10 PhD positions in collaborative research programme on 'Responsible Life-sciences Innovations for Development in the Digital Age'

Duration: January 2016-December 2019

Apply before: 28 May, 17:00

Introduction

Wageningen University (The Netherlands), the CGIAR Research Programme on Integrated Systems for the Humid Tropics and other international partners (see Annex 1) are recruiting PhD students for their collaborative programme entitled:

> Responsible life-sciences innovations for development in the digital age: Environmental Virtual Observatories for Connective Action (EVOCA) in crop, water, livestock and disease management.

The programme will study how ICT based virtual platforms may be leveraged to address development challenges. A central assumption is that enhanced information exchange, participatory monitoring and integration of knowledge may alter the logic of decision-making in networks of inter-connected stakeholders (see Annex 2 for a Programme summary).

By applying responsible innovation concepts across different life-science domains, the EVOCA programme will generate a thorough understanding of the conditions for successful virtual platforms that enable participatory monitoring and effective action in development contexts. It will thereby make a major contribution to the combination of ICT-based participatory technologies and life-science knowledge, and to our understanding of how inclusive digital platforms can enable connective action for irrigation, livestock, crop and animal disease control and resource management strategies that effectively address rural development challenges.

The programme will work on several issues and in several African countries. We will develop and test virtual platforms in five case studies (see Annex 3 for short case study descriptions):

- Case 1: a crop and disease management expert system in potato production in Ethiopia;
- Case 2: water monitoring and irrigation management for food production in Ghana;
- Case 3: a malaria mosquito radar as a digital citizen science platform in Rwanda;
- Case 4: tick-borne disease and livestock-wildlife management in Kenya;
- Case 5: sustainable intensification of cocoa and food crop farming systems in Ghana.

For each of the five case studies we are looking for 2 PhD students who will closely collaborate as part of an interdisciplinary team. All PhD students will be supervised by both natural and social scientists.

Each PhD project will last 4 years, commencing in early January 2016. For the first phase (basic PhD training and proposal development) and last phase (finalizing writing) of the PhD trajectory, candidates will be required to stay in the Netherlands for two periods of about 7 months each. An additional 4 month visit to the Netherlands is anticipated at the end of the 2nd PhD project year. In the remainder of the 4 year period, candidates will be employed by one of the partner institutes in the case study regions for collecting field data and liaising with practice partners.

What candidates are we looking for?

We are looking for enthusiastic team players with the following qualifications:

1. an excellent academic record in a relevant natural or social science discipline (Masters completed);

2. proven interest in the interaction between the natural and social sciences;

3. affinity with the use of modern digital information and communication systems in the management of crops, water, wildlife or diseases;

4. strong knowledge and skills regarding research design, quantitative, qualitative and/or spatial-temporal methods for data collection, and quantitative (statistical) and/or qualitative approaches to data analysis and presentation;

5. proven ability to work in (interdisciplinary) scientific teams and collaborate with a range of societal stakeholders and in possession of a valid driving license;

6. strong oral and written communication skills in English, especially regarding academic writing and presentation;

NOTE: Applicants will be asked for a 'Certificate of Proficiency in the English Language' unless they have a degree from a university in an English-speaking country. This certificate can be obtained via organisations such as TOEFL, British Council or IELTS (Acceptance is subject to final decision by the Dean of Wageningen University).

How to apply?

Applications are submitted via email to info@evoca.nl , including the following information:

1. An application letter that explaining your motivation:

(a) Please indicate clearly in the subject line of your letter for which case study/studies you apply (see Annex 2). Please note that you may apply for a maximum of two cases!

(b) Please mention in your letter also whether or not you are already working for a partner organisation (see Annex 1), or another organisation that could be interested in participating in the research programme.

2. A detailed CV including personal details (name, contact details, age, gender), academic training, work experience and a list of publications. Please include also language skills, computing and (academic) software skills and research for development (R4D) networks.

3. Scanned copies of academic diplomas (bachelors and masters) and associated lists of marks/qualifications for courses followed. Diplomas will be validated by NUFFIC.

