Call for Applications for PhD Candidates in Agricultural Sciences at the University of Rwanda, College of Agriculture, Animal Sciences, and Veterinary Medicine (UR-CAVM)

1. Background

The University of Rwanda, College of Agriculture, Animal Sciences and Veterinary Medicine (CAVM) in collaboration with the Swedish University of Agricultural Sciences (SLU), Sweden through the Research Training Partnership Programme, Rwanda (2019/24) has received funding from the Swedish International Development Agency (SIDA), Sweden, to implement two research and training programmes:

i) **Toward Integrated and Sustainable Agriculture Production Systems (IA).** The Overall objective of the project is to promote sustainable, nutritious and healthy agriculture productions systems and food and nutrition security. IA integrates three broad thematic areas: 1/ Integrated farming systems, 2/ Climate smart agriculture production systems; and 3/ Healthy and nutritious agriculture production systems. Equally important, agriculture production has to be achieved in an equitable and environment friendly fashion that promotes adaptation and resilience to climate change, engages and empowers women and youth, and identifies and reduces losses, wastages, inequalities, and inefficiencies in the production, transformation and commercialization of agriculture inputs and products. In the long-term, this capacity building project will contribute to making Rwandan agriculture a sector that supplies rural and urban populations of Rwanda with healthy, abundant, diverse, affordable food, and in return will lift farmers and rural populations out of poverty and enable them to actively participate in the creation of, and benefit from, global prosperity.

ii) **Engendering Rural Transformation for Sustainable Development (ENTRUST).** The main focus of ENTRUST programme is to increase the understanding of rural transformation and its drivers using an inter-disciplinary approach. In addition, the programme integrates a gendered approach to examine the influence of policies on local economic development, agricultural entrepreneurship and value chains as well as in depth exploration of farming, food consumption patterns and health outcomes using micro and meso level data in Rwanda. This PhD training aims specifically to position the theme of rural transformation both in the context of the UR teaching curriculum and research programme and with regard to sustainable development; as well as meet the goals in higher education to make UR a prime research institution in the region and the continent, influencing policy and practice; contextualise livelihoods, diversification of rural economies, and strengthen the role of the University of Rwanda in addressing socio-economic issues in relation to rural development,

rural transformation, rurality, and gender; and apply holistic approaches to understanding rural transformation as they relate to very specific SDGs (no 1-5, 8-11 and 16-17), Rwanda's Vision 2050, the NST, Sector Strategic Plans in Rwanda, District Development Strategies, and national retreat and dialogue resolutions.

Both will foster on the development of supervision capacity for CAVM staff, will enhance the culture of publication, scientific exchange, collaboration with farmers, and will promote a vibrant and internationally competitive research environment by training a critical mass of researchers that can generate and disseminate new knowledge that assist decision-makers, the private sector, and farmers to transit from subsistence to commercial agriculture.

2. PhD in Agricultural Sciences (AS)

UR-CAVM calls for interested candidates to apply to 7 PhD positions for training in the PhD AS programme (see following section 3). The 7 local PhD candidates will register at the University of Rwanda, and their training will be delivered by UR-CAVM in full collaboration with SLU. Joint supervision from SLU.

Five and two PhD positions for training in the PhD AS programme are offered respectively under **"Toward Integrated and Sustainable Agriculture Production"** (i.e., research positions 1-5) **and** ENTRUST (i.e., research positions 6-7) subprogrammes.

Under PhD in AS, the coursework covers 60 credits, whereas field/research work covers 300 credits. The programme will be based in Rwanda. However, some works for a particular reason might be organised at SLU, Sweden. In that case the program shall take in charge all movements' requirements. The student will be jointly supervised by professors and senior researchers from both SLU and UR. Tuition fees will be waived for UR staff.

3. Local PhD research projects

I. Livestock nutrition and high-quality low-cost animal feed (Integrated Agriculture)

- UR-Sweden programme: Integrated Agriculture subprogramme
- Available Positions: 1 Position
- Specific eligible criteria: Master's in animal productions

To meet the increased demand of high-quality food protein by an increasing population there is need for improving our knowledge on how to increase the production plant and animal-based protein in a sustainable way. In livestock and aquaculture production, feed is not only a key factor in determining the productivity of the system, but it also accounts for the higher proportion of the production costs.

