

Forging Links between Agriculture and Health

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Final Report to IDRC covering period April 2008 – September 2012

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Executive Summary

The goal of this project was to support the development of the Agriculture and Health Research Platform (AHRP) during the period 2008-12. The Platform consists of an alliance of stakeholders from the Consultative Group on International Agricultural Research (CGIAR) and from the international health community, notably including the World Health Organization (WHO). IFPRI led the development of the Platform, with the funds provided under this grant. Key activities included network building, policy research on identified priorities, capacity strengthening and policy communications. The research agenda took account of the broader concerns of stakeholders and policymakers in the agricultural, nutrition, and health communities. Research was intended to focus on mitigating negative effects on agricultural activities while maximizing opportunities for agriculture to benefit health, and better health to benefit agriculture. Globally, the expected impact was: stronger, more effective and sustainable agricultural systems that promote health, and healthier farmers and consumers. Among the poor, the health benefits of agricultural research, programs, investments and policies will increase, and vice versa with regard to improving the benefits that accrue to agriculture from a healthier rural population. These anticipated impacts were to be achieved through the formation of new research collaborations between agriculture and health investigators, the development of methodological innovations, strategic communication of research findings, policy impact, and capacity strengthening at regional, national and subnational levels.

The original goal of the Agriculture and Health Research Platform (AHRP) was to promote and coordinate research on the two-way linkages between agriculture and health, with the aim of alleviating livelihood and food insecurity through enhanced policy and program effectiveness. AHRP's objectives were: a) to develop partnerships with the health sector so as to draw on mutual strengths in filling major knowledge gaps at the interface between agriculture and health; b) to build on common ground between researchers, policymakers, and practitioners; c) to develop and adapt methodological tools to link agriculture and health in research, policy, and practice; and d) to communicate through publications and outreach.

The purpose of the multistakeholder platform approach was to provide a space or forum for the two sectors to come together, and to generate international public goods through research findings that have relevance not only across sectoral divides, but potentially across different regions. Recognizing

context-specificity, the global platform aimed to provide adaptable approaches, principles, processes, and options for responding to adverse agriculture and health linkages.

Major highlights included the following:

- finalization and approval of CGIAR Research Programme No. 4 (CRP4) on *"Agriculture for Improved Nutrition and Health"* (now called A4NH)
- convening of major international conference on *"Leveraging Agriculture for Improved Nutrition and Health"* in New Delhi, 10-12 February 2011,
- convening (in collaboration with the Leverhulme Centre for Integrated Research on Agriculture and Health) of a workshop on *"Measuring Effects of Integrated Agriculture and Health Interventions"* in London, 12-13 May 2011,
- convening of a side-event to the 2020 conference on agriculture-nutrition linkages in India, in association with the Indian Economics Association (part of the TANDI project that emerged from the October 2009 AHRP consultation in Delhi – see "Partnerships" below).
- convening of a workshop on aflatoxin and stunting.
- finalization of 2 of the 3 commissioned studies,

The impact of the Platform has been particularly evident in its influence on the CGIAR reform process (securing of CRP4 led by IFPRI), in the selection of agriculture, nutrition and health as a key communications theme for IFPRI, the major success of IFPRI's International Conference on *"Leveraging Agriculture for Improved Nutrition and Health"* held in New Delhi in February 2011, and the strong endorsement by the CGIAR Consortium Board of the original CRP4 proposal.

Two of the three commissioned studies are now complete (in terms of research) while outreach activities continue. The rift valley fever study will be completed shortly. Details on all three studies are provided below.

The research problem

Agriculture is the primary source of livelihoods for the majority of the world's poor, who in turn are the most vulnerable to ill health. Agricultural policy and practice affect human health, and health in turn affects agricultural productivity and output. Agriculture supports health by providing food, fiber, medicinal plants, and materials for shelter for the world's population. In rural communities, it contributes to livelihoods and food security and provides income that can be spent on health care and prevention. Successful health policies in turn benefit agriculture by protecting the labor force from days (and income) lost to illness, chronic disabilities, or mortality. Agriculture is particularly important to achieving the first Millennium Development Goal (MDG 1)—eradicating extreme poverty and hunger—because it can contribute to increased food availability and access and greater income. Agriculture is also linked directly or indirectly to several other goals, especially the health and survival goals—that is, the goals to reduce child mortality, improve maternal health, and combat HIV/AIDS, malaria, and other diseases (MDGs 4, 5, and 6). Thus, good health and productive agriculture are linked, and both are essential for poverty reduction and are key instruments for achieving the MDGs.

Despite these obvious linkages, the agriculture and health sectors have typically failed to work together in developing joint policy aimed at generating common benefits more effectively and efficiently.

This was the original rationale for this project in early 2008. It remains relevant and as important as ever. Indeed there are several factors and processes which are forcing an increasing convergence between the agriculture and health problems, including climate change, globalization, transboundary epidemics, food and fuel crises etc. Such long wave dynamics further strengthen the logic for joint “agri-health” approaches being developed. Several outputs and outcomes described in this report show that progress is being made in strengthening intersectoral links globally, and this project has played an important catalytic and substantive role.

Synthesis of outputs and achievements

This project spanned five years, from 2008-2012. Annex 4 of this report lists 56 outputs from this project, with more to follow (e.g. peer-reviewed journal articles from the commissioned studies). The main achievements during the final two years (September 2010 – September 2012) – when many activities came to fruition -- are detailed below. But we start here by listing some of the key outputs of the first phase.

1. Synthesis of outputs from preparatory phase (2008 – 2010) with full details shown in Annex 4

- Call for Concept Notes released. 133 concept notes received from which eight full proposals prepared and reviewed. Ultimately, three proposals accepted and work commissioned.
- Paper entitled “*Bridging the Gap: Linking Agriculture and Health to Achieve the Millennium Development Goals*” by von Braun, Ruel and Gillespie published by Cornell University.
- Formation of a high-level panel for the invited session on Agriculture, Health and Nutrition at Global Ministerial Forum on Research for Health, Bamako, 17-19 November 2008.
- Abstract accepted for poster at Global Ministerial Forum on Research for Health, Bamako, 17-19 November 2008.
- In 2008, AHRP coordinator invited to join Special Programme for Research and Training in Tropical Diseases (TDR), (sponsored by UNICEF/UNDP/World Bank and WHO) Thematic Reference Group on Environment, Agriculture and Infectious Diseases.
- Literature review and proposal on malaria and agriculture linkages (2009);
- *Ag-Health Updates* (twice-yearly news bulletin) released from 2009.
- Book chapter entitled: “*Changing Global Diets: Implications for Agriculture*” submitted for publication in a book to be published by the Society of Agronomy entitled: “*The International Dimension of the American Society of Agronomy: Historical Perspectives, Current Issues, and Future Challenges.*” (2009)
- Paper on priority-setting approaches for research on agriculture and health by Nimu Mwangi
- Proposal for a study of the impact of malaria on agriculture worker productivity.
- “Bridging the Gap: Linking Agriculture and Health to Achieve the Millennium Development Goals” chapter in book published by Cornell University on food and health in Africa, by Von Braun, Ruel and Gillespie.
- Lead article for IFPRI Forum newsletter “Sick and Tired: Climbing out of the Health-Poverty Trap”.
- Extensive contributions to the Annual Report of the Special Programme for Research and Training in Tropical Diseases (TDR) Thematic Reference Group on Environment, Agriculture and Infectious Diseases, sponsored by UNICEF/UNDP/World Bank and WHO .

- **TANDI.** Following the October 2010 stakeholder consultation, a proposal was prepared for furthering the recommendations of this group. With funding from the Bill and Melinda Gates Foundation, the emerging TANDI project (*“Tackling the Agriculture-Nutrition Disconnect in India”*) sought to better understand and address the failure of sustained economic and agricultural growth to make significant inroads into levels of malnutrition in India, a country where one third of the world’s malnourished children live. The project succeeded in generating a consensus on the nature of the “agriculture-nutrition disconnect” and elucidated key pathways of potential impact of agricultural growth on nutrition. TANDI was an offshoot of the Platform, and one of several activities “under its umbrella”, though it is not directly funded by the IDRC grant.
- An essay and slides on the AHRP for the Center-Commissioned External Review (CCER), November 2009.
- Two-page concept note for the CGIAR Research Program on Agriculture, Nutrition and Health (CRP4). A 20-page proposal was developed and submitted to CGIAR directors for their initial review, and a slide presentation made on 31 March 2010 at the GCARD in Montpellier.
- Extensive annotated bibliography on Agriculture-Health Challenges in Africa prepared by Nimu Mwangi and Stuart Gillespie.
- Article on AHRP for CGIAR Annual Report 2009
- CRP4 proposal

Events

- The AHRP coordinator attended WHO’s *Advisory Committee on Health Research* as an observer in late March 2009 in Geneva. The two main items comprised the Global Ministerial Forum and the emerging WHO research strategy. Early drafts of Bamako agenda and the WHO research strategy both include a strong focus on partnerships and the importance of research that originates from outside the health sector. Agriculture, environment, climate change are all prominent. Agriculture and health has been selected as a key parallel session for Bamako.
- The AHRP coordinator was invited to an April 2009 WHO meeting on priority-setting methodologies for health research. Some of these methods have potential in guiding future work of the Platform.
- As one of several preparatory meeting for the Bamako conference, the Ministerial Conference on Research for Health in the African Region was held in Algiers, 23-26 June, YEAR. The AHRP submitted a paper on agriculture and health research, subsequently translated into French, Spanish and Portuguese, and the AHRP Coordinator was invited to facilitate a session on “Collaborations.”
- International AIDS Conference, Mexico (2010). Strong focus on food, livelihoods, nutrition. Individual abstracts were submitted and accepted by various AHRP partners including CIP, IFPRI, WorldFish, FAO, WFP, WHO. Several high-level presentations were made by AHRP members.
- Changing Environments and Emerging Infectious Diseases workshop hosted by the Emerging Pathogens Institute at the University of Florida, 2010.
- Human Health and Forests consultation hosted by CIFOR and SwedBio (Geneva, Washington DC)
- Global Food Systems: Their Impacts on Nutrition and Health for All. Presentation on Addressing the double burden of malnutrition through strengthening agriculture and nutrition linkages. Earth Institute at Columbia University (New York, NY), 16 September.
- The Global Ministerial Forum on Research for Health was held in Bamako, Mali, 17-19 November 2008 (www.bamako2008.org). This conference, held every four years charts the way ahead for

international research on health-related issues. The focus on “research *for* health” (not simply health research) signals a new understanding of the need to form intersectoral collaborations. AHRP organized a high-level session on “Agriculture, Food Security and Nutrition” and presented a poster on the “why, what and how” of strategic partnerships between agriculture and health, featuring the Platform. A report of the session is attached, along with the agenda, and the conference “Call to Action” (in which food security and the stated need for interdisciplinary research coalitions, features strongly).