4. A research outline for a selected case of 1,000 words maximum (see Annex 4). (If you apply for two cases, please send in a separate research outline for each case).

Applications must be received **by 28 May 2015, 17:00 Central European daylight saving time**.

Further process and timeline

Selected candidates will be invited for interviews by early June 2015. Interviews will be conducted in June and July 2015, normally via skype. Successful applicants will be informed by 31 August 2015.

Annex 1: International partners

CGIAR Research Programme on Integrated Systems for the Humid Tropics

The International Institute of Tropical Agriculture (IITA)

International Livestock Research Institute (ILRI)

International Centre of Insect Physiology and Ecology (*icipe*)

International Potato Centre (CIP)

Forum for Agricultural Research in Africa (FARA)

Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)

Other partners

Africa Rice Center (AfricaRice)

Grameen Foundation

Technical Centre for Agricultural and Rural Cooperation (CTA)

Foundation for Sustainable Development (FSD)

Kumasi Institute of Technology, Energy and Environment (KITE)

Integrated Water & Agricultural Development Ghana LTD. (IWAD)

Awassa Agricultural Research Center - Southern Agricultural Research Institute Ethiopia

(SARI Ethiopia)

Veterinary Services Kenya

University for Development Studies (UDS)

Arba Minch University, Ethiopia

College of Medicine and Health Sciences, School of Medicine - University of Rwanda

SNV Netherlands Development Organisation

Annex 2: Summary of the research programme (the full project document can be downloaded from www.evoca.nl)

People in rural Africa face social, economic and political challenges in sustaining their livelihoods. But also the natural environments on which they depend are under pressure. Global environmental change increases the spatial and temporal variability and sensitivity of many natural processes affecting biodiversity, health, agriculture and water systems. Timely information on relevant environmental dynamics (such as water levels, spread of plant pests or prevalence of disease-carrying insects) is often lacking because of limited understanding of local system dynamics. This in turn reinforces collective action problems, i.e., collaboration deficits due to relatively high individual costs of contribution to common goods with marginal or uncertain individual benefits. Recent developments in web-based and mobile technologies hold considerable promise to overcome these problems. They allow linking science-based models of dynamic natural processes with participatory monitoring and broad information accessibility. ICT-based virtual platforms enable and encourage users to share relevant environmental information such as the observation of infected crops, rainfall and water availability or a malaria-mosquito densities. Digital media complement traditional organising agents for collective action; they set in motion a "logic of connective action" where even fragmented populations share (often personalized) content across media networks; the shared content in turn contributes to collective knowledge and coordinated action. Our central research question is: How can life-science knowledge, digital technologies and responsible innovation concepts be leveraged in development contexts to build inclusive virtual platforms for environmental information that enable connective action for addressing development challenges in crop, water, health and wildlife management?

The implications for development in rural Africa are potentially highly significant. If citizens, farmers and decision-makers are enabled to share and access high-quality, updated and locally tailored information on natural processes that are relevant to their needs and ambitions, they are in a much better position to master the development challenges they face. While so-called environmental virtual observatories (EVOs) have been shown to effectively assemble and distribute user-relevant information on dynamic environmental phenomena, systematic attempts to involve users in content sharing and to link user content to science-based models so as to generate connective action are novel. The EVOCA programme aims to boost and study the development of Environmental Virtual Observatories for Connective Action (EVOCAs) in West and East Africa. This entails the development of participatory monitoring systems, virtual platforms and digital applications, whereby both the development process and the resulting EVOCAs are geared towards evoking connective action in five cases:

- a crop and disease management expert system in potato production in Ethiopia;
- water monitoring and irrigation management for food production in Ghana;
- a malaria mosquito radar as a digital citizen science platform in Rwanda;
- tick-born disease and livestock-wildlife management in Kenya;
- sustainable intensification of cocoa and food crop farming systems in Ghana.

