ANNEX 6

CABI Science Review: Report on Sub-Saharan Africa

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Implementing CABI's Strategy in sub-Saharan Africa:

The context within which CABI works within sub-Saharan Africa is well described in the 2014-16 Medium Term Strategy, as follows: "Farmers in the developing world are not receiving the best advice on plant health problems when and where they need it, whilst governments and national organizations responsible for research and extension are ill-prepared to respond to such needs. This is often due to low awareness as well as poor management of information in respect of solutions and recommendations that are already known. Nevertheless, development agencies around the world have found that putting such recommendations into practice for smallholders on a regular basis, across large areas and varied agricultural conditions has proved difficult to sustain beyond partial improvements achieved through intermittent project investments. A key challenge in this respect is the degraded capacity of extension systems and supporting institutions, coupled with out-dated or inappropriate policies and regulations." To meet this challenge CABI has created a relatively unique niche in the "continued evolution of the organisation towards integrated ("one CABI") solutions for delivery of knowledge to solve problems in agriculture and the environment."

The science that CABI undertakes is primarily seen as the production of new knowledge while the more development oriented work of the organization is seen as the application of that knowledge, what is often termed research into use. Moreover, the costs of disseminating information has decreased exponentially over the last couple of decades through rural radio, the internet, and increasingly mobile telephones. At the same time, agricultural extension has remained ineffective in disseminating new technologies to smallholder farmers in Africa, especially given the succession of different models of extension which have attempted to reach large numbers of farmers with appropriate advice at reasonable cost. New information technologies are increasingly seen as a solution to the extension conundrum, both in terms of being able to generate and analyze "big data" to be better able to target that information and in terms of being able to translate the large reservoir of research knowledge into advice useful to farmers. This would seem to be the central, operational core to "one CABI", as well as the competitive niche within which CABI sources R&D projects, on which funding of the Africa Regional Office depends.

Development agencies recognize the potential of information based approaches, in that such approaches are scalable, they are cost-effective, and capacity can be developed making the approach sustainable. However, there are information challenges associated with this approach. Firstly, rain-fed agriculture in Africa is highly heterogeneous requiring targeting of relevant information related to soil, pest, disease, and water management. Secondly, agro chemicals are expensive, difficult for farmers to access, and require significant accompanying

information to manage effectively. Finally, smallholder farms are highly diversified and given the low use of external inputs, productivity is dependent on internal resource flows and system complementarities. This has given rise to more integrated approaches to increasing smallholder productivity such as integrated pest management (IPM), integrated soil fertility management (ISFM), agroforestry, conservation agriculture, etc. However, these approaches are knowledge intensive, highly contextualized and difficult to scale. A recent survey of IPM experts concluded: "The intention of this article is not to question the value of IPM for developing-country agriculture. On the contrary, it is because we recognize IPM's potential merits that its poor adoption seems paradoxical and worth further analysis. Indeed, this study echoes previous ones that have critically explored IPM adoption in the developing world. One is left wondering why the situation has been little improved in the more than 30 years that have passed since the problems of adoption were first raised."[1]

IPM has been a particular research thrust of CABI, but principally from the perspective of understanding the biology that underlies the effective design of an IPM strategy. However, as the quote above suggests, the more critical research questions lie in designing delivery systems for IPM and understanding constraints on farmer adoption of IPM, that is two additional science areas that underlie research into use. This agenda would appear to be central to the Knowledge for Development program, and where that program continues to evolve a research agenda and associated capacity. Moreover, within CABI the PlantWise program offers a laboratory within which to undertake this research. For other programs research into use operates at higher scales. For the Commodities Program it is primarily in terms of actors in the value chain and for the Invasives Program it is primarily in terms of government response capacity at national or sub-regional scale. Research into use is not only a natural extension of the science agenda of CABI but in fact would fill a vacuum in understanding farmer translation of information into improved farm management, information targeting in the value chain, and policy change at national level. The research agenda on farmer adoption would start to understand the extension conundrum in Africa and as well lead to more cost effective investment strategies by both governments and development aid agencies.