Because of the competition for finite land and resources, high-quality protein of animal origin should be produced attending the principles of sustainability and circular economy focusing on positive society-wide benefits (e.g., land-use change and environmental impact).

In this context, an efficient management of nutrition -which would result in increased productivity, health and welfare- should exclude or minimized the use of human-edible food resources (Gill et al. 2010). Fish and ruminants are species capable to produce high-quality food proteins –meat or milk- on diets with none, or minimal, inclusion of human-edible food. Our proposal aims to work on integrated fish-livestock farming systems (Little and Edwards, 2003) based on locally available resources.

The project will focus in vivo studies on different ration formulations based on locally available feed resources (grasses, legumes and by-products); Grow black soldier fly (BSF) larvae, as a source of high-quality protein for fish and poultry, to study different substrates based on organic waste, ruminant manure, and by-products (Devic et al., 2013); Fish and poultry: in vivo studies on different ration formulations based on BSF larvae and other locally available feeds-by products

Expected results: Feed and feeding practices to increase the supply of high-quality protein of animal origin based on locally available feed/by-products resources avoiding the competition for human edible food.

II. Impact of current agricultural land and water management systems in Rwanda on greenhouse gases emissions: Assessment and mitigation strategies (Integrated Agriculture)

- UR-Sweden programme: Integrated Agriculture subprogramme
- Available Positions: 1 Position
- Specific eligible criteria: Master of Sciences in Environment, or Soil and Water Engineering, or Soil Sciences, or equivalent Master

The marshlands generate substantial benefits including flood alleviation, ground water storage and recharge, retention of pollutants and food web support. Actions are needed to further develop the land and water management systems in order to utilize the full agricultural production potential and minimize environmental side effects (PSTA II, 2009). Agricultural land can act as a source of greenhouse gases when not proper managed (IPCC, 2014). Optimized water management strategies can result in large decreases of GHG emissions (Feng et al., 2013). In Rwanda, agricultural land is used for different crop production without taking into consideration of GHG emissions into atmosphere. In order to support the world-wide efforts of reducing the emission of GHGs into atmosphere, it is essential to study the amount of GHGs emitted from different land management systems of Rwanda. The focus will be on the marshlands, but other land types will also be considered.

The first main focus of this project is to set up a baseline of GHG emissions from currently used major land and water management systems. The second focus is to evaluate the impact of different land and water management systems on the emission of GHGs from agricultural lands.

A third focus is to test the applicability of different measures and their potential to reduce GHG emission while maintaining or increasing yields (Jain et al., 2014; Lampayan et al., 2015). The fourth action will include simulations of different management options with predicted future climate changes in order to estimate the potential increase in GHG emission under current land use and with implemented measures evaluated under action three. The fifth action will be to establish a basic GHG emission monitoring program in order to generate validation data for the model calculations but also for assess in the future the effectiveness of control measures and to relate GHG emission changes to land and water management changes in the catchment.

Expected results*:* 1) Identify critical source areas for GHG emissions; 2) Quantify the GHG emission from different land and water management systems; 3) Propose some measures for direct reducing GHG emission from agricultural land; 4) Estimate the rate of GHG emission when using different management systems in future climate; 5) Establish a monitoring system for GHG emissions.

III. Assessment and improvement of the current crop intensification programme with regards to its environmental impact, effectiveness in pest, weeds, and nutrients management (Integrated Agriculture)

- UR-Sweden programme: Integrated Agriculture subprogramme
- Available Positions: 1 Positions
- Specific eligible criteria: Master in Crop Sciences, Agronomy, Soil Sciences, or equivalent

Agricultural production is currently being intensified at an unprecedented rate in Rwanda, largely by means of conventional methods such as increased use of mineral fertilizers, chemical pesticides and simplified crop rotations. Even if this approach in the short term is likely to lead to increased crop yields of certain key crops such as maize and potatoes, it will also increase the pressure on the environment and human health, and may erode biodiversity, ecosystem services and ultimately the resilience of agricultural production (Sala et al. 2000; Steffen et al. 2018)). Ecological intensification, which aims at reducing the need for external inputs by careful management of ecosystem services provides an alternative intensification path that may lead to more resilient agricultural production and reduced environmental impact (Bommarco et al 2013). The proposed project will assess if selected ecological intensification approaches can make maize cropping systems more sustainable in Rwanda.