To anticipate the intended and unintended societal and developmental consequences that EVOCAs may have on social systems, we will apply a responsible innovation framework in the interactive design component of this programme (see below). The responsible innovation framework systematically addresses questions about the impacts of the *product*, the management of the innovation *process* and the *purpose* of an innovation. Applying this framework means that we will explore and address a number of questions during the design trajectory (see Table 1).

Product questions	**Process questions**	**Purpose questions**
How will the risks and benefits be distributed?	How should standards be drawn up and applied?	Why are researchers doing it?
What other impacts can we anticipate?	How should risks and benefits be defined and measured?	Are these motivations transparent and in the public interest?
How might these change in the future?	Who is in control?	Who will benefit?
What don't we know about?	Who is taking part?	What are they going to gain?
What might we never know about?	Who will take responsibility if things go wrong? How do we know we are right?	What are the alternatives?

Table 1: Lines of questioning on responsible innovation (source: Stilgoe et al., 2013).

The case teams that are formed will go through a joint interactive design process, inspired by principles of 'integral design', the responsible innovation framework and prototyping.

General building blocks of each case include:

1. Diagnosis of technical and social dimensions of the problematic situation, with special emphasis on informational dimensions that hamper effective preventive action and response (individual and collective);

2. Assessment of existing information and knowledge infrastructures, explicit and latent needs and knowledge gaps, and pre-existing initiatives and experiences with digital applications;

3. Interactive conceptualisation and (further) prototype development using the Nature Today ICT platform and/or building on already available software environments;

4. Complementary research on end-users, intermediaries and social organisational aspects relevant to addressing issues pertaining to responsibility;

5. Societal contextualisation and collaborative experimentation with these digital innovations (as action research, i.e., the research intervenes in social contexts and these interventions are evaluated considering lines of questioning on responsible innovation, see Table 1);

6. Further specification of relevant precise specifications and functionalities of EVOCA as an outcome of the process of experimentation, dialogue and implementation;

7. Assessment of social conditions (constraining and enabling) for successful maturing and use of the digital innovation;

8. Research on induced processes of change and consequences associated with the development and use of digital innovations in the (a) the relevant domain (crop, disease, water and livestock & wildlife management) and (b) the innovation support processes and R4D systems involved.

The PhD students and their supervisors will collaborate closely in the implementation of these building blocks, and divide tasks and leadership roles according to their expertise.

In a nutshell, the proposed programme will: (a) develop and apply a design framework for responsible digital innovations for development; (b) (further) develop promising participatory virtual platforms and digital applications for resource management in African rural communities; (c) study the systemic conditions for the successful embedding of such innovations in development contexts; (d) compare five cases and draw lessons for successful digital innovations for connective action in crop, water, livestock and disease management; and (e) assess how digital applications depend on and/or change innovation and research for development R4D systems.

Annex 3: Case study descriptions

Case 1: EVOCAs for disease management in potato production, Ethiopia

This case study develops and analyses a model-based decision-support system for potato plant protection with real-time observations in Ethiopia. It features research on the design implications of the bio-physical features of bacterial wilt and late blight, and the way EVOCA can be embedded in existing innovation systems.

Potatoes are a crucial staple food in Ethiopia. The major diseases impeding production are the oomycete *Phytophthora infestans* which causes late blight, and bacterial wilt with the causal agent *Ralstonia solanacearum*. The latter is indigenous in Ethiopia and is becoming increasingly important, also in areas designated for seed production. Late blight is very aggressive and can wipe out a crop within a few weeks if not controlled and when environmental conditions are conducive to sporulation and infestation. Yield losses might be as high as 80%. Available fungicides can control the disease but need to be applied frequently to protect newly formed leaves. For large-scale commercial farms around the world, sophisticated decision-support tools provide advice when to spray. These tools aim to reduce the number of fungicide applications and to optimize their effectiveness in a preventive manner. On the basis of weather forecasts and the occurrence of *Phytophthora* the models predict crop canopy development (how much unprotected canopy is present), inoculum pressure (sporulation intensity), and infection likelihood, and derive advice to farmers.