- Food safety conference, WHO Geneva, 20 November 2008 – Clare Narrod, IFPRI represented the Platform.
- Ecohealth Forum, Merida, Mexico, December 2008 in which several AHRP partners participated (Drimie, Wagah) including two of the three PIs for the selected research studies (Iannotti, Schelling).
- Annual meeting of AHRP Core Group, 13-14 January 2009, ILRI Nairobi, Kenya. The annual core group meeting of the AHRP was held January 13-14 2009 with representatives from 25 different institutions including universities, CGIAR centers, NGOs, and UN agencies doing work on agriculture and health. A strategy document for the platform was developed in second quarter 2009 based on discussions at this meeting and further consensus gained from various stakeholders. Participants at the annual meeting included CIP, WHO, CIFOR, FAO, CIAT, WorldFish, ILRI, University of Florida, HKI, IITA, IWMI, Millennium Villages (Earth Institute), London International Development Centre, ICIPE, Bioversity International, West African Health Organization, RENEWAL Kenya, University of Nairobi, Concern Worldwide, USDA, IDRC, George Washington University, London School of Hygiene and Tropical Medicine, World Bank, The AIDS Support Organization (TASO), Uganda. A dedicated webpage is available <http://www.ifpri.org/ahrp/ahrpevents.asp>, with key presentations and detailed descriptions of the relevant activities of each participating organization.
- UN Economic and Social Council (ECOSOC) seminar on agriculture and health (7 July 2009). Eighty delegates (some ministers, many deputies) attended a lunch seminar at the UN Palais des Nations, Geneva during the ECOSOC special session on health.
- Contributions to two symposia at the International Society of Environmental Epidemiology (ISEE) annual conference, Dublin (August 2009) on agriculture and health.
- Symposium on agriculture, nutrition and health at the International Conference on Nutrition, Bangkok (5 October 2009), organized by IFPRI.
- Stakeholder Consultation on Agriculture, Nutrition and Health, New Delhi, 12-13 October 2009.
- Dr Kadiyala represented the AHRP at the annual meeting of the Special Programme for Research and Training in Tropical Diseases (TDR) Thematic Reference Group on Environment, Agriculture and Infectious Diseases, sponsored by UNICEF/UNDP/World Bank and WHO, in Shanghai.

2 Synthesis of outputs and achievements in final phase (September 2010 – September 2012)

In this section, we focus on the final two years -- first on “global” achievements, before turning to summary reports of the three commissioned studies.

1. “Global” achievements

Project highlights included:

- A. Completion of the CRP4 proposal on Agriculture for Nutrition and Health, since approved by the Consortium Board and Fund Council.
- B. Successful co-organization, convening and follow-up of IFPRI’s International Conference on *“Leveraging Agriculture for Improved Nutrition and Health”*, New Delhi, 10-12 February 2011.
- C. Joint IFPRI/AHRP/Leverhulme Centre for Integrated Research on Agriculture and Health (LCIRAH) workshop on *“Measuring Effects of Integrated Agriculture and Health Interventions”* in London, 12-13 May 2011.
- D. *“Tackling the Agriculture-Nutrition Disconnect”* (TANDI) side-event to the Delhi conference, 10 February 2011
- E. Convening of a workshop on aflatoxin and stunting, co-organized by IFPRI and the Bill & Melinda Gates Foundation, in Washington, DC, February 1-2, 2012

A CRP4 proposal: *“Agriculture for Improved Nutrition and Health”*

The CGIAR has committed itself to ensuring that agricultural research serves the needs of the poor, including the need for better nutrition and for better health. In its new vision (CGIAR SRF 2010), the CGIAR commits to *reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience through high-quality international agricultural research, partnership, and leadership*. The CGIAR Research Program *“Agriculture for Improved Nutrition and Health”* (CRP4) directly and strategically supports this new vision. This program is designed to support the overall CGIAR research agenda by improving our understanding and options for how agriculture can better accentuate the positive benefits and mitigate the risks of agricultural development on human health and nutrition. These lessons are meant to serve the entire CGIAR agenda, within agroecological production systems and along food value chains. Emphasis will be placed on two populations: a) people who are left behind by socioeconomic development, suffer from high rates of malnutrition and agriculture associated diseases, and rely on aid and development support, and b) poor people in dynamically intensifying and changing systems in which research can help shape agricultural development more positively and safely.

CRP4 will work at the interface of the agriculture, health, and nutrition sectors. For the ambitions of this program to be met, partnerships will be critical. CRP4 proposes a much closer partnership between the agriculture, health, and nutrition research and development communities than seen previously. New approaches to cross-sectoral work are proposed. While new, CRP4 will build on past successes of CGIAR and partners working together on agriculture, health, and nutrition programs (including through the AHRP) and seek to complement a number of new international initiatives for improving agriculture-nutrition and agriculture-health integration and synergies.

The original CRP4 proposal was the culmination of effort by many internal and external collaborators who worked closely together for more than one year. Twelve CGIAR Centers and multiple partners from agriculture, health, and nutrition communities actively participated in contributing to the development of this proposal through written contributions, stakeholder and partner workshops, and oral discussions. The process of drafting the initial concept note, which serves as the basis for the proposal, was led by Marie Ruel (IFPRI) and John McDermott (formerly of ILRI), both active members of the AHRP, with important contributions from Howdy Bouis (HarvestPlus). The core writing team of the full proposal included: Jessica Fanzo and Stefano Padulosi (Bioversity); Howdy Bouis, Bonnie McClafferty (HarvestPlus), Stuart Gillespie (IFPRI), Helena Pachón (CIAT), Maximo Torero (IFPRI), and Delia Grace (ILRI). The full CRP4 proposal can be found at: <https://sites.google.com/a/cgexchange.org/mp4/home>. Dr John McDermott has now moved to IFPRI as the Director of CRP4 which has now been fully approved, with work now underway. .

How did the AHRP influence the development of the CRP4? The AHRP had a major influence on CRP4 initiation and development. Much of the conceptual groundwork had been done, literature reviewed, research priorities generated, stakeholder communities and networks built, at the concept note stage for CRP4. This is evident when comparing the June 2009 AHRP concept note (“*Scaling up research and action on agriculture-health links*”, sent to IDRC as an annex to the 3rd interim report) with the proposal. The existing stakeholder links enabled CRP4 to convene a well-attended consultation in Addis Ababa during July 2010. AHRP’s influence is explicitly recognized in the CRP4 proposal:

- *Page 19: “The CGIAR centers involved in this program have considerable experience in partnerships across the types of development processes involved in CRP4 (support to policy and decisionmakers, development implementers, and value chain actors). In addition, all have experience in specific domains of ANH linkages, through previous and ongoing research and research-development partnerships as well as, collectively, through the CGIAR Agriculture and Health Research Platform. (See <http://programs.ifpri.org/ahrp/ahrp.asp> for further information.)”*
- *Page 20: “Intergovernmental agencies have increased their coordination in relevant areas: nutrition, through the Subcommittee on Nutrition (SCN), the SUN movement and the REACH initiative; food safety, through CODEX and SPS technical standards for WTO; and zoonoses and emerging diseases, around the One Health initiative. CGIAR centers have engaged with these organizations individually, around major programmatic areas, as well as collectively through the Agriculture and Health Research Platform.”*

In short, AHRP gave IFPRI and ILRI (the two most active AHRP members in the CG) with a head start in CRP4 development, and a legitimacy both within and beyond the CGIAR.

B. International Conference “*Leveraging Agriculture for Improved Nutrition and Health*”, New Delhi, 10-12 February 2011

Much has been written about this high-profile event that attracted over 1,000 participants for several days in mid-February 2011, in New Delhi. Participants convened to think through the interactions among agriculture, nutrition, and health and consider ways to exploit them to improve human nutrition and health -- clarifying what is known about the links among the three sectors, what is not known, and where opportunities for leveraging agriculture for nutrition and health may lie. The conference website

[\(http://2020conference.ifpri.info/\)](http://2020conference.ifpri.info/) contains a wide range and depth of outputs – including a “highlights” booklet -- along with periodic updates on upcoming events and initiatives. A major new book “*Reshaping Agriculture for Nutrition and Health*” which drew on conference proceedings was published by IFPRI during 2012.

How did the AHRP influence the development of the conference? Following early activity of the AHRP in 2007, and its expansion and consolidation with IDRC funding in 2008, the topic of “Agriculture for Improved Nutrition and Health” was gathering momentum within and outside IFPRI. In 2010, IFPRI designated this issue as its main communications theme for the year. This led to the decision, following discussion between key IFPRI staff (including those involved in the AHRP), to hold a major international conference on this issue in New Delhi in early 2011. A lot of the groundwork had been done by the AHRP in terms of clarifying conceptual frameworks, generating research priorities, engaging with, connecting and building stakeholder communities, and releasing several publications and policy briefs to increase visibility and wider interest. Several AHRP members were active on the conference steering committee (including Gillespie, Ruel, Bos, McDermott, von Braun, Joiner), shaping the structure, content, inputs and expected outputs of the conference, and later participating as speakers and/or chairs in various sessions. It is clearly not possible to estimate the relative magnitude of impact of the AHRP on the conference (and such monitoring was not in any case planned at the outset of the AHRP, as the idea of the conference had yet to emerge then). But the influence was clearly significant. Many invitees for the conference had been identified earlier by the AHRP.