Science in the Africa Regional Office:

CABI's Africa Regional Office has positioned itself as a bridge between the more traditional biophysical research done on crops and livestock and the application of that research, in most cases through extension programs. This is a reasonable niche for CABI, given the significant capacity of the CGIAR Centres in the region and other research capacities such as ICIPE, BECA, and USAID's Innovation Platforms. Within this arena of international research capacities focused on Africa, there are still niches which are not addressed, for example invasives and cash crops, such as coffee, tea, and cocoa, although CG Centres are extending into these crops as well, for example IITA and ICRAF into cocoa. Given the research infrastructure that the CGIAR has, were CABI to move more directly into more traditional agricultural research, it would have

[1] Parsa, et al. (2014). Obstacles to integrated pest management adoption in developing countries. PNAS 111 (10): 3889–3894.

to be through research networks with national partners, a modality that CABI has pursued in the past, for example with coffee or the CABI fungi accessions maintained at KALRO's NARL (National Agricultural Research Laboratories). Donors, on the other hand, have moved away from funding such networks because of the development of the Sub-Regional Organizations (SRO's) such as ASARECA.[2]

This shift in funding priorities is reflected in the Muguga station where CABI was housed and worked for a number of years. One of the review team met a scientist who has been there since 1983 and recalls the extremely good working relationship between the then KARI and CABI. There was good funding, the labs were well appointed with both personnel and equipment, activities were well funded, and KARI staff were able to be upgraded based on their skills developed through periodic courses. The building that stored CABI's equipment and books and was once extremely functional, now looks dilapidated, with some rooms empty or used as storage. Some scientists from African countries have remarked on the fact that now most research funding goes to international research centers, usually manned by world class scientists, and that do little to build the capacity of national scientists. Sustainability of laboratory and analytical capacity in NARI's is a continuing issue, especially given its past reliance on project funding and the inability of national budgets to fill the financial gap. Although there is demand by member countries for such capacity, pragmatism has led to reliance on capacity in international centers, such as the agreement with ICIPE on the use of its laboratories.

CABI's Africa program primarily relies on research done elsewhere, analyses it and packages it for end-user benefit. On talking to Dr Jack Ouda at KALRO, who has worked very well with CABI and continues to do so, he has great praise for CABI and mentions that he has a pool of 12 scientists who have been trained by a joint project they have with CABI. The training has involved: research methods, use of ICT to prepare extension methods for farmers, and scientific writing. His view was that they can already build on existing collaboration to do more. A team member also visited KEPHIS and talked to a team leader PK Njoroge, Ag. Head of Sanitary and Phytosanitary services, who is concerned mostly with regulation and inspection. About 70% of their business is in cut flowers and 30 % in vegetables. There did not appear to be any concern to intentionally target food products, given that Kenya is a hungry country and could produce staple food crops for both export and local consumption. On collaboration with CABI, they talk of the excellent synergy that exists between the 2 organizations: CABI avails some new analytical methods while KEPHIS is a strong government arm that deals with regulatory and standards issues.

In its PlantWise program CABI relies on the research done by other research institutes, such as IITA's work on banana bacterial blight and cassava brown streak, ICIPE and ILRI's work on napier

[22] ASARECA up to 2007 functioned primarily as a coordination mechanism for research networks operating in East and Central Africa. In that year as a result of shifts in donor priorities ASARECA shifted to managing its own programs based on competitive grant mechanisms. Donor support for research networks in the region essentially dried up, including support to the CABI research network on coffee.

stunt, or CIMMYT's work on maize lethal necrosis. CABI has positioned itself as a bridge between the products arising from these research efforts and their application to improve productivity of smallholder farmers. Much of this bridging is done through piloting within an action research modality. Certainly this was the case with the global plant clinics that evolved into the PlantWise approach. The PlantWise approach is in turn based on a local diagnosis of pest or disease problems brought to the plant clinics and recommendations to manage the pest or disease; that is, the approach is based on information provided to the farmer. Understanding how effective this approach is in improving farmer management of plant health has been a core issue in the design of the M&E system and the more recent impact evaluations and in the continued improvement in the PlantWise model.