In the first stage of this project, maize grown under the current intensification programme will be compared with more integrated, traditional production systems with respect to the pressure of pests and weeds, soil fertility and yield of maize. Furthermore, sustainability of these cropping systems will be compared using several indicators of i) environmental impact (e.g., water pollution, pesticide residues) and ii) resilience of the (selected) ecosystem service of pest control (e.g., functional diversity of pest predators, and the time it takes for pest control services to bounce back after disturbance (Martin et al. 2018).

Finally, we will compare the nutritional status of families in the different management systems.

In the second step of the project, selected approaches to ecological intensification (e.g. mixed cropping, conservation tillage or soil amendments), will be identified based on the results of the initial survey, literature and ongoing projects (e.g., the capacity building programme in Uganda), and integrated into the intensified cropping systems. The modified cropping systems will then be compared to conventionally intensified systems with respect to pest and weed pressure, soil fertility, crop yield as well as indicators of resilience and environmental impact.

The proposed project is expected to provide i) an assessment of the productivity and sustainability of conventionally intensified maize cropping systems and more traditional, integrated cropping systems of Rwanda; ii) an evaluation of whether selected ecological intensification approaches can enhance productivity and sustainability of maize cropping in Rwanda.

IV. Assessing irrigation water productivity in Rwanda and defining potential strategies for improvement

- UR-Sweden programme: Integrated Agriculture subprogramme
- Available Positions: 1 Positions
- Specific eligible criteria: Master in Soil and Water Engineering, or Master in Soil and Water Management, or Master in Agricultural Hydrology, or equivalent Master

Several studies in Rwanda are addressing the importance of in increasing the area of irrigated agriculture as a pathway for increased agriculture production and food security (i.e., PSTA II, 2009, MINERANA, 2009; MINAGRI, 2018). Still, the same studies highlighting the need of increasing irrigation efficiencies and reduce environmental impact. Therefore, the main focus of this project will be to develop strategies for improving water productivity (more crop per unit water at a reasonable cost) and reduced environmental impact (such as less pressure on existing water resources and less impact on water quality). The focus are the marshlands, but other landscape types will also be considered.

The first focus of this project is to set up a model for representing the irrigation baseline for some representative irrigation schemes. This will include water distribution and irrigation operations at the scale of farm fields (i.e., Brauman et al., 2013; Bekchanov, et al., 2010).

The second focus will be to assess the existing irrigation operation at farmer fields and the efficiency of the water distribution infrastructure (water losses, costs, net return and respond to farmer's need). The third focus will be to quantify how different strategies at farm level could potentially improve water productivity and water quality. This includes irrigation and fertilization scheduling, irrigation methods and crop selection. The fourth focus will be to define some strategies for water distribution that are harmonized with the irrigation scheduling at the farmer's field. The fifth focus will assess the impact of climate change on irrigation demand.

Expected results are: 1) Quantify the efficiencies of water distribution infrastructures; 2) Quantify the water productivity at the farmer's field for some major crops; 3). Propose some strategies for improvement in water distribution that consider the irrigation need at farmers' fields; 4) propose appropriated irrigation scheduling that consider climate, soils, crop needs and environment; 5) quantify the impact of climate change on irrigation demand for some major crops

V. Improving river water quality: Estimation of sediment yield and measures for reducing sediment discharge to the river

- UR-Sweden programme: Integrated Agriculture subprogramme
- Available Positions: 1 Positions
- Specific eligible criteria: Master in Soil and Water Engineering, or Master in Soil and Water management, or equivalent Master