In addition to the work of AHRP-related CGIAR staff, the following participants travel and subsistence to the Delhi conference were directly supported by an additional sum of CAD \$25,000 that was provided by IDRC for this purpose. This list includes key focal points for the three studies described below.

- Bastiaan Brak, Research Fellow, University of Leeds, UK
- Srun Darith, Deputy Secretary General, Council for Agriculture and Rural Development (CARD), Cambodia
- Kabba Joiner, Former Director General, WAHO, Burkina Faso
- Tabitha Kimani, PHD Graduate Fellow, ILRI, Kenya
- Sarom Men, Vice Rector, Royal University of Agriculture, Cambodia
- Willis Oluouch-Kosura, Program Director – CMAAE, AERC, Kenya
- Apollo Onyango, Company Agronomist, Kenya Horticultural Exporters Ltd., Kenya
- Aminuzzaman Talukder, Country Director and Regional Food Security Advisor, Helen Keller International, Cambodia
- Ismaila Thiam, Program officer, Non-Communicable Diseases and Nutrition and Food Security, WAHO, Burkina Faso

C. Joint IFPRI/AHRP/Leverhulme Centre for Integrated Research on Agriculture and Health (LCIRAH) workshop on “Measuring Effects of Integrated Agriculture and Health Interventions” in London, 12-13 May 2011

On 12-13 May 2011, LCIRAH and the AHRP co-hosted an international workshop in London on improving metrics for agri-health interventions. The workshop brought together more than 100 people from health and agriculture communities. The first day featured a discussion of existing metrics and methods together with their value and limitations, highlighting a range of case studies. The second day focused on practice and policy aspects of measuring food security and nutritional outcomes. A two-page

summary report of the workshop was annexed to the June 2011 technical report, and agenda, slides and workshop report are available at: http://www.lcirah.ac.uk/conference.php?event_id=5.

Apart from co-organizing and co-funding this workshop, the AHRP was visible during the two days, with two presentations – one by Talukder and Olney on the IFPRI/HKI operational research on homestead food production (Study 1 discussed later), and one by Gillespie on the TANDI initiative (also discussed below). Participants of this workshop funded directly by the AHRP grant included:

- Kabba Joiner, WAHO
- Ismaela Thaim, WAHO
- Zaman Talukder, HKI Cambodia
- Padam Raj Bhatta, Joint Secretary, Ministry of Health and Population, Nepal
- Deanna Olney, IFPRI
- Stuart Gillespie, IFPRI

D. “Tackling the Agriculture-Nutrition Disconnect” (TANDI) side-event to the Delhi conference, 10 February 2011

The seeds for the TANDI initiative were sown at the AHRP Delhi workshop of October 2009. A proposal was subsequently developed, submitted to, and approved by the Bill and Melinda Gates Foundation who had shown an interest in this issue in India. The goal of TANDI is to better understand and address the failure of economic and agricultural development to make significant inroads into reducing undernutrition in India. The initiative promotes a multistakeholder platform, bringing Indian economists, nutritionists, public health experts and other stakeholders together to address key knowledge gaps, and drive a change in policy and program processes to maximize the role of agriculture in accelerating the reduction of undernutrition. A side-event to the February 2011 Delhi conference was held to bring people, emerging papers, and new ideas together on this issue -- the full agenda and session description of which was annexed to the June 2011 report. Papers presented at the Delhi side-event are being brought together as an IFPRI book in 2012.

E. Workshop: “Aflatoxin: Impact on Stunting in Children and Interventions to Reduce Exposure to Mycotoxin”

Co-organized by International Food Policy Research Institute and the Enteric and Diarrheal Diseases, Agriculture and Nutrition teams at the Bill & Melinda Gates Foundation, a workshop was held (with funding from this AHRP grant) in Washington, DC, February 1-2, 2012

A group of multidisciplinary experts was brought together to explore the relationship between mycotoxin exposure and growth retardation in infants and to identify potential areas for collaboration and future research efforts. An additional goal was to develop links and exploit synergy and partnerships among those interested in agriculture, health, and nutrition, and policies and interventions to address this problem. To this end, there was an opportunity for the meeting participants to stay after the presentations and discussions on February 2 to interact with one another and develop collaborative efforts that could be submitted in the form of letters of interest (LOI) to the BMGF.

The workshop report – submitted in August 2012 -- summarizes the two plenary sessions of the meeting (Association between Aflatoxin and Stunting, and Setting the Research Agenda) and the two concurrent

sessions sponsored by the BMGF that focused on understanding the impact of mycotoxins on gut function and stunting (Potential Impact and Models, and Mechanisms and Biomarkers).

The meeting participants emphasized the enormous global burden of disease attributable to maternal and child under-nutrition. In this context, the adverse sequelae of mycotoxin exposure through contaminated food is particularly high in the those parts of the developing world where the population's diet is limited to mainly a single food staple that is vulnerable to fungal infection, with the major period of vulnerability being prenatally and in the first few years of life. Consumption of aflatoxin-contaminated food is associated with lifelong impediments to health and development, including cognitive impairments, susceptibility to disease, and reduced response to vaccinations. Although direct causality and the mechanisms by which mycotoxins cause these outcomes are not fully understood and they are likely to involve multi-system, multi-organ as well as organ-specific effects, there is accumulating evidence for the role of inflammation and the adverse impact on intestinal integrity as important factors. Interventions face a number of barriers including the need to be tailored to the specific agroecological, economic, regulatory, educational, and social milieu of the country of deployment as well as to complex ethical and safety issues related to use of preventative strategies.

Nevertheless, some simple promising strategies are currently under study. Further work is needed in the area of mechanisms so that they can be taken into account in designing epidemiological studies and intervention strategies. Although biomarkers and assays are available for aflatoxin, more work in this area is needed for other mycotoxins as well as work to compare results across assays for specific mycotoxins. While animal models are available, the one most similar to humans, the piglet, is limited in terms of the number of animals that can be studied. While there are a number of rodent models, these are limited by the differences in the metabolic and immune systems of rodents from those of humans. Studies to assess the burden, mechanisms, and intervention strategies are labor intensive and need an in-country infrastructure that requires time and resources to develop. Thus, the potential for using extant samples from prior studies or building add-on studies to ongoing projects, such as MAL-ED, will be important for efficiently obtaining the knowledge needed to understand and intervene in the adverse health outcomes associated with mycotoxin exposure.

2. The Commissioned Studies

In 2008, the AHRP prioritized the following areas: HIV and agriculture; avian influenza and other zoonoses, household livelihoods and food security; agriculture, nutrition, diet and health; food safety and growing food supply chains; water-borne diseases and water management; occupational health (including pesticides) and child labor in agriculture.

Three studies were commissioned by the AHRP after a competitive process. A Call for Concept Notes was widely disseminated in April 2008. By the deadline of 11 May 2008, 133 concept notes had been received. Using agreed eligibility criteria and with assistance from an independent external peer review panel, a shortlist of 19 concept notes was prepared, with approx. 6-7 notes in each of the three core themes (nutrition, food safety and water). By the end of June 2008, a total of nine full proposals were requested, with a deadline of 1 September. Eight were submitted, and these were again reviewed by the review panel, prior to a collective decision being made on the following three studies:

1. ***Homestead Food Production Programs for Better Health and Nutrition.*** Helen Keller International, International Food Policy Research Institute, Cornell University
2. ***Measuring, predicting and adapting to aflatoxin risk under climate variability and change.*** University of Leeds and International Institute for Tropical Agriculture.
3. ***Enhancing prevention and control of Rift Valley Fever in East Africa by intersectoral assessment of control options.*** Swiss Tropical and Public Health Institute, Kenya Medical Research Institute, Center for Disease Control, Ministry of Livestock Development, Kenya, International Livestock Research Institute, Egerton University, Kenya.

Study updates are provided here.

Study 1: Homestead Food Production Programs for Better Health and Nutrition in Cambodia

Helen Keller International (HKI) has implemented homestead food production (HFP) programs in Asia for the past 20 years, and in the last decade added poultry production to its program in Cambodia. The overall goal of the program is to improve maternal and child health and nutrition outcomes – specifically to improve micronutrient status (vitamin A and iron), improve growth among children and to reduce the prevalence of illness. To achieve these goals HKI’s HFP program is designed to work through three primary pathways: 1. Increasing the availability of micronutrient-rich foods through increased household production of these foods; 2. Income generation through the sale of surplus production; and 3. Increased knowledge and adoption of optimal nutrition practices, including the consumption of micronutrient-rich foods. The idea of establishing stronger linkages with health services has also been considered.

Earlier research showed that production increased, dietary diversity increased but an impact on health and nutrition outcomes such as anemia and growth appeared to be elusive. Why was this? Was it related to design issues in the evaluation or was it related to issues in program implementation and utilization and/or program design issues associated with a true lack of effect? This AHRP study was designed to gain some insight into these questions. Specifically we investigated how HKI’s HFP program in Kampong Speu Province in Cambodia is working to benefit the participants, and to identify ways in which the program may be able to be improved. To this end we investigated the program delivery, client use, and uptake as well as the perceptions and attitudes of key stakeholders, program implementers, and program beneficiaries and non-beneficiaries related to the HFP program.

The data collection for the project concluded in March 2010. Data entry was concluded in August 2010, preliminary data analysis in November 2010, and final analysis in May 2011.

Workshops and presentations. Two workshops were held in Cambodia in December 2010 to present the preliminary findings from the operations research and to discuss the potential to change the HFP program based on those results. The first workshop that was held was a full-day, in-house workshop with program implementers, beneficiaries and other key stakeholders from local NGOs and a few representatives from the government. At this workshop results from the research were presented without the conclusions and recommendations from the research team with the intention of having the workshop participants come to their own conclusions based on the findings presented. They were further asked to identify the program areas that they thought were working well and those that could be improved, based on the results presented. This discussion was followed by a ranking exercise in which small groups were asked to rank the areas identified as needing improvement in terms of feasibility of change, potential to improve maternal and child health and nutrition outcomes and the

cost of these changes, among other things. This exercise resulted in a series of recommendations that the group thought could feasibly be implemented and that would contribute to improvements in the impact of the HFP program on maternal and child health and nutrition outcomes. These are featured in the main overall study report, finalized 14 June 2011 (and annexed to the June 2011 interim technical report to IDRC).