The system requires a dense network of observations by farmers (and extension officers) on crop infestation. It is therefore a good example of an EVOCA. Its use requires farmers to have direct access to a computer with the appropriate decision-making software. However, an emerging option is to receive text messages with advice through mobile phones by a central office that collects and evaluates information. The Dutch company DACOM has tested such a system for advising local farmers from its central office in the Netherlands, based on weather station and crop information on the ground in South Africa. This test was rather useful but was only evaluated for its potential success in agronomic terms. It is not yet known what is needed to make such a warning system accurate and reliable, how to organize the local set-up (including crop monitoring) and expertise to create the centre providing the advice, and what training for farmers is needed to provide the right information and take proper action.

Bacterial wilt (a.k.a. brown rot, agent: *Ralstonia solanacearum*) is, after late blight, the most important potato disease in Ethiopia. The disease is both seed-borne and soil-borne, and according to some Ethiopian farmers, also vector-borne. As Ethiopia does not have a formal seed potato certification scheme yet and regional quarantine measures are usually lacking in this country, bacterial wilt is rapidly developing into a very serious threat. The disease is currently also encroaching on the highlands, which are supposed to be the perfect environment for the production of healthy seed potatoes. This new development frustrates the programmes aimed at the production of quality declared seed.

Bacterial wilt kills the haulm suddenly and causes the tubers to rot as well. Yield depressions can be 100% and infested seed cannot be used. Moreover, infested land should not be used for potato production for quite some while. Research on control or containment of the disease in Eastern Africa has been carried out but has not led to any significant success.

Regarding both diseases, in order to be effective, the design of an EVOCA needs to be embedded in the current innovation system of potato production, including its hardware, orgware, and software. Employment of responsible innovation approaches will ensure this adaptation is done in a systematic and democratic way. Testing of the EVOCA for Phytophtora will shed light on the effectiveness of mobile phone communication in crop management in the African context, and the conditions for effectiveness.

Case 2: A hydro-climatic EVOCA for the water-food-climate nexus: enabling adaptive action in irrigated rice production systems in Ghana

This case study develops and analyses a virtual platform that links water-climate models and local knowledge to facilitate innovative adaptation to climate change in rice production in Ghana. While decision-making on farming activities (e.g. choice of crops, planting date, irrigation, etc.) in developing countries rely heavily on accumulated experiential knowledge, climate change, is making water availability and crop production more unpredictable. Past experiences on for example timing of the wet season, rainfall intensity, temperatures and availability of river, reservoir and groundwater become less reliable. To improve food security and sustain livelihoods it is important to integrate water and food production systems, thereby taking into account knowledge and information about current and future climate variability.

Recently, forecasting climate variability and change at seasonal to century timescales has seen important advancements. Especially in Africa forecasting has improved substantially over the last few years. While forecasting information is potentially valuable for farmers and water managers, it needs to be translated into locally relevant information and communicated in appropriate formats to allow for coherent planning (planting, fertilizing, etc.). Structural interactions between forecast experts and local knowledge experts – and providing a platform to do so – are therefore essential. However, developing business opportunities for farming and water management from such knowledge exchange and the resulting information services is demanding. In addition, little is known under which conditions these innovative information systems can develop around the water-food-climate nexus so as to empower farmers to innovate management, and perhaps change water and food system governance at large.

This case study focusses on the co-production of a hydro-climatic EVOCA, which integrates seasonal and decadal projections from water and climate models with local knowledge and observations for irrigated rice production systems in Ghana. Increasing rice production in Ghana has become an important governmental objective to reduce its agricultural import and ensure future domestic food security. It is an increasing source of income for smallholder farmers. In Ghana, water supply for irrigated rice production is becoming less reliable due to both increased climate variability and higher water demands. Uncertain water availability undermine agricultural practices resulting in amongst others reduced yields, low quality of rice, and rice production systems that are under pressure. Addressing these challenges requires improved information on future soil and surface water availability so as to allow for more adaptive management of the water and food systems. But the fully developed EVOCA will provide not only information. The case study will help to understand whether the connective action enabled by the EVOCA can help to build ownership of the information system, and stimulate the development of a participatory innovation system in the context of an irrigated agricultural system under stress.