In Rwanda a combination of heavy rains, demographic pressure and unsustainable land use result in rivers carrying significant quantities of sediment, this brings several constrain for using the polluted water as for drinking, fish production or irrigation (i.e., PSTA II, 2009, MINERANA, 2009). Climate change prediction showing that this situation in the region will even aggravated if not controlling measures are taken (IPCC, 2014).
Sedimentation of eroded material in the rivers cause various problem to the water infrastructure and increase the frequency and intensity of flood events. Reducing sediment load is the pathway for protecting river water quality that support human activities and natural ecosystems.
The first main focus of this project is to set up a model for assessing the interaction between hydrology, land use and soil characteristics that enables to identify critical source areas and pathways for the sediments in the catchment (i.e., Newhama et. al., 2002; Aviles, et. al., 2018). The second focus will be to assess and test (some) potential measures for direct reducing sediment loads to the river and for protection of channels and water ways that are connected to the river (i.e., sediment traps, stabilization of the banks). A third action will be to estimate how soil conservation or change in land use could reduce sediment yields. The fourth action will include simulations with predicted changes of rainfall patterns under future climate in order to estimate the potential increase in sediment yields under current land use and with conservation measures evaluate under action three. The fifth action will be to stablish a basic water monitoring program in order to generate validation data for the model calculations but also for assess in the future the effectiveness of the sediment control measures and to relate water quality changes in the river to land use changes in the catchment.

Expected results: 1) identify critical source areas and pathways for sediments transport to the selected river; 2) Quantify the sediment load from different source areas; 3). Propose some measures for direct reducing sediment loads to the river and show their effectiveness for reducing sediment load; 4) Estimate the rate of sediment yields for rainfall patterns in future climate; 5) Establish a monitoring system for water quality for defining the baseline and evaluate the impact of change in hydrology and land use in the catchment.

VI. Gender and Rural Entrepreneurship

- UR-Sweden programme: ENTRUST subprogramme
- Thematic area: 1
- Available Positions: 1 Position
- Specific eligible criteria: Master in field of gender and rural transformation towards sustainable development.

This research programme will move beyond the study of women and entrepreneurship by emphasizing performance and growth, and instead understand entrepreneurship as a gendered process by which institutional change and increased empowerment can take place (Ahl, 2006), drawing on theories from organizational research. We recognize that there is a need to consider context-specific factors such as socio-cultural, legal-institutional, economic and political (Ahl et al. 2016). By framing entrepreneurship as a gendered process with potential to increase the empowerment of rural women, men and youth, we enable the identification of women, men and youth entrepreneurs' different interests, needs and preferences. Moreover, in contrast to earlier research on women and entrepreneurship, we recognize the importance to include both women and men in the gender analysis, as well as accounting for generational issues. Pettersson with colleagues have previously developed and applied the analytical framing of entrepreneurship as empowerment for women in both a Nordic and Tanzanian context, which they call Feminism (Ahl et al 20). In this research theme, we want to apply this concept specifically to the rural sector in Rwanda, as well as to expand it to also consider the empowerment of marginalized men and youth. Research questions will include: (i) What are the factors that can explain the limited engagement and reluctance of women and youth in the agri-food sector? (ii) What types of entrepreneurships exist and how do they affect local economic development? (iii) What are the contexts of successful rural entrepreneurs? (iv) What is the role for gender norms and responsibilities? (v) How do gender norms and practices impact women's, men's and youth's opportunities and constraints in rural entrepreneurship/entrepreneurial processes? (vi) What institutions facilitate or constrain the engendering of rural entrepreneurship?

VII. Farming, food consumption patterns and health

- UR-Sweden programme: ENTRUST subprogramme
- Thematic area: 2
- Available Positions: 1 Position
- Specific eligible criteria: Master's in interdisciplinary program in economics, food and nutrition sciences.

The main goal of this research thematic area is to shed light on farming, food demand and security, dietary habits, nutrition and the health situation in Rwanda, taking into account prevailing regional characteristics and disparities.