The second workshop was a half-day workshop in which an overview of HKI's HFP program successes throughout Asia was presented by Zaman Talukder. The results from the operations research and from the in-house workshop were then presented by Sao Vicheka and Deanna Olney. The participants in this workshop included the primary program implementers from HKI and WOSO as well as a number of representatives from different organizations such as FAO, UNICEF and World Fish among others. In addition representatives from the Ministry of Agriculture and Health participated in the workshop. The presentations were again followed by a small group activity in which participants were asked to take one of the key recommendations from the in-house workshop and asked to develop a plan of how this could be implemented and the expected impact of implementing these changes. The results from these small group discussions were then presented back to the group.

A presentation of the results was also made in December 2010 to Cambodia's Nutrition Technical Working Group. Some of the results from the operations research were also presented at the *'Measuring Effects of Agri-Health Interventions'* Workshop held in London on May 12th and 13th, 2011.

Reports and papers. The final report was annexed to the June 2011 report to IDRC, submitted earlier. A paper for publication will shortly be finalized, and a separate summary produced for HKI to distribute to their partners and other key stakeholders, in Cambodia and beyond.

Outreach and use of findings. First, HKI (as stated in their action plan for an enhanced HFP model, in their final report to IFPRI) have already incorporated some of the findings related to inputs management and training into the existing HFP programs. The HFP model has been further adjusted, based on study findings, to maximize effective implementation to achieve improved program outcomes. Results have also been shared with relevant agencies in Cambodia and other countries. Second, IFPRI and HKI together have already used modified versions of the framework and instruments used in this research as part of another evaluation of a HKI HFP program in Burkina Faso. Since June 2011, the findings have been presented in various fora.

Study 2: Measuring, predicting and adapting to aflatoxin risk under climate variability and change

Mycotoxins contaminate approximately 25% of the world's food supply. This project assessed the seasonal predictability of human exposure to aflatoxin by using expertise in human health and climate and crop processes. Predictive quantitative models of aflatoxin on crops were developed, derived from seasonal forecasts, crop modelling, and measurements of crop aflatoxin contamination. Blood-based biomarkers of aflatoxin exposure were used alongside the modelling in order to understand the implications for human health. The forecasting tool has the potential for both immediate benefit and longer-term enabling of adaptation to climate change.

Project team. From University of Leeds, UK: Prof. Andrew Challinor <a.j.challinor@leeds.ac.uk> was the main contact and responsible for the modelling work. Dr. Yun Yun Gong oversaw the analysis of the blood samples for aflatoxin-albumin adducts. Dr. Bastiaan Brak carried out the modelling work. In Africa. Dr Ranajit Bandyopadhyay. IITA, Nigeria. Food aflatoxin analysis; Dr Papa Madiallacké Diedhiou

Université de THIES, Senegal. Sampling of groundnut and food products in Senegal, collection of weather and agronomic data in Senegal; Dr Abdoulaye Déme, Faculté de Médecine Pharmacie et Odontostomatologie (Laboratoire de Cancérologie), Université Cheikh Anta Diop, Dakar, Senegal. Human biomarker sampling.

Highlights included:

- *Population and crop sampling* were carried out in April 2010. Additional, unplanned, samples from 25 people from 5 villages in the Sedhiou area (N1242718, W1533644) were carried out on 27, 28 and 29 June.
- *Blood aflatoxin analysis*. First batch of blood samples have been analysed using an ELISA method. All these 86 samples were found positive with the adduct. The mean AF-alb adduct is around 80pg/mg albumin which indicates a rather high level of exposure.
- *Climate data and probabilistic forecasts*. The climate and weather station data for the project have been transferred to servers at Leeds. The availability of weather station data is under investigation.
- *Development of the forecast tool* is the principal goal of the project, so some detail is given below.
- *Completion of final report* and draft of a paper to be published shortly on the findings.

Pre- storage and post-storage aflatoxin risk parameterisations were developed for the GLAM crop model. As part of this, two soil temperature models, EPIC and KANG were implemented to estimate pre-storage aflatoxin risk using a risk index (see Figure 1). The literature reports range of temperatures as being conducive to aflatoxin, and these ranges are large relative to the disagreement between the two soil temperature models. Estimating soil temperature is therefore unlikely to be a constraint to aflatoxin prediction.

The model was then used to answer the questions: Is the skill in seasonal weather forecasting in West Africa sufficient to predict the occurrence of high aflatoxin concentrations in groundnut?; if so, what methods can be used to maximise the capacity for prediction? To answer this, aflatoxin risk/severity indices were compared for 12 locations in Senegal (see Figure 2) based on observed weather data (WMO, MIDAS) with aflatoxin risk/severity indices for the same locations and time frame based on seasonal weather forecasts.

Annual observed weather data files for the whole of Africa have been used to obtain reliable estimates of the daily maximum and minimum relative humidity. The results of that work suggest that coastal regions are more prone to post-harvest aflatoxin risk than terrestrial regions. On average the coastal region experiences a higher relative humidity throughout the day than the terrestrial region (see Figure 3). It is therefore likely that coastal regions experience more days per year that exceed the threshold, i.e. 83% RH, required for *Aspergillus* proliferation and subsequent aflatoxin production.

The research questions above will require a) development of crop/soil parameters GLAM for Senegal / West Africa to be able to run aflatoxin risk scenarios; b) prepare and run GLAM in 'aflatoxin risk mode' using seasonal weather forecasts for the grid cells that match the WMO station locations, and c) apply a correlation analysis between the two 'aflatoxin risk indices' sets. Next, secondary crop aflatoxin data obtained from two locations (Georgia in the U.S. and the ICRISAT Sahelian Centre in Sadore, Niger) will be used to calibrate and evaluate the pre-harvest aflatoxin risk index model.

Figure 1 Visual illustration of the pre-harvest aflatoxin risk model: each day with temperature within certain bandwidth during last 40% of podfilling and fraction available soil water is below 0.2 counts towards a risk index.

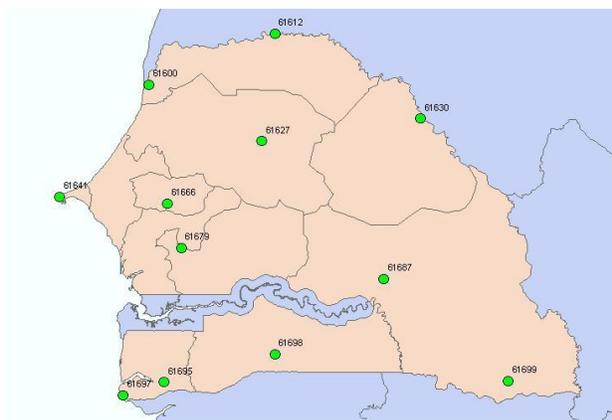
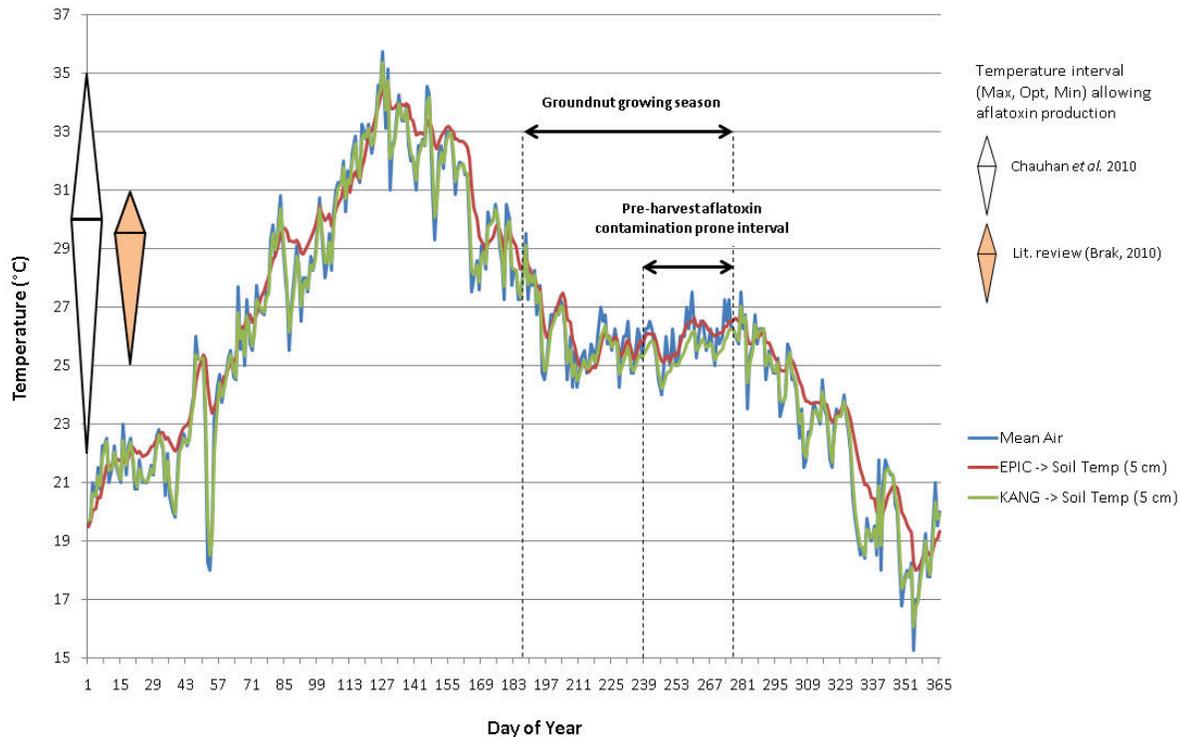


Figure 2 Weather stations in Senegal for which observed data is used to calculate aflatoxin risk indices.