An Emerging Research Agenda in Plantwise and Knowledge for Development: A first attempt at an impact evaluation in Teso, Uganda[3] found that few farmers (about 10%) could reproduce the diagnosis and a few more (about 12%) could articulate the recommendation as provided by the plant clinic. Farmer use of information and the "market" for information has become a research area in the understanding of farmer adoption. For example, the APAI program at MIT's JPAL summarizes the research problem as follows: "A farmer's choice to adopt a new technology requires several types of information. The farmer must know that the technology exists; she must know that the technology is beneficial; and she must know how to use it effectively. These types of information may come from different sources: (1) From external sources, such as agricultural extension workers and markets; (2) From observing the decisions and experiences of neighbors; and (3) From the farmer's own experience."[4] Matching the source and content of the information to farmer use is then the focus of the research.

The impact study in Teso was not designed so that "the results of the impact evaluation… (would) constitute a direct test of the quality of advice given or a test of farmer efficacy at following said advice." (p 9) However, such research will increasingly be a prerequisite for donor investment in such programs. For example, JPAL's Agricultural Technology Adoption Initiative (ATAI) program has RCT evaluations of both the Digital Green and One Acre Fund approaches to agricultural extension. At the same time the University of Reading's is undertaking an impact evaluation of Shamba Shape Up in Kenya. Such research is essential for the continued evolution of PlantWise, the Africa Soil Health Consortium, and the agenda of Knowledge for Development more broadly. Again, the work of the ATAI program would support this, for example: "Given that the relative importance of different sources of information is likely to vary across technologies and contexts, understanding this difference can help improve the effectiveness of interventions which seek to provide farmers with information to promote technology adoption. Research suggests that the way information is presented (who provides the information, how much information is given and in what form) can be as important as the content of the information itself. For example, presenting information in

[3] Brubaker, J, Danielsen, S, Olupot, M, Romney, D and Ochatum, N (2013) Impact evaluation of plant clinics: Teso, Uganda. CABI Working Paper 6. 88p

[4] http://atai-research.org/our-approach/informational-inefficiencies

different ways (i.e. framing) can have large effects on decision making."[5] Differences in framing characterize the recent explosion in models for information delivery to farmers, such as those identified above, and many of CABI's approaches, for example PlantWise itself and the Direct to Farm (D2F) use of mobile phones.

Commodities and the Evolution to Value Chains: Research into use in the Commodities Program for a long time built capacity in productivity research, especially in terms of managing the array of pests and diseases. This extended into varieties and seed systems. Most of this work focused on high value cash crops and, as was discussed above, was done through research networks. Changes in the markets for these crops toward more specialized, high quality market segments and away from bulk, wholesale delivery have moved research into use in this area more into other parts of the value chain, especially processing and quality assurance, sometimes through mechanisms such as credit schemes. Moreover, with the opening of the West Africa office there is potential to expand this work into crops such as cocoa and possibly smallholder oil palm. Value chain approaches, including work on the use of innovation platforms, has expanded rapidly in sub-Saharan Africa over the last decade, especially as the liberalization of agricultural markets in the 1990's exposed the inefficiencies and lack of investment in smallholder access to markets. This has spawned work in assembly and bulking, price information systems, processing, credit and insurance, and seed systems. Such interventions in turn provide incentives for farmer investment in improved production technology. As well, value chain approaches can extend into international trade, where CABI already has work in the area of phytosanitary regulations and their impact on trade flows.

Value chain work, and its links to trade for export cash crops, is a natural extension of the capacity that CABI has built in commodities. There is significant donor demand for this type of work; for example, the most recent strategy for the Gates Foundation's work in agriculture is organized around country and commodity priorities, with support within the value chains being organized across the value chain. As well there are potential links to nutrition through food safety, as for example mycotoxins in coffee beans. At the same time, CABI has not built significant capacity in this area to respond to this demand. A single socio-economist in the Africa Regional Office has extended his work from a primary focus on farmer adoption to some work on the coffee value chain, particularly the economics of technique and scale in de-pulping technology. Another project, Improving cotton production efficiency in small-scale farming systems in East Africa through better vertical integration in the supply chain, tended to focus on the adoption of integrated crop management techniques. Expansion into this area will require agricultural economics expertise in marketing and trade. To be competitive in this area, CABI needs to build this capacity in house.