Food crop production in Rwanda is predominantly dependent on the productivity characterizing small farm-holders. Increasingly, there is need for more research to contribute to debates regarding household agriculture and food security, and its contribution towards nutrition and wellbeing (Mackay et al 2018). This is crucial for addressing the double burden of nutrition particularly in countries with rising incomes like Rwanda. Raising productivity levels among smallholder farms therefore represents a vital means to address problems of undernutrition, overnutrition and farm household wellbeing. A body of evidence now exists underscoring the need to have good nutrition between a woman's pregnancy and a child's second birthday. This period sets the health course for irreversible brain development, growth and predisposition to later adult life diseases, viz. cardiovascular related, obesity and diabetes (Black et al, 2013). The overall transformations experienced by the Rwanda economy at all levels are not uniformly distributed in the country and they are influencing households in the following manner: i) through an evident rural/urban divide and ii) regional disparities that are presently prevailing. This situation would require combining a meso approach considering the five established economic and administrative regions (provinces) and micro- approaches. In this process, special attention needs to be devoted to the peri-urban areas within which households could be at the same time part-time farmers and also involved in other economic activities (for instance informal markets).

The proposed research thematic area addresses the following tentative questions/issues: (i) How do the regional farming activities and their related upstream and downstream industries respond to the nutrition and health situation among Rwanda population? (ii) how do increase in household income, a rapid urbanization and a continuous re-structuring of its farming sector influence individual's health status, (iii) what are the implications of agriculture-nutrition-health knowledge among different gender groups on food production, household food security, food preparation, consumption, dietary diversity and nutritional outcomes for adults and children? (iv) What are the opportunities for the land use consolidation (LUC) policy and crop intensification program (CIP) to contribute towards promoting nutritional outcomes in rural and peri-urban Rwanda? (v) What is the impact of globalisation, environmental change and urbanisation on dietary patterns and nutritional status of the population in Rwanda? (vi)What is the status of knowledge level among genders in relation to nutrition, healthy diets and food preparation and how can this knowledge be increased, communicated and sustained to promote, maintain or recreate healthy food dietary habits?

4. Funding

INTEGRATED AGRICULTURE: The present fellowship provides funding for only research work of the five PhD position and the workstations' facilitation. The tuition fees for UR staff will be waived. In case there is need to complete one or another work in the partner university, (SLU Sweden), the fellowship will support the students' travel to Sweden and living allowance while in Sweden.

ENTRUST: The funding for the two PhD positions will be supported by Sida through UR Sweden Program for Research, Higher education, and Institutional Advancement. The tuition fees for UR staff will be waived. The program will support research work and workstation facilities in Rwanda. In case there is need to complete one or another work in the partner university, (SLU Sweden), the fellowship will support the students' travel to Sweden and living allowance while in Sweden.

5. Admission

Potential PhD Candidates are expected to express their motivation and interest to undertake the PhD programme in the area of engendering rural transformation or integrated agriculture production for a maximum period of four years from date of registration. Applicants must qualify and meet the admission criteria and conditions both at UR and SLU. The following are key eligibility criteria:

6. General eligibility criteria

PhD applicants must qualify and meet the admission criteria and conditions as per the UR guideline. The following are key eligibility criteria:

x. Be a permanent staff of the University of Rwanda.
xi. Be a Rwandan citizen.
xii. Hold a master's degree in agriculture and allied sciences delivered by an accredited university with specialization in Agriculture Engineering, soil and water engineering, Animal productions, Veterinary sciences, Forestry and Agroforestry, Agroforestry and soil management, Landscape restoration, Horticulture, Crop sciences, Food safety, Food processing, Agricultural waste management (see specific eligibility criteria indicated for each position).
xiii. Present a clear PhD research proposal about one of the proposed areas of interest,
xiv. Be fluent in English, both orally and in writing (Proof of English proficiency (i.e., TOEFL or equivalent).
xv. Readiness to adhere to UR capacity building policies and regulations.
xvi. Ready to continue working at the University of Rwanda after completion of the PhD studies.
xvii. In line with UR's gender policy and UR's commitment to bridge the gender gap in research and teaching at UR, female candidates will be given a priority; all things being equal, female candidate shall be preferred.
xviii. Successful candidates should be prepared to work full time on the project and not be in possession of another fellowship for PhD studies. For those in teaching positions, the *teaching load will be reduced to a maximum of 20%.* Other side activities, assignments, consultancies or employment are strongly discouraged.