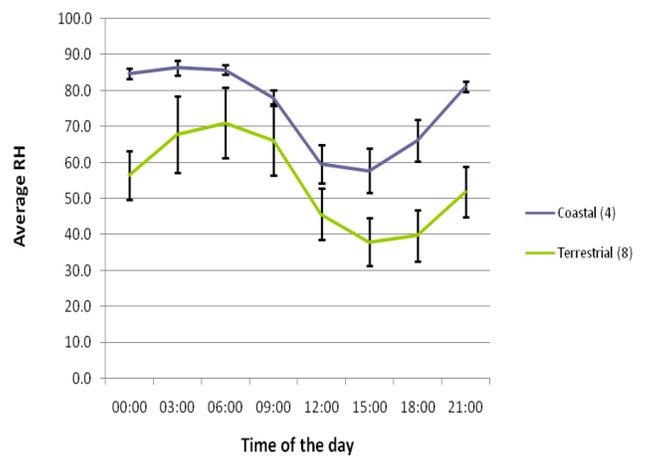


Figure 3 Relative humidity throughout the day, averaged over the period 1999-2010 for 4 coastal and 8 terrestrial weather stations in Senegal.

Outreach. Study findings have been presented in a number of places and linked to a number of other projects. Perhaps most notable is the work with Africa College <http://www.africacollege.leeds.ac.uk/>. At the Africa College conference on the 22-24 June 2011, entitled "Food Security, Health and Impact" the research study and findings were presented in three different sessions, with discussions with

participants on how the results can have a positive impact on livelihoods.

Study conclusions

The study concluded that the European Centre for Medium-Range Weather Forecasts (ECMWF) seasonal forecasts are of potential use in identifying end-of- season weather conditions conducive to aflatoxin production. Whether these operational forecasts can in reality be used as the basis of an early-warning type system depends largely on the extent to which weather conditions determine aflatoxin contamination. In some locations, non-weather factors such as soil-type and distribution of *Aspergillus* strain-type have been shown to play a role (Mehan *et al.*, 1991; Probst *et al.*, 2007).

Research in The Gambia (Turner *et al.* 2003), has shown that children are frequently exposed to high aflatoxin levels whereas the AC_OBS indices were mostly zero. This suggests that post-harvest aflatoxin contamination contributes more to aflatoxin exposure in the southern-most latitude zone.

On the other hand, aflatoxin exposure in the north due to pre-harvest aflatoxin contamination is reduced because annual rainfall is insufficient and groundnuts are grown using irrigation instead.

Study 3: Enhancing prevention and control of Rift Valley Fever in East Africa by intersectoral assessment of control options

An outbreak of the zoonosis Rift Valley Fever in East Africa impacts on the health of people and animals, livestock production, household incomes and trade. This research partnership of health and livestock institutes addresses the need for closer cooperation between the two sectors to allocate limited resources more appropriately and to facilitate planning of concerted activities. In Kenya, the cost-effectiveness of control options was assessed by generating and analysing data on costs, disease burden and benefits of control across multiple sectors. The project sought to inform trans-sectoral preparedness and contingency planning, and, eventually to an integrated policy.

Summary of achievements:

- Reports on stakeholder mapping, policy and institutional analyses including recommendations on how to bring all the actors together in coordinated and collaborative approaches completed
- Final registration of Tabitha Kimani as PhD student at Egerton University (thesis submission expected February 2013) Recruitment of a Kenyan and a Swiss MSc student for complementary work on transmission modelling, consideration of inter-epidemic transmission, and assessment of burden of disease
- Inclusion of inter-epidemic transmission of RVF in livestock and people in the project.
- Two multi-sectoral consultative stakeholder workshops to define realistic control scenarios to assess; more than invited participants took actively part – showing a strong interest in intersectoral zoonoses control.
- Predictive RVF risk map presented
- Two Masters studies successfully defended.
- Presentation of first DALY estimates and model simulation outcomes allowing their inclusion in the prepared economic models. These are the first DALY estimates ever presented for RVF in Africa and it is acknowledged that we have a first operational RVF transmission model based on a livestock demographic model adapted to the Sahelian context
- Diverse abstract submissions

- Planning for a One Health session with the specific topic of RVF in East Africa at the next American Society of Tropical Medicine Conference.

Overview of activities and results. The three sub-contracts between the Swiss Tropical and Public Health Institute and the collaborating institutions in Kenya were signed (Egerton University on 25.06.10, ILRI 15.07.10 and CDC-KEMRI 29.09.10). A graduate fellowship contract with signed between ILRI and Tabitha Kimani on 29.07.2010. In view of making use of existing expertise at ILRI, an amendment to the sub-contract with ILRI was established to engage a modeller and provide a working place for the Swiss MSc student. Indeed, two budget lines have been reserved for a more formal engagement of the FAO-ECTAD unit in Nairobi, however with the FAO's contracting system, this was not possible. Still, FAO and its regional manager Dr. Bouna Diop fully supported this project. Their vision was to become a One Health hub in East Africa. Our PhD student Tabitha Kimani has had temporally limited assignments with the FAO-ECTAD, which allowed her to participate in relevant meetings on RVF in the Eastern African region.

In view of new collaborations, ILRI's complementary activities on RVF such as the development of high throughput methods for detection of arboviruses contributed to a proposal on climate-vector-livestock transmission model of RVF. Our project focused on the vector-livestock-human interfaces. The parameters were identified and data generated. At Egerton University's new public health faculty, graduate and postgraduate courses were established and the faculty dean, Dr. Tsimbiri Pamela Fedha, is fully supportive of the project. Egerton University with its agricultural, economic and health faculties could become a motor in the region to promote fostered exchange between the health and agriculture sectors in graduate and postgraduate training and research. KEMRI has identified the need to closer look into the inter-epidemic transmission. Human acute cases of RVF are thought to be malaria and thus misdiagnosed. In the past year, we have identified inter-epidemic cases in both people and livestock as crucially important.

The **PhD proposal** was submitted to Egerton University for review. After revisions according to the review committee, the revised proposal was submitted for final approval and Tabitha Kimani was fully registered at Egerton University. Supervision will be ensured by Dr. Margaret Ngigi, Dr. Thomas Randolph and Dr. Esther Schelling. Thesis submission expected February 2013.

Two MSc students have been actively involved in this project. Dr. Njenga CDC-KEMRI supervised Austine Bitek Orinde, who undertook a Masters in Applied Epidemiology at the Jomo Kenyatta University of Agriculture and Technology. The specific objectives of his MSc study were i) to consolidate age-stratified data on RVF epidemiological parameters; 2) to assess private and public human health control costs of RVF epidemic and 3) to assess disability adjusted life years (DALYs) of RVF epidemic. In parallel, a Swiss MSc student, Samuel Fuhrmann (Masters in Epidemiology and Infection Biology at the University of Basel), focused on the livestock side. The three objectives of his MSc study were 1) to conceptualise a transmission model at the insect-livestock interface and identify needed parameters to simulate inter- and epidemic dynamics with and without intervention, 2) to review and compile available data needed for parameters of a transmission model such as livestock and mosquito (e.g. *Aedes spp*) demographics and dynamics, and 3) to collect missing information with a Delphi study, analysis of existing laboratory reports and serological testing of an available sera-bank. Both masters students contributed to the collection of economic data and the assessment of the DALYs that were required to assess cost-effectiveness of interventions, as well as to collect missing data to fit transmission models. Both MSc protocols and draft questionnaires were endorsed by their supervisors and a joint field study of both MSc students was undertaken in May 2011. A request to access existing livestock sera bases for

serological testing of inter-epidemic RVFV transmission of vectors to livestock was deposited with the DVS. KEMRI also assessed in more detail the inter-epidemic transmission from livestock to humans. Two transmission models were developed – for epidemic and inter-epidemic transmission. That inter-epidemic transmission may be of public health and economic relevance was not foreseen at the time of submission of this project.

Ana Boischio of IDRC visited Kenya and met with Tom Randolph at ILRI and other ILRI collaborators interested in RVF. In February, Tabitha participated (following an invite from AHRP) in IFPRI's International Conference on *Leveraging Agriculture for Improving Nutrition and Health*, 10–12 February 2011, New Delhi, India.

Data collection instruments for **stakeholder and institutional analysis** were developed together with partners. In August/September 2010 the stakeholder mapping was done. The report was available in October (report annexed to June 2011 report). In February 2011, the field work for the institutional analyses was carried out in Fafi and Garissa districts and a draft report circulated end of March 2011 (report annexed to June 2011 report). The information generated in the stakeholder mapping study served as framework for the subsequent policy and institutional analysis. A One Health (OH) framework is expected to drive new institutional and organisational arrangements among national, regional and international organisations to improve prevention and control of emerging infectious diseases and zoonoses. The stakeholder mapping could well describe the international and regional levels of collaboration, but only an in-depth study with interviews allowed to better understand the interactions between and within national and local actors. The institutional analyses took RVF as a model, but sought to consider all diseases the vectors-wildlife-livestock-human health interfaces. It documented all inter- and intra-relationships amongst the national, regional and international organizations and institutions and assessed the strengths of collaboration.

Many **international actors** such as WHO, FAO, CDC, and AU-IBAR play their roles at multiple levels in their efforts to coordinate international efforts in zoonoses management. Since RVF is a climate related disease, at the international level actors in weather prediction such as NASA are important, which is also true for the national levels. Another international actor is the World Trade Organization within the context of sanitary or phytosanitary (SPS) measures, which refer to the joint FAO/WHO Codex Alimentarius as the relevant standard-setting organization for food safety. Various donors - USAID being the most prominent one in Kenya – are active in health activities through various programmes and projects. Kenya depends on donors, who support directly government or technical and research agencies.

