

8.0 Contacts

The consultant(s) shall submit their bids clearly stating their interpretation of the Terms of Reference, clear timelines, and a budget. The bids should be sent by email to the Bioinnovate-recruit@cgiar.org on or before Friday 14 December 2012. Successful applicant(s) will be notified within a period of two weeks.

6.5 APPENDIX E: BIOS OF REVIEWERS

Jonathan Crouch

Agricultural development for small-scale farmers in low-income countries: Following a BSc in Agricultural Botany and a PhD in biotechnology and plant breeding, I have 18 years of experience in international agricultural development in Africa, Asia and Latin America. For 10 years I was a member of the senior management team of three international organizations, where I coordinated large multidisciplinary research programmes, multi-million dollar operational budgets and a global grant allocation programme. I have spent extensive periods of time living and working in Africa throughout the past two decades, including Ethiopia, Ghana, Kenya, Mali, Niger, Nigeria, South Africa, Uganda and Zimbabwe.

Over the past three years, I have been working as an independent consultant focusing on clients wanting to enhance their impact in Africa. During this time I have been contracted to help with strategic policy and planning issues, partnership building and fund raising activities, as well as reviewing programmes, projects and proposals. My clients have included international development organizations and donors as well as UK research organizations.

Technology transfer in emerging economies: The primary focus of my career has been to translate cutting-edge research into practical benefits for the development of new crop varieties for resource-poor farmers in low-income countries. Starting in Nigeria with plantains and bananas, I later worked on legumes, oilseeds and cereals while based in India and Mexico, but always with a major focus on impacts in Africa. Through these projects I have worked with academia, government, the private sector, NGOs, donors, foundations and stakeholders across Africa.

At CIMMYT, I was involved in the establishment and implementation of the DTMA and WEMA projects (driven by a $75M+ investment from the Gates Foundation) for enhancing drought tolerance in African maize through public-private partnerships. This required building strong partnerships with diverse organizations across the region. During 2011-12, I was contracted by the African Agricultural Technology Foundation (AATF) to design a more effective M&E system for managing their product development and delivery activities.

I have experience of working in the commercial sector in Europe, fostering start-ups in India and collaborating with multinational corporations on development projects globally, including managing complex intellectual property rights scenarios in those projects. Whilst in India I launched Agri-Biotech Incubator and Science Park initiatives at ICRISAT, was involved in the establishment of BecA in Kenya, and coordinated a major international conference on the creation of incubators and science parks in developing countries.

Institution building and capacity development in Africa: I have extensive experience in developing, refining and reviewing organizational and programmatic strategic plans in association with senior managers and executive boards of international organizations with a major focus on Africa. I have over a decade of experience in managing projects across Africa, including planning and delivery of research for development programmes, developing and implementing monitoring and evaluation systems, leading programmatic restructuring and championing cultural change. In addition, I have been contracted by FAO to review seed systems in Ghana and by USAID to review biotechnology programmes in South Africa and in 2011 was contracted by ILRI to help develop the growth phase business plan for the BecA regional biosciences center.

Technical expertise: I have very broad disciplinary expertise (listed on page 5 of attached CV):

- All major crop groups (cereals, legumes, oilseeds and clonal crops);

A.

- A diverse range of disciplinary approaches (including biodiversity, tissue culture, genetics, genomics, transgenics, computational sciences and plant breeding);

- Enhancing most types of economically important traits (including agronomic traits, nutritional enhancement, adaptation to climate change, and biofuel production);

Through my research in these areas, I have authored over 300 scientific publications including over 100 peer-reviewed journal papers, book chapters and reviews (please click here for full details). During 2011-2012, my publications received over 1,000 citations.

In addition, I have published on intellectual property management, management of agricultural research for development, public-private partnerships, innovation system management and technology transfer in low-income countries. I have also published over 20 major reviews on diverse topics associated with crop improvement in international agricultural development, and I have written a wide range of white papers to aid internal senior management and governing board decision-making.

[jonathan.crouch@agrinovis.com]

Peter Bloch

A serial entrepreneur in the UK and USA with extensive experience in applying innovation and a cross-disciplinary approach to increase food security in Sub-Saharan Africa through seed sector, agridealer and small farm development. I have expertise in coalition building, media design and production, technology transfer and designing intellectual property strategies.

I have been contracted by the International Fertilizer Development Center (IFDC), ICRISAT, CIMMYT and others to assist in enhancing various elements of agribusiness value chains in Kenya, Malawi, Mozambique, Somaliland, Zambia and Uganda. During 2011-12, I was part of the team contracted by AATF to help develop more effective M&E systems for managing their product development and delivery activities.

From 2007-2009 I was engaged as a consultant by CAS-IP, at that time the intellectual property system office of the CGIAR. I assisted alliance members with marketing, strategy and IP-related issues and was a regular contributor to the CAS-IP blog. System-wide initiatives included the development of a new IP policy for the CGIAR.

Since becoming involved in development, my focus has moved towards introducing innovations into the agribusiness sector that serves small farmers, with a focus on helping agricultural retailers to better serve their customers, and designing interventions that will have a sustainable impact on productivity. I was instrumental in designing and launching the Malawi Seed Alliance, which brought together seed companies, government and small producers to rebuild Malawi's reputation for delivering high quality groundnut to export markets.

My current focus is on building a coalition involving multiple stakeholders to eliminate counterfeit seed across Sub-Saharan Africa. This will involve mobile communications technology and will rely heavily on using media to engage small farmers to view farming as a business. I continue to support the development of Women In Agro-Business In Sub-Saharan Africa Alliance (WASAA), a task that IFDC asked me to address, and empowering women farmers and agribusiness owners is integral to both current and past projects.

The one constant I have observed over the past six years is that crop research and donor-driven development programs have been extremely challenged in distributing innovations and new products to small farmers, and have often missed opportunities to repair broken links in distribution chains. My work has mostly been in these areas. While program managers cannot speak directly to the small farm community, they

can talk to the agridealers (there are 1,800+ in Uganda alone) who are the primary link between distributors and consumers. Helping these small business owners to recognize the business opportunities in the small farm sector by encouraging entrepreneurship and a high level of customer service has been integral to the IFDC programs I have worked on, and are critical to increasing small farm productivity.

[peter@peterbloch.net]

Bio-Innovate Program Mid-Term Review Report 2013

The evaluation report provides an overview of the Bio-Innovate Program and its 9 innovation and policy consortia projects supported by Sweden through Sida. The nine projects address policy, improved crops and value chains, bio-controls, and remediation of industrial wastes; and many lessons have been learned. The report revealed that while the Bio-Innovate projects have the potential to generate sustainable and scalable impact on a national and or regional level; important issues needed to be addressed if the desired results are to be attained and sustained. This Program mid-term review was carried out by an independent review team, and the report is presented in this publication.

SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
Address: S-105 25 Stockholm, Sweden. Office: Valhallavägen 199, Stockholm
Telephone: +46 (0)8-698 50 00. Telefax: +46 (0)8-20 88 64
Postgiro: 1 56 34–9. VAT. No. SE 202100-478901
E-mail: info@sida.se. Homepage: http://www.sida.se

Sida