7. Key documents to support the application

The following documents are required to support your application:

i) Application letter addressed to the Ag. Director of the Centre of Postgraduate Studies of the University of Rwanda [Max: 1 page];

ii) Certified copy of your Masters' degree relevant to this PhD programme;

iii) A cover or motivation letter stating your interest in this programme and the gap to bridge after your PhD research and education [Max: 2 pages];

iv) Curriculum Vitae demonstrating your previous experience relevant to this PhD program plus the publication or academic experience [Max: 3 pages]

v) Indicative PhD Project proposal. This should comprise (1) the background, (2) the problem statement demonstrating the research gap and the current art of science in the area of research of interest among the three thematic areas; (3) the methodology and anticipated sources of data to be used, (4) how you intend to make this project successful and what you see as future challenges in undertaking this research, (5) five to ten key references well documented likely to inform this study, (6) other relevant additional statements. [Max 5 pages].

vi) Three recommendation letters: one from the current employer, one from your previous supervisor, and the other from any other reference person (former employer or professor).

vii) Applicants from a College at UR need to inform the Principal about applying for this position; and attach a confirmatory letter from the Principal.

viii) Copy of the valid identification card or passport

8. How to apply

Application and support documents should be done electronically via email to ur-cpgscholarship@ur.ac.rw and copies to amukamuhirwa@gmail.com (for research topics 6-7) or s.rukeratabaro@ur.ac.rw or simon.rt@gmail.com (for research topics 1-5)
More information and further clarifications can be obtained from Dr. Alphonsine Mukamuhirwa, Deputy Team Leader of the ENTRUST sub-programme. E-mail: amukamuhirwa@gmail.com, Dr Simon Rukera-Tabaro, Deputy Team leader of the Integrated Agriculture subprogram, and from UR-CPGS Scholarship officer Mrs Gashayija Umulisa Gloriose to the E-mail: ur-cpgscholarship@ur.ac.rw

9. Recruitment process

i) The hard copy application files shall be submitted to the office of the Ag. Director of the UR-CPGS at the UR Headquarters (UR-Gikondo Campus).

ii) A soft copy of the application shall be sent to Mrs. Gloriose Umulisa Gashayija, Scholarships Officer at UR-CPGS (ur-cpgscholarship@ur.ac.rw) with Cc to the Subprogramme Deputy Team-leaders (Dr Simon Rukera Tabaro, email:simon.rt@gmail.com or s.rukeratabaro@ur.ac.rw, tel: +250 (0) 788 450 031; Dr Alphonsine Mukamuhirwa, email: amukamuhirwa@gmail.com, a.mukamuhirwa@ur.ac.rw, tel: +250 (0) 783 768 517.

iii) The recruitment team includes senior academic staff from both UR and Swedish University of Agriculture Sciences. Successful candidates will be notified a couple of weeks after the interviews and are expected to start in January 2022.

iv) All applicants will be notified of the first selection outcome, and Eligible applicants will be invited for an interview for the final selection of the candidate.

v) **The interview process will, apart from the interview, include an exercise in writing to test the candidate's English proficiency.**

10. Contact details for more information

For more information, please contact Dr. RUKERA-TABARO Simon, the Deputy Team leader for Integrated Agriculture subprogram/UR-Sweden Program, email: s.rukeratabaro@ur.ac.rw or simon.rt@gmail.com tel: +250 (0) 788 450 031, or Dr Alphonsine Mukamuhirwa, the Deputy Team leader for ENTRUST subprogram/UR-Sweden Program, email: amukamuhirwa@gmail.com, a.mukamuhirwa@ur.ac.rw, tel: +250 (0) 783 768 517.

11. Important dates for the application process

- **Submission deadline: 20th October 2021at 23h59'**
- Publication of the list of shortlisted candidates and invitation to the interview by 08th Nov. 2021
- Selection interviews to be organized between 09th - 10th November 2021
- Successful candidates are announced by 01st December 2021
- Admission early February 2021
- Study leave/Contracts early March 2021

Done at Kigali, September 22, 2021

Prof. Nosa O. EGIEBOR
Deputy Vice Chancellor for Academic Affair and Research