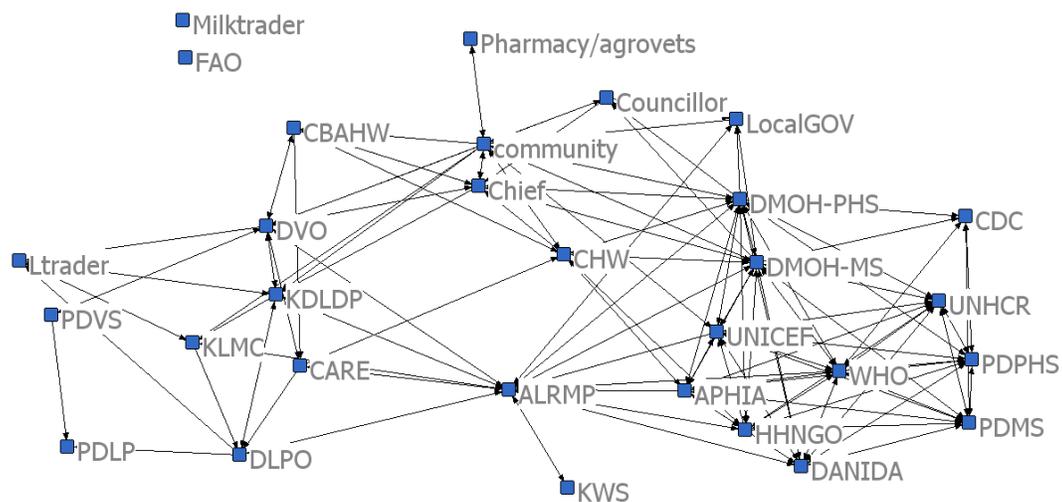
Policy and legal frameworks exist at national, regional and international levels, however they do not address multisectoral collaborations, except the tripartite agreement between FAO, OIE and WHO. These new collaborations were largely driven by emerging and re-emerging infectious diseases. And at the regional level, the collaborations become loose and also weakly link to other regional actors.

At the **national level**, the study identified 28 public and private sector actors and groups of actors physically present in Kenya and relevant to OH, and at the district levels 14 actors or groups of actors and three programmes/projects were identified with mandates in public health, animal-livestock health, animal-wildlife health, vectors and environment and covering various thematic areas from services delivery to research. Past and current formal/informal relations between the two health sectors are driven by three diseases: avian influenza, rabies and RVF. But it is avian influenza that triggered partly institutionalized multisectoral collaborations between various stakeholders – and then went into a

hibernating mode. The RVF and rabies initiatives were self driven, limited to a few medical and animal health personnel with no institutional backing. The lack of institutionalization in collaborative and strategic alliances and without policies and legal frameworks have been identified as main reasons for collapse of multisectoral approaches.

Results at the **district level** were as follows: i) the capacity of the animal health sector is below the necessary conditions to prevent spread of zoonoses to people and thus prevent important human cases during a next outbreak, ii) the public health sector in arid and semi-arid lands has a higher capacity than the veterinary services, but below the national average, iii) there are several public health clusters of actors and, thanks to WHO, they have very strong linkages, iv) there are few animal health clusters and they have weak linkages amongst themselves, v) cross-sectoral critical ties for OH between the two health sectors are missing or are very weak for disease management at the district level, vi) the public health sector has local governance structures and institutions such as community health workers, which strengthen their linkages to livestock keepers and the community in general, vii) the animal health lacks local governance structures and community animal health worker system is not backed up by policy and legislation. viii) the SNA helped to identify other non-health actors who play critical roles in cross-sectoral coordination and finally, ix) although the livestock producers, pastoral households and livestock traders are central stakeholders in the prevention and control of zoonoses, their roles and responsibilities as well as their perceptions towards RVF and its control measures are hardly documented and understood. They are not yet empowered to play an effective role in disease control. The vastness of the arid and semi-arid zones, poor road and telecommunication networks, high poverty levels; low private sector investment in service delivery, are all challenges confronting the implementation of OH at the district level.

Figure 4: example of social networks of district level actors with mandates in public health, animal-livestock health, animal-wildlife health, vectors and the environment. A strong 'human health cluster' exists in the right of the figure



Recommendations relate to suitable institutional arrangements at the local, national and regional levels. Key recommendations include to operationalise OH at all levels in the country. Guiding principles should be: i) maximize on building potential linkages and partnerships with ongoing related collaborations, activities at the local, regional and international level, ii) frameworks should focus on promoting concerted actions at all levels and including all stakeholders (after mapping) to address the zoonoses, iii) frameworks should be clear on roles and responsibilities of each actor, aim at effective

communication, and define collaboration and coordination structures activities and rules or norms, iv) local level action plans should be linked to national action plans, which, in return, need to be linked to regional and international action plans, v) creating networks is a good method of bringing together stakeholders to discuss how to tackle zoonoses, and vi) develop supporting policy and legal instruments.

Conclusions Many efforts went into the stakeholder and institutional analysis. Up to date, little is known on how to implement One Health approaches at different levels and these in-depth studies were needed for further public engagement. Other One Health initiatives realise nowadays that such regional and country studies are still missing.

A stakeholder workshop was held in Garissa in August/September 2011 when findings were presented and the interventions to assess were discussed and prioritised. Central questions such as if mass vaccination is feasible with the given personnel and infrastructure will be addressed. RVF is a good example on how a zoonoses with severe impacts in both the health and agriculture sectors can only be well managed with good collaborations at all levels, and with concerted actions between main actors in all relevant fields.

The project had a slow start. This was mainly due to assignment of Tabitha Kimani at the FAO regional office, lengthy PhD registration procedures at Egerton University and the establishment of three sub-contracts. The first results were available in August/September 2010, which helped to refine the objectives of the two master theses.

Partnerships

Following the October 2009 AHRP consultation in New Delhi, a proposal was submitted to the Bill and Melinda Gates Foundation to further explore linkages between agriculture, nutrition and health in India, building on the stakeholder engagement that revolved around this meeting. The **TANDI** project (“Tackling the Agriculture-Nutrition Disconnect” project was approved and started work in January 2010. The first phase, led by IFPRI, closed in August 2012, and a second phase – led by the Indira Gandhi Institute for Development Research (IGIDR) -- will commence shortly. A book of papers from Indian authors (edited by Gillespie, Kadiyala and Thorat) will be published in early 2013.

AHRP has forged a strong alliance with the Leverhulme Centre for Integrated Research on Agriculture and Health (**LCIRAH**) based in London. LCIRAH’s strong capacity strengthening focus complements AHRP’s emphasis on research and communications. AHRP and LCIRAH collaborated in co-organizing a workshop on joint metrics that directly contributed toward one of the key objectives of the AHRP (“*to develop and adapt methodological tools to link agriculture and health in research, policy, and practice*”)

The **RAIN** project in Zambia (Realigning Agriculture for Improved Nutrition), which started this year, is another indirect spin-off from AHRP activity, in that this is a collaboration between IFPRI, Concern Worldwide and Zambian partners to design, monitor and ultimately evaluate a project that seeks to generate common benefits across agriculture, health and nutrition domains.

Since June 2011, two new initiatives have emerged – **Transform Nutrition** and **LANSA** (Leveraging Agriculture for Nutrition in South Asia). These are DFID-funded consortia that both cover the issues of agriculture, nutrition and health, and linked with A4NH. IFPRI leads *Transform*, and co-manages LANSA, which is led by the MS Swaminathan Foundation in Chennai, India.

Project implementation and management

During the period leading up to mid-2011, most activity of IFPRI staff within this project focused on CRP4 proposal development, the Delhi conference, and the LCIRAH/AHRP workshop in London – all of which have contributed to the original AHRP objectives. The last year has mainly focused on monitoring deliverables of the three commissioned studies and the aflatoxin/stunting workshop.

Project implementation and management of the three individual studies has been interwoven in the narrative above. IFPRI has been directly involved in one of the three studies (Homestead Food Production in Cambodia) as an operational partner, through Deanna Olney (Research Fellow, IFPRI). Marie Ruel (director, PHN, IFPRI) has supported this project, having contributed several weeks of her time over its lifespan, in advice, review etc (cofinanced from IFPRI core resources). The AHRP coordinator, Stuart Gillespie, has interacted with the PIs of all three studies on a regular basis, assisted by Suneetha Kadiyala (based in New Delhi). Two other staff members (earlier linked to this project) have since left IFPRI (Scott Drimie and Lora Iannotti).

Conclusions

Over the last 4.5 years, the AHRP has helped set the foundations for concerted work to bridge sectoral divides between agriculture, nutrition and health. This has been achieved through a series of consensus-building workshops and exercises (including an open call for proposals that generated a huge response from range of stakeholders), several high-profile presentations (e.g. Global Ministerial Forum on Research for Health, 2008; Stakeholder Consultation on Agriculture, Nutrition and Health in New Delhi, 2009; UN ECOSOC High-Level Segment. “Forging Links between Agriculture and Health” lunch seminar, 2009; IFPRI 2020 International Conference on Leveraging Agriculture for Improved Nutrition and Health, New Delhi, 2011, LCIRAH/AHRP metric conference, London, 2011), and further work in developing successive drafts of the CGIAR’s CRP4 program proposal. The AHRP’s work has paved the way for other initiatives that, in some way, drew upon its early conceptual and organizational thinking and practice. In addition to CRP4 (now called A4NH), these include the TANDI initiative, the *Transform Nutrition* consortium, and the recent *LANSAs* (Leveraging Agriculture for Nutrition in South Asia) consortium, and the RAIN project in Zambia, to name a few. The AHRP strongly influenced the Leverhulme Centre for Integrated Research on Agriculture and Health (LCIRAH) in London. A stream of research outputs from the three commissioned studies and other “global” work has been produced, as listed in Annex 4. In working directly with young researchers and with partner organizations in Africa and Asia, AHRP studies have espoused a “capacity strengthening/learning by doing” approach to research. Several students have benefited from the platform in being able to undertake interdisciplinary research within the confines of the commissioned studies.