The proposed information system is based on an on-line platform, which links up with mobile phone and internet technology (text messaging, apps) and off-line information channels for information input and output to relevant user groups (farmers, water managers and local governments).

The main question this case study will address is: How can an Environmental Virtual Observatory for Connective Action (EVOCA) be developed and implemented to make the water-food-climate nexus in Ghana's rice production systems more sustainable, resilient and secure? Sub-questions are:

- How can hydro-meteorological forecasts in combination with predictions of agricultural production be integrated into an EVOCA enabling connective action for stakeholders and adaptive strategies for irrigated rice production systems in Ghana?
- How can a hydro-climatic EVOCA be embedded in local decision-making and help to develop a responsible innovation system so as to create actionable knowledge for adaptive governance of the food-water-climate nexus in Ghana's rice production systems?

The proposed project will (a) co-develop novel EVOCA for adaptive management of synergies and trade-offs between water and food in irrigated rice production systems in Ghana under changing climate, (b) identify systemic conditions for success of these platforms.

Case study 3: The Malaria Mosquito Radar

Much progress has been made over the past decade in tackling malaria as a global health threat. The recent World Malaria Report from December 2014 (WHO, 2014) estimates that malaria mortality rates have decreased worldwide by 47% between 2000 and 2013. This is largely the result of massive scaling-up of coverage with long-lasting insecticide treated nets (from 3% in 2004 to 49% in 2013), indoor residual spraying with insecticides and the use of artemisinin combination therapies. Despite increased global funding (estimated at 2.7 billion in 2013), the World Health Organization recognizes, however, that emerging resistance to insecticides and to malaria medication may jeopardize current efforts. Importantly, much of the remaining transmission is attributed to 'outdoor' or 'residual' transmission. This is the result of strong selective pressure on the Anopheles mosquitoes that are vectors of the Plasmodium parasite. In response, innovative and unconventional initiatives are needed to eradicate malaria in geographies where pockets of malaria transmission are no longer decreasing. Whereas the research team has been strongly involved in the development of alternative vector control tools [51, 52], the team recognizes that there is a strong need for the active engagement of citizens in a final push that aims for a complete eradication of malaria.

Successful malaria eradication requires that the relevant stakeholders (people at risk, medical staff, ministries, pest control organisations, farmers, etc.) know how, when and where to take which action. At the level of the innovation system, successful malaria prevention requires (1) thorough knowledge about the ecology of the species, (2) detailed spatially and geographically sensitive information about incidences of malaria mosquitoes and their infection status and (3) user-directed information about effective ways to avoid mosquito bites. Gathering the relevant information and communicating to the right people in time is difficult and expensive, posing a major obstacle to effective treatment and prevention. This case study will develop an EVOCA, termed 'Malaria Mosquito Radar' as a tool for the surveillance, analysis and communication of malaria mosquito populations and for the assessment of outdoor malaria transmission.

The Radar will fill a gap in existing Integrated Vector Management programs. The Radar builds on innovative ICT projects in The Netherlands like Tekenradar.nl (Tick), Allergieradar.nl (Allergy), Muggenradar.nl (Mosquitoes) and Natuurkalender.nl (Nature's Calendar). All these have demonstrated that it is possible to involve tens of thousands of 'citizen scientists' and school children in the monitoring of spatial and temporal variation in the occurrence of vectors (ticks and mosquitoes), vegetation (flowering and leaf unfolding), diseases (Lyme disease, hay fever) or nuisance (mosquito bites). The observations are made directly available to the public via websites and mobile applications. The success of these projects is largely due to frequent and active communication of (real-time) observations, forecasts and interpretations to stakeholders and the public via social and mass media. Media attention supports the recruitment, training and motivation of observers and in the dissemination of advice for prevention and treatment.

The main objective of the Malaria Mosquito Radar project is to monitor, analyse, forecast and communicate mosquito population/activity, malaria cases/symptoms and to actively inform stakeholders on when, where and how to implement malaria prevention and treatment activities. The Malaria Mosquito Radar will be developed in close collaboration with the other digital innovations described elsewhere in this proposal. PhD students will work on the social and communication aspects and on the biological and epidemiological aspects.