Ensuring Invasives Are Not Pervasives: It is a paradox that a quick and early eradication of invasives entails less cost for control and yields huge benefits in terms of production that would have been lost and yet response time is invariably slow and invasives usually become endemic, ie pervasive. CABI has provided leadership in this important area in terms of mapping the

[5] http://atai-research.org/our-approach/informational-inefficiencies

distribution of priority invasives in East Africa, modeling the spread, undertaking risk assessments and connecting to control strategies, either biological control or IPM depending on the pest or weed. Surveillance together with targeting control strategies should be menu for research into use in the Invasives Program. However, this has not proved sufficient for the development of national control strategies. Various hypotheses have been suggested including inability to budget for such programs, the low percentage of operational budgets in R&D systems, and the inability to prioritize with scanty information on potential economic impact. Each of these suggests work in the policy area to complete the necessary components for an effective response to the management of invasives, particularly the ability to estimate potential economic impact.

Social Science, M&E, and Impact Assessment

The Africa Regional Office continues to evolve a research agenda structured essentially around "research into use". This is a particularly competitive niche for CABI in an African context. For example, DFID has produced guidelines for research into use and summarizes the process as follows: "Research uptake includes all the activities that facilitate and contribute to the use of research evidence by policy-makers, practitioners and other development actors. Research uptake activities aim to:

- support the supply of research by ensuring research questions are relevant through engagement with potential users; communicating research effectively; and synthesising and repackaging research for different audiences.
- support the usage of research by building capacity and commitment of research users to access, evaluate, synthesise and use research evidence."[6]

As argued above, research into use generates its own research agenda.[7] Such an agenda is interdisciplinary but necessarily requires a significant social science capacity. In CABI's Africa office each of the program areas has evolved to a point where additional social science capacity is required in order to ensure effective research into use programs. Moreover, each has quite different requirements in terms of social science competency. At the same time, donors are increasingly expecting capacity in the area of M&E and gender studies to integrate into project design. An argument for capacity in spatial analysis could also be made, especially as analytical support to the Knowledge Bank and Invasives Program. The last science review as well recommended capacity in impact assessment. At the same time social science has not been a traditional focal area for science within CABI and if such capacity is to be built, it will have to be project supported, meaning that either social science will have to generate its own projects or as at present, social science is integrated to varying degrees into program projects. In this review team's assessment the question is not whether to build increased capacity in social science but rather how to build such capacity, for what purposes and how will it be organized?

[6] DFID (2013). Research Uptake: A guide for DFID-funded research programmes. UK: DFID.

[7] See for example: Using Science as Evidence in Public Policy. Committee on the Use of Social Science Knowledge in Public Policy, K. Prewitt, T.A. Schwandt, and M.L. Straf, Editors. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

A central question would be whether to build a core social science capacity that supports projects across program areas or to build specific capacities in each of the program areas, particularly as disciplinary requirements tend to be quite different. The review team does not have a position on this, as it will depend on how the project portfolio evolves. However, the review team would argue that the emerging agenda in Knowledge for Development is particularly central to the one-CABI vision and may require some upfront investment in order to build the program and develop project proposals. Building a research agenda around information-based delivery of improved plant health—soil health or even nutrition would be another option—practices to farmers would have to break down the complexity of this task. There is a small literature to suggest that farmers are much more adept at diagnosing pest problems than disease problems. When selecting diseased plants, on what basis does the farmer do the selection from the gamut of crops and pathogens? Are these pathogens that would lead to the largest potential yield or profit gain? If correctly diagnosed, to what extent do farmers understand and learn the control measures, ie what are their learning outcomes from different means of packaging the information. How complicated can that information be, particularly as recommendations move toward more IPM approaches. Having diagnosed the problem and understood the potential control measures, do farmers translate that into actual changes in farming practices and do farmers achieve an improvement in either yield or profit? Is this best done in farmer groups and what is the role of learning by doing? For many pests and diseases there is an epidemiological dimension and can these be managed collectively at community level. The research thus informs the most cost- effective design of plant health extension and would support continued evolution in a program such as PlantWise, but would as well provide broader insight into different extension approaches. Different extension models continue to be promoted but without a fundamental understanding of farmer learning and translation of that learning into changes in farm practices.