ANNEX 1: TEAM COMPOSITION

Organization 1 (IFPRI, CGIAR center, USA)						
Family name	Given name	Male (M) / Female (F)	Job title	Address (mailing address, phone number, fax, email)	Project role/responsibility (please indicate if lead PI and identify if consultant)	% of time committed on this project
Gillespie	Stuart	M	Senior Research Fellow	c/o IDS, Library Road, Brighton BN1 9RE, UK (tel: 44-1273-915759) email: s.gillespie@cgiar.org	Coordinator of AHRP and project manager	5-10%
Kadiyala	Suneetha	F	Research Fellow	2033 K St. NW Washington DC 20015 +1(202) 862-5600	Collaborator on global and S asian activities	5-10%
Ianotti	Lora	F	Research Fellow	2033 K St. NW Washington DC 20015 +1(202) 862-5600	Collaborator on HKI project (2008-9)	5%
Drimie	Scott	M	Research fellow	2033 K St. NW Washington DC 20015 +1(202) 862-5600	Collaborator on global events and African activities (2009-10)	5%
Olney	Deanna	F	Research Fellow, IFPRI	2033 K St. NW Washington DC 20015 +1(202) 862-5631; d.olney@cgiar.org	PI Nutritionist	5%
Ruel	Marie	F	Division Director, PHND, IFPRI	2033 K St. NW Washington DC 20015; m.ruel@cgiar.org	PI Nutritionist	1%
Talukder	Amizzaman	M	Country Director, HKI	HKI Phnom Pehn, Cambodia; ZTalukder@hki.org	Food security	5%
Vicheka	Sao	F	Project Manager, HKI	HKI Phnom Pehn, Cambodia; saovicheka@yahoo.com	Project leader	100%

Organization 2 (Swiss Tropical and Public Health Institute, research organization, Switzerland)						
Family name	Given name	Male (M) / Female (F)	Job title	Address (mailing address, phone number, fax, email)	Project role/responsibility (please indicate if lead PI and identify if consultant)	% of time committed on this project
Schelling	Esther	F	Research group leaders	Swiss Tropical and Public Health Institute, Socinstrasse 57, PO Box, 4002 Basel, Switzerland, +41612848163, esther.schelling@unibas.ch	PI / epidemiologist	5%
Randolph	Thomas	M	Director, CRP3.7 Livestock and Fish	International Livestock Research Institute, P.O. Box 30709 Nairobi 00100, Kenya, +254 20 422 3067 T.RANDOLPH@CGIAR.ORG	Agricultural economist	5%
Bett	Bernard	M	Veterinary epidemiologist	International Livestock Research Institute, P.O. Box 30709 Nairobi 00100, Kenya, +254 20 422 3453 B.BETT@CGIAR.ORG	Veterinary epidemiologist	5%
Njenga	Kariuku	M	Virologist and Head, Integrated Human-Animal Health Program	GDD-Kenya, Centers for Disease Control and Prevention, Nairobi, Kenya, +254-722-208925, +254-20-2723008; KNjenga@ke.cdc.gov	Virologist	5%
Ngigi	Margeret	F		Egerton University, P.O Box 536, Egerton 20115, Kenya, +254-051-2217891/2, ngigim@yahoo.com	Agricultural economist	5%
Kimani	Tabitha	F	PhD student	International Livestock Research Institute, P.O. Box 30709 Nairobi 00100, Kenya, +254722760660, T.Kimani@cgiar.org	PhD student	50%
Fuhrmann	Samuel	M	PhD student (new)	Swiss Tropical and Public Health Institute, Socinstrasse 57, PO Box, 4002 Basel, Switzerland, +41612848111, Samuel.fuhrmann@unibas.ch	Master student	50%
Bitek	Austine	M	Master student	Jomo Kenyatta Agricultural University, +254721606743, bitekorinde@yahoo.com	Master student	50%

Organization 3: University of Leeds, UK						
Family name	Given name	Male (M) / Female (F)	Job title	Address (mailing address, phone number, fax, email)	Project role/responsibility (please indicate if lead PI and identify if consultant)	% of time committed on this project
Challinor	Andrew	M	Professor of Climate Impacts	Institute for Climate and Atmospheric Science School of Earth and Environment, University of Leeds Leeds LS2 9JT, United Kingdom	PI	20
Gong	Yun-Yun	F	Senior Lecturer	Division of Epidemiology School of Medicine, University of Leeds Leeds, LS2 9JT United Kingdom Tel: 00 44 [0]113 343 7757 Fax: 00 44 [0]113 343 6603 Email: medyg@leeds.ac.uk	CO-I, responsible for health biomarker component study designing and protocol development, ethics application, biomarker analysis and data summary.	15
Brak	Bastiaan	M	Post-doctoral Research Assistant	Currently: University of Reading, School of Agriculture, Policy and Development, Earley Gate, Reading, RG6 6AR, +44 (0)118 3786380 b.h.brak@reading.ac.uk	PDRA. Modelling work: combined crop and (pre-harvest) aflatoxin simulation, evaluation of the potential of ECMWF seasonal forecasts for West Africa to be used as 'early warning aflatoxin threat' system.	100

Project: <i>Homestead Food Production Programs for Better Health and Nutrition</i> . Helen Keller International, International Food Policy Research Institute, Cornell University					
Types of Outputs	Title / Reference & Summary Description	Date of the output	Primary authors/ organizations responsible	Was this output disseminated? If yes, how? Please indicate what type of audiences have been reached (i.e. policy makers, researchers, others?)	Location of the output Please provide weblink if applicable
Peer reviewed article(s)	Using program impact pathways to understand and improve the program delivery, utilization and potential for impact of Helen Keller International's Homestead Food Production Program in Cambodia.	8/31/2012	Deanna Olney and Elisabeth Becker, IFPRI, USA Sao Vicheka, Meng Kro, Chhom Chakriya, Hou Kroeun, Ly Sok Hoing and Aminzzaman Talukder, Helen Keller International, Cambodia; Victoria Quinn, Helen Keller International, USA. Lora Iannotti, Washington University, USA Terry Roopnaraine, independent consultant, Zambia.	no	Submitted to the Food and Nutrition Bulletin
Workshop/presentations	Results from an operations research study of HKI's homestead food production program in Cambodia. Nutrition and Health Effects of Homestead Food Production in Cambodia Nutrition and Health Effects of Homestead Food Production in Cambodia.	December, 2010 February 2011 May 2011	Deanna Olney, IFPRI, USA Sao Vicheka, Helen Keller International, Cambodia Deanna Olney, IFPRI, USA Deanna Olney, IFPRI, USA		Dissemination Workshop on Homestead Food Production Programs for Better Health and Nutrition. Phnom Penh, Cambodia, Invited presentation, George Washington University, Invited presentation, Measuring Effects of Agri-Health Interventions, London, England.
Research reports	Helen Keller International's Homestead Food Program in Cambodia: Results from and Operations Research Study.	2011	Olney DK, Becker E, IFPRI Vicheka S, Kro M, Chakriya C, Taludker Z, HKI, Cambodia Quinn V, HKI, New York Iannotti L, Washington University Roopnaraine T, independent consultant	The report has been shared with HKI's partners in Cambodia as well as within HKI, New York and their other regional and country offices.	Report submitted to International Development Research Center and Helen Keller International. .

Project: <i>Measuring, predicting and adapting to aflatoxin risk under climate variability and change</i> . University of Leeds and International Institute for Tropical Agriculture					
Types of Outputs	Title / Reference & Summary Description	Date of the output	Primary authors/ organizations responsible	Was this output disseminated? If yes, how? Please indicate what type of audiences have been reached (i.e. policy makers, researchers, others?)	Location of the output Please provide weblink if applicable
IFPRI '2020 conference'; Conference Leveraging Agriculture for improving Nutrition and Health	'Measuring, predicting and adapting to aflatoxin risk under climate variability and change'	10-12 February 2011	Authors: B. Brak, A. Challinor Organisers: IFPRI	Yes, e-Poster at the 2011; single powerpoint slide shown on a large monitor on a timed loop with other e-Posters Policy makers and researchers	New Delhi, India http://www.slideshare.net/agnutrhealth/aflatoxin-risk-under-climate-change
Workshop: Mycotoxin control: understanding the impact on human health and agriculture	'Measuring, predicting and adapting to aflatoxin risk under climate variability and change'	25th June 2011	Speaker: B. Brak Organiser: Y.Y.Gong	Yes, oral presentation. 26 researchers, government officers, and students attended the workshop. Speakers include, multidisciplinary mycotoxins experts from UK, Tanzania, Uganda, China, South Africa	Weetwood Hall, Leeds
AGU Fall 2011 meeting in San Francisco.	'Evaluating the skill of ECMWF seasonal weather forecasts in predicting pre-harvest aflatoxin contamination of groundnut in Senegal'	9 December 2011	Authors: B. Brak, A. Challinor	Yes, poster presentation; print-outs of poster were distributed to those interested.	Summary of poster presentation: http://adsabs.harvard.edu/abs/2011AGUFM.H53D1445B
Oral presentation at workshop: 'International workshop on mycotoxin control in agro-products' in Wuhan, China	Relative contribution of weather conditions to groundnut aflatoxin contamination pre- and post-harvest, across a range of agro-ecological zones in China	12-17 th Aug 2012	Speaker: B. Brak	The workshop was organised by Oil Crops Research Institute of the Chinese Academy of Agricultural Sciences / Key Laboratory of Detection for <i>Mycotoxins</i> , Ministry of Agriculture, Wuhan, China.	BinHu Hotel, 325 Donghu Rd Wuhan, Hubei province, China
	Workshop: Mycotoxin control: understanding the impact on human health and agriculture	25th June 2011	Organiser: Y.Y.Gong	26 researchers, government officers, and students attended the workshop. Speakers include, multidisciplinary mycotoxins experts from UK, Tanzania, Uganda, China, South Africa	The Weetwood Hall, Leeds
	Africa College International Conference on Food safety, Health and Impact: Mycotoxin Session	22-24 th June 2011	Organiser: Y.Y. Gong	Over 100 people were at the conference. The session was well attended by policy makers, officers, and researchers from UK, EU, and many African countries.	Devonshire Hall, University of Leeds http://www.africacollege.leeds.ac.uk/index.php
	Presentation: aflatoxin and human health	10-17 th Aug 2012	Speaker: Y.Y. Gong	The workshop was organised by China National Kay Laboratory of Mycotoxin. 8 international mycotoxins experts on detection, risk assessment and modelling gave wonderful presentation.	National key Laboratory of Mycotoxin Detection, Wuhan, China,
	Speech at China International Food Safety & Quality conference,	10-12 th Nov 2011	Speaker: Y.Y. Gong	One of the Biggest international Food Safety Conference in China	The Longemont Shanghai, China
Research reports					
'Climate: Observations, projections and impacts. Reports for 24 countries'. A review commissioned by the United Kingdom's Secretary of State for Energy and Climate Change and led by the MetOffice.	A chapter 'Climate change impact projections – crop yields' in each of 24 country reports.	Spring 2011	Authors: Brak, B., Challinor, A.	Yes. Results presented at COP17 in Durban, December 2011, subsequently published as pdf's on UK MetOffice homepage (see right).	UK MetOffice http://www.metoffice.gov.uk/climate-change/policy-relevant/obs-projections-impacts