Case 4: EVOCA for tick (borne disease) management with livestock-wildlife interaction in Kenya

This case creates and analyses an EVOCA that links mobile-phone based observations and Companion Modelling to enable the participatory development of coordinated tick management strategies. In developing countries, livestock is mostly owned by smallholders. Disease reduction in livestock is constrained by domestic animals sharing disease vectors, diseases and grazing lands with wildlife. Besides tsetse flies, ticks are the most widespread vectors and transmit high-impact diseases like East Coast fever, heartwater, bovine babesiosis, and bovine anaplasmosis. E.g., in eastern and much of southern Africa, East Coast fever has a reported a mortality rate of up to 80% in susceptible animals or epizootic situations. The multi-host system makes vectored diseases far more difficult to eradicate than directly transmitted diseases like rinderpest. Moreover, wildlife is an asset, generating important revenues through tourism. Having both wildlife and livestock production zones makes the local control or eradication of animal diseases more difficult and brings wildlife and livestock production into conflict. In addition, sectoral policy development further contributes to high inefficiency in controlling disease transfer.

There are several technologies to reduce tick prevalence such as applying acaricides to livestock, including tick 'mopping' (although the reported effectivity is still debated), treating wildlife by using feeding stations that apply acaricides to larger wild herbivores, vaccination against tick-borne disease such as East Coast fever (ECF) and/or grass sward height reduction through grazing by coarse grazers and/or burning. However, both traditional and modern methods to eradicate ticks and related diseases remain inadequate and prohibitively costly. Tick control measures are often hampered by lack of information on ectoparasite and disease distribution. Acaricide-resistance, high frequency acaricide treatments, and a lack of information and motivation of livestock owners leads to ineffective application. While each of these technologies has some effect, coordinated and well supported action is needed to attain a satisfactory level of tick load management. To ensure a proper design and implementation of coordinated tick management, we need to involve representative actors in the EVOCA design process for (a) local tick data collection, and (b) coordinated tick load management.

The study is primarily located in the Laikipia District, Kenya, where mobile broadband is available. Using mobile phone applications, data on tick abundance is collected by stakeholders. This is fed into technical experiments to assess the effectiveness of the technology for the specific area, after which a conceptual model for multi-stakeholder, coordinated tick management is made. The model includes various types of tick reduction technologies, to explore the effectiveness of various combinations of tick reduction practices, simultaneously executed by different actors in a coordinated manner. Then stakeholder representatives engage in Companion Modelling (COmMod) to discuss and design the most optimal tick management strategy (i.e. a combinations of tick reduction technologies). By means of a Multi Agent System (MAS) simulation model, observations, reflections and actions of agents, and their effect on (geo-referenced) natural resource dynamics (such as vegetation, wildlife, livestock, ticks) are simulated. This allows actors to virtually explore the costs and benefits of various coordinated action scenarios from an individual as well as a collective, coordinated perspective. After an exploration of the trade-offs, the stakeholders propose the tick management strategies they want to include in a real life experiment, with non-participating cattle herders and selected wildlife areas as controls. Careful design of the ComMod model and process, applying principles of responsible innovation, are needed to ensure a feasible, effective and fair contribution of all to the data generation and sharing (connective action), as well as the application of tick reduction measures in the field (coordinated action). Using Nature Today, the integration of the mobile phone application, the technical experiments and the ComMod exercise will result in a web-based EVOCA.

Case 5: Connectivity for sustainable agricultural intensification in cocoa and food crop farming systems in Ghana

In Ghana, the International Institute of Tropical Agriculture (IITA), the Dutch development organisation SNV and the Grameen Foundation use the opportunity of a 84% mobile phone penetration to establish an EVOCA for sustainable intensification in cocoa based farming systems. This case study concerns the further development and analysis of this emerging virtual platform that links science-based geographical maps and climate variability and change forecasts with locality and farm-system specific data. The information generated is aimed at enhancing farmer and community level learning and action, and also at strengthening the position of farmer organisations in influencing policy change.