Organizing research around such an agenda is quite different from what would be done in M&E of existing projects. A research lens would explore more options and would primarily focus on farmer decision making. Developing a systematic M&E capacity within CABI is still underway, with a focus currently on designing the monitoring component around the plant clinics. Developing an evaluation plan is still in the future, but with some spillover on institutional effectiveness from the ongoing impact assessment of PlantWise in Kenya. The point is that there is some interaction between these three components, namely social science research, M&E and impact assessment, but in general they each require quite different research design skills and would organize their sampling, questionnaire design, and data collection quite differently. At the moment both M&E and impact assessment capacity is funded through PlantWise, with M&E based on building internal capacity and IA in linking to outside capacity. The design of a social science research capacity in CABI is beyond the scope of this review, but the argument is that CABI should invest in such planning.

A Potential Programmatic Thrust in Nutrition

From the early 2000s nutrition has come much more prominently onto the development agenda. This may be partly explained by (over) nutrition becoming an increasing concern in the

developed world. The G8 countries paid increased attention to hunger and malnutrition across the world, with a special focus on sub Saharan Africa. Key countries such as the United Kingdom and the United States of America, both have hosted G8 meetings during that period and called on all stakeholders to join efforts to support strategies to rid the world of hunger, poverty and associated challenges. America launched the Feed the Future initiative, targeting a number of countries. The United Nations launched the SUN (Scaling Up Nutrition) program. The Gates Foundation developed more projects in nutrition, primarily as a vehicle to achieve health outcomes but then evolved that into their agricultural program. After decades of unsuccessful attempts, common strategies were beginning to be developed between the agricultural research and the nutrition communities, which found expression in the CGIAR's Agriculture for Nutrition and Health program and increased emphasis on biofortification. Achieving nutritional outcomes for vulnerable populations, especially pregnant and lactating mothers and children under five, required more integrated approaches involving household food production, women's education, water quality, and control of intestinal parasites.

At the Africa Union level, the CAADP initiative has just marked 10 years since inception, while 2014 was marked as Africa's year of Agriculture and Food Security. At the 2015 Heads of State Summit in Addis Ababa, the Malabo Declarations of 2014 to step up support for food security and ending hunger were ratified. What this means is that the governance and policy environment in Africa is positive, and allows a lot to be done by both research and development organizations, CABI included. CABI is well placed to do work in the nutrition area where they have found it difficult in the past.

As a new program area, nutrition would have to complement existing programs and integrate into CABI's overall strategy. Moreover, a nutritional component would have to be designed at the interface between agriculture and nutrition and in an African context would tend to focus on the delivery end of the R&D spectrum. For CABI the two pillars of a nutrition program capacity would be food safety, particularly mycotoxins, or the design of nutrition delivery or education programs. Food safety would require a substantially enhanced capacity in diagnosis and it is a question whether the plant clinics are the appropriate locus of such capacity. As with plant health information, there is a critical research question of how best to frame the delivery of nutritional information and whether delivery should be combined with nutritionally enhanced crop varieties. Also, the locus of the target population shifts from markets to health clinics. Thus, operationalizing a program to deliver nutritional outcomes through food based interventions would require a shift in institutional partners and delivery pathways. Introducing nutrition into CABI program activities could start with the same model as that used in the soil health area, where CABI had no previous experience or internal capacity. That is, the nutrition work would build on CABI's expertise in framing, packaging and delivering information and in building platforms for institutional partnerships. One example is the work of CABI in using ICT to package nutrition advisory messages at country level to send as 160-character text messages.

Regional Decentralization to West and Southern Africa

The Africa Regional Office has until recently operated its programs on the continent from its base in East Africa. Not unexpectedly most of its projects are located in East Africa and CABI has both a longer history in the East Africa region and deeper institutional relationships. Decentralization currently is motivated by the need to have implementation capacity for the PlantWise program in West and Southern Africa. In the medium term the intent is to develop a deeper project portfolio in both regions, that is better attuned to regional requirements, builds on closer institutional relations in the region, and can better respond to demand from development partners in the region. Given that a significant number of development agencies now program their resources through well defined country priorities, having capacity either in the country or the region is important in being able to deliver competitive project proposals.

Africa as a whole has a complement of 41 staff, of which 7 are in West Africa, operating under the Ghanian sub-regional office. The office in Southern Africa is still in the planning phase. The Ghana Office is planned to grow into a western African regional hub, to cover both French and English speaking countries. The issue is what capacities are required in the office to be competitive for projects in the region. In this regard, CABI does not have to build an independent capacity to meet regional needs but rather can draw, particularly in the project design stage, on the range of capacities in either the African regional office or globally. One significant feature of West Africa as compared to East Africa and which affects the diffusion and scaling issue is the agroecological zonation in the region, which allows for better defined and broader "recommendation domains" and the potential for more robust scaling, potentially across countries. Building a research program around the dominant agroecological zones might be a first cut at developing a programmatic strategy for the region.