ANNEX 4 – LIST OF RESEARCH OUTPUTS

Technical report no. 1 for the period April – September 2008

- Call for AHRP Concept Notes released
- AHRP full proposal format
- 133 concept notes received from which eight full proposals prepared and reviewed.
- Formation of a high-level panel for the invited session on Agriculture, Health and Nutrition at Global Ministerial Forum on Research for Health, Bamako, 17-19 November 2008 (description attached).
- PowerPoint presentation on “Climate change, agriculture, and health”, UKCDS, London 29 May 2008.
- Paper “Climate change, agriculture, health and nutrition: research challenges”, Stuart Gillespie, Senior Research Fellow, International Food Policy Research Institute
- Paper entitled “Bridging the Gap: Linking Agriculture and Health to Achieve the Millennium Development Goals” by von Braun, Ruel and Gillespie has been submitted to Cornell University (to be published as chapter in forthcoming book).
- Book chapter entitled: “Changing Global Diets: Implications for Agriculture” submitted for publication in a book to be published by the Society of Agronomy entitled: “The International Dimension of the American Society of Agronomy: Historical Perspectives, Current Issues, and Future Challenges.”

Technical report no. 2 for the period October 2008 – March 2009

- Flyer “The Bamako Call to Action on Research for Health”, from the Global Ministerial Forum on Research for Health, Bamako, Mali, 17-19 November 2008
- The Global Ministerial Forum on Research for Health was held in Bamako, Mali, 17-19 November 2008. Session Sheet for AHRP high-level session on “Agriculture, Food Security and Nutrition”.
- Project Report Template for SMT Strategic Initiatives: Agriculture and Health Research Platform (AHRP). A detailed stakeholder mapping in India was undertaken for the AHRP. The objective was to identify priority issues and organizations working at the interface between agriculture and health. This report will also be used to bring key stakeholders to a roundtable to be held later in 2009 in New Delhi. A report of the mapping is attached.
- “Agriculture & Health Research in India: A compilation of key stakeholders and potential collaborators.” Report for the stakeholder mapping in India undertaken for the AHRP. The objective was to identify priority issues and organizations working at the interface between agriculture and health. This report will also be used to bring key stakeholders to a roundtable to be held later in 2009 in New Delhi.
- Report of the Annual meeting of AHRP Core Group, 13-14 January 2009, ILRI Nairobi, Kenya.
- Ag-Health Brochure
- “Food for Health: Food Security, Agriculture, Nutrition and Health”. Report of the parallel session at the Global Ministerial Forum on Research for Health, Bamako, Mali, 17 November 2008
- Summary of the Ecohealth Training Workshop, Cape Town, South Africa, March 2-4, 2009
- Report of the IFPRI Renewal Workshop, Stellenbosch, South Africa, 2-4 March 2009

Technical report no. 3 for the period April 2009 – October 2009

- Agriculture and Health Research Platform. Tackling the Agriculture-Nutrition Disconnect in India.
- Scaling up research and action on agriculture-health links. A draft concept note for discussion. Stuart Gillespie (International Food Policy Research Institute, AHRP coordinator) s.gillespie@cgiar.org 3 June 2009
- Provisional Agenda. Stakeholder Consultation on Agriculture, Nutrition and Health. National Academy of Agricultural Sciences (NAAS), CG Block, NASC Complex, Pusa, New Delhi. 12-13 October 2009
- Stakeholder Consultation on Agriculture, Nutrition and Health in India, 12-13 October 2009, New Delhi. What is the Agriculture and Health Research Platform? (Background Note)
- ICN2009, Bangkok. Symposium (S02): Bridging agriculture and health through nutrition Cascade II: Integrating agriculture, food systems, indigenous cuisines and diet quality
- CONCEPT NOTE. 2009 ECOSOC High-Level Segment. “Forging Links between Agriculture and Health”. Luncheon Panel Discussion
- AGENDA. 2009 ECOSOC High-Level Segment. “Forging Links between Agriculture and Health” Luncheon Panel Discussion
- SUMMARY - 2009 ECOSOC High-Level Segment. Luncheon Panel Discussion on “Forging Linkages between Agriculture and Health”, organized by IFAD, FAO, IFPRI. Palais des Nations, Geneva, 7 July 2009
- Agriculture and Health Challenges in Sub-Saharan Africa, Compiled by: E. Wairimu Mwangi, July 30, 2009
- Concept Note. “Experimental Estimates of the Impacts of Malarial Infection on Agricultural Worker Productivity”

- Methods and approaches for setting scope and priorities for research at the interface between agriculture and health. July 2009. E. Wairimu Mwangi.
- Nutrition, agriculture and health: An Overview. New Delhi, October 12, 2009 (Powerpoint presentation – Stuart Gillespie)

Technical report no. 4 for the period November 2009 – April 2010

- Annex 1 Progress Reports from 3 Commissioned studies.
- Annex 2 Agricultural and Health Research Platform: Center Commissioned External Review (CCER) essay
- Annex 3 PowerPoint presentation on the CCER
- Annex 4 MP4: Agriculture, Nutrition and Health. Two-page concept note for the forthcoming Mega-Program on Agriculture, Nutrition and Health.
- Annex 5 A slide presentation made on 31 March 2010 at the GCARD in Montpellier
- Annex 6 Agriculture and Health Challenges in Sub-Saharan Africa. Report submitted to the Agriculture and Health Research Platform (AHRP), First Draft. E. Wairimu Mwangi. April 12, 2010.
- Annex 7 How is the CGIAR leveraging agriculture research to improve human health and nutrition? Article on AHRP for CGIAR Annual Report 2009
- Annex 8 Leveraging Agriculture for Improving Nutrition and Health. Concept Note for an International Policy Consultation 2020 Vision for Food, Agriculture, and the Environment Initiative International Food Policy Research Institute

Technical report no. 5 for the period May–September 2010

- Annex 1 CRP4 proposal
- Annex 2a/b Extensive contributions to the Annual Report of the Special Programme for Research and Training in Tropical Diseases (TDR) Thematic Reference Group on Environment, Agriculture and Infectious Diseases, sponsored by UNICEF/UNDP/World Bank and WHO.
- Annex 3 Draft concept note for a conference on “Measuring effects of agri-health interventions”. To be organized by the Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH) and the Agriculture and Health Research Platform of the International Food Policy Research Institute (IFPRI), with support from the Leverhulme Trust and IDRC.
- Annex 4 Flyer for Major international conference “Leveraging Agriculture for Improving Nutrition and Health” to be held in New Delhi, 10-12 February 2011, organized by the 2020 Vision initiative of IFPRI in consultation with the AHRP
- Finalized annotated bibliography on Agriculture-Health Challenges in Africa prepared by Nimu Mwangi and Stuart Gillespie.

Technical report no. 6 for the period September 2010 – May 2011

- Annex 1 Report of the joint LCIRAH and AHRP international workshop, “Measuring the effects of integrated agriculture-health interventions” held in London, May 12-13 2011.
- Annex 2 Agenda and session of the side-event to the February 2011 Delhi conference.
- Annex 3 Final report of the study, “Helen Keller International’s Homestead Food Production Program in Cambodia: Results from an Operations Research Study”
- Annex 4 Summary of the final report of the study, Helen Keller International’s Homestead Food Production Program in Cambodia: Results from an Operations Research Study (one of the three commissioned studies under AHRP)
- Annex 5 Report of the Stakeholder Mapping for “One Health” Approach to Rift Valley Fever and Other Zoonoses Control (one of the three commissioned studies under AHRP)
- Annex 6 “Analysis of Institutions and Organizations for Enhancing Prevention and Control of RVF and Other Zoonoses within the “One Health” Framework in Kenya”. Report of fieldwork for institutional analyses carried out in Fafi and Garissa districts.

Technical report no. 7 for the period June 2011-August 2012

- Annex 1 “Measuring, predicting and adapting to aflatoxin risk under climate variability and change”. Final report of the study led by Leeds University.
- Annex 2 “Evaluating the skill of ECMWF seasonal forecasts in the context of pre-harvest aflatoxin contamination of peanut in Senegal”. Latest draft of a paper to be published.
- Annex 3 Progress report (March 2012 – June 2012) for the commissioned study, “Enhancing prevention and control of Rift Valley Fever in East Africa by intersectoral assessment of control options”.
- Annex 4 and 5 Two presentations: “Operations research of HKI’s Homestead Food Production (HFP) Program in Cambodia”
- Annex 6 Report of the workshop, “Aflatoxin: Impact on Stunting in Children and Interventions to Reduce Exposure” co-organized by International Food Policy Research Institute and the Enteric and Diarrheal Diseases, Agriculture and Nutrition teams at the Bill & Melinda Gates Foundation, Washington, DC, February 1-2, 2012
- Annex 7 Brochure/flyer for the “LANSA (Leveraging Agriculture for Nutrition in South Asia)” project
- Annex 8 Brochure/flyer for the Transform Nutrition Research Programme Consortium.