The large cocoa export sector in Ghana is one of the main drivers of deforestation. Poverty and the migration of youngsters to the urban area lead to labour scarcity and extensive farm practices, and climate change is further decreasing agricultural productivity and driving deforestation, due to temperature stress, variable precipitation patterns and a decrease in reliable crop growing days to critical levels. Meanwhile, extension organisations continue to provide science-based generic advice, rather than locality and farm system specific advice. Hence, farmers heavily rely on their own experiential knowledge.

At this moment, IITA has made a start with baseline data collection to initiate the envisaged ECOVA. Scientists have gathered data on farm systems (number and location of fields, crops, practices, pests incidences, outputs etc., of about 150 farms) which they will combine with climate change forecasts to characterise the diversity of cocoa production systems on climate and intensification gradients in terms of production efficiency, climate change adaptation and mitigation. This information will be used to generate locality and farm-system specific 'best bets' for operational farm practices as well as longer term investments (such as diversification into agro-forestry, rejuvenation and improvement of tree quality). The ICT formats of the Grameen AppLab will be used to make the information available to 35 Farmer Field School Trainers from Kuapa Koko, a farmer-based support organisation in the cocoa sector. The idea is to equip these extension workers with smart phones, train them in the uploading of farm information as well as ICT-based extension activities. Meanwhile, Grameen also looks for another partner to improve the knowledge base and agricultural extension activities of about 50 extension officers in food production via smart-phone applications. So far, Grameen's 'last mile' extension activities consist of a Community Knowledge worker providing general information on best farm practices, decision-support tools and price and weather forecasts transmitted via mobile-phone SMS; pictures, voice messaging, radio listening groups and video uploading. With the assistance of our PhDs, SNV, IITA and Grameen now want to take up the challenge of connectivity: (a) to integrate science-based data bases with user uploaded data, to create a more dynamic and place-specific database, (b) to be able to identify locality and farm system 'best bets' for operational farm practices and longer term investments, and (c) develop communication tools such as SMS, voice, pictures, videos, scenario simulation, games etc. that fit the users' way of knowing, that attract attention and engagement for knowledge exchange/uploading and learning, and stimulate interaction for agricultural intensification.

We hypothesise that the EVOCA concept will enhance connectivity and planning for sustainable agricultural intensification through knowledge exchange, coalition building and cooperation between scientists, farmers (or so-called placeholders), farmer-support organisation and policy makers. We will explore this assumption through participatory action research, deploying different approaches to knowledge integration (hybrid forms of scientific and placeholder knowledge) and communication formats for different and mixed groups.

PhD research will focus on the engagement of scientists, extension workers, and various types of farmers (varying in gender, age, level of education and poverty) in EVOCA-supported knowledge exchange, learning and cooperation for sustainable farm intensification. Specific attention will be paid to analysing and ameliorating new forms of inclusion and exclusion that may be associated with the EVOCA. In addition PhD research will focus on the value of EVOCA – and especially geo-referenced visualisations generated by it – for learning and coalition building among farmer-support organisations, regional agricultural planners and policy makers.

Annex 4: Format for proposed research outline

Please explain in 1000 words maximum (excluding references) how you would approach a PhD research in the case study for which you apply. Your outline will include the working title of your project, a brief sketch of the theoretical perspective, the research problem and research question; a short outline of the methodological approach; and a description of the expected scientific significance and development impact of the research you propose.

1. YOUR NAME:

2a. CASE NUMBER:

2b. PROJECT TITLE:

3. THEORETICAL PERSPECTIVE(S) (you may select a theoretical perspective from a social and/or natural science perspective, depending on your preference):

4. SCIENTIFIC PROBLEM DEFINITION AND KEY RESEARCH QUESTIONS:

5. METHODOLOGICAL APPROACH (please also include your thoughts on the operationalization of responsible innovation):

6. SCIENTIFIC SIGNIFICANCE:

7. EXPECTED DEVELOPMENT IMPACT:

8. REFERENCES