Science Capacity Needs over the Next 5 Years

There is a chicken and egg question in building science capacity in that the capacity (programs, infrastructure, scientific disciplines) determines the science that can be done, on the one hand, and yet project funding, based on program capacities needed to attract such funding, is required to build any new capacity. In an African context CABI's programs have each evolved in relation to both country demand and priorities of donors. CABI is expanding its geographic reach and is expanding and evolving its programs into a "research into use" framework. This provides the ability to expand CABI's visibility and in turn its funding base. This review has suggested three potential areas for new program development building on dominance of PlantWise in the Africa project portfolio. These are evolving a regional surveillance capacity from the plant clinic network and the invasives work, building social science rigor into the understanding of farmer adoption, diffusion and scaling, and building a capacity in delivery of food based nutritional approaches. All three suggest an unexploited niche in the region that builds on the one-CABI strategic vision, and yet each requires quite different capacity needs, and therefore strategic choices. This report has been biased to the latter two, but all three are legitimate areas for future development. As well, there are different approaches to developing such new capacities. One would be to make a strategic choice and pre-fund a position or positions in that area which would provide leadership for development of the program. The other option is the pilot modality in an action research framework, as was used in PlantWise.

The choice is based on risk preferences and an evolving assessment of demand from both regional partners and donors.

Addendum

What Ruth was hearing:

1. Not clear why not much attention was paid on the 2009 review

2. The 2009 Review started to address the need to demonstrate impact at the ground level, and for this to happen, the right skills, such as in M&E needed to be identified/developed. Clearly, that need is more imperative now as more and more donors demand to be shown where their "dollars" are going. M&E stands out as one of the social science skills to both develop and bring on-board, because without it, one cannot measure impact in any tangible manner.

3. There was full praise for PlantWise collaborative projects, and that in these, CABI has been able to display unique leadership and expertise. This has been CABI's niche and a lot has been said about it already.

4. More and more, there is better synergy between the London Office and the Africa office

5. Communications technology has come in very handy and cuts down travel costs as skype conference between Nairobi and Ghana works quite well.

6. Publishing: Finding time to do this is a challenge although there are those who felt there should be no problem, especially the younger scientists, as one should be able to factor it in their yearly work plan and least 2 publications annually.

7. Staff Development: Staff have been granted time to participate in scholarly writing courses and in other trainings to enhance their abilities. The staff I interviewed had no complaints whatsoever about CABI; they were full of praise with regard to the support they receive to grow. On the other hand, the senior staff have found time to supervise post-doctoral students some of whom have ended up as staff/interns at CABI. This arrangement has led to joint publishing. Names of students benefiting from the expertise of a couple of senior scientists at CABI was provided. A more formal arrangement would do the following: give visibility to all involved, avail ample time for CABI scientists to do this instead of them always feeling the pressure of having to create time outside their normal CABI work, and an appreciation to share and publish research findings for humanity's benefit would be inculcated in the young scientists' minds.

8. Content development of nutrition: it might be a good idea to have an in house nutritionist. The justification for this has been given above. Mainstreaming nutrition in CABI's work would give credibility to the origin of the text messages they send out, would keep up with the ever

changing messages on nutrition, and would erase the impression that CABI is doing it out of popular pressure, or as just a tag-on issue that may soon go off the radar.

9. Food quality is big now in terms of both safety and nutrition. A huge part of the world trade involves food and countries especially in the industrialized world are becoming a lot more stringent on these issues. Many farmers and food traders from the South have lost huge amounts of money for failure to put in place regulatory and inspection structures designed to address the expectations and concerns of receiver countries. Food rejects translate into big economic and reputation losses on the importing countries and clearly a discouragement and major financial set back to the traders and farmers.

10. CABI does not need to have its own labs; but should rather help to upgrade KALRO and use them, just like they did before. KEPHIS on the other hand expressed the view that if CABI were able to establish and run high level labs with a clear uniqueness that is not found within the region, then such a lab could benefit countries and scientists internationally.