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Human and Institutional Capacity Development Gap Analysis: Summary Report and Recommendations for Rwanda

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Sustainably intensifying smallholder livestock systems to improve human nutrition, health, and incomes

Abbreviations

AET	Agricultural Education and Training
AOI	Area of Inquiry
ASF	Animal-Source Food
BSc	Bachelor of Science
CAVM	College of Agriculture, Animal Sciences and Veterinary Medicine
CCT	Cross-Cutting Theme
CDAIS	Capacity Development for Agricultural Innovation Systems
FAO	Food and Agricultural Organization of the United Nations
HICD	Human and Institutional Capacity Development
IFAS	Institute of Food and Agricultural Sciences
ILRI	International Livestock Research Institute
MINAGRI	Ministry of Agriculture and Animal Resources
MSc	Master of Science
RAB	Rwanda Agriculture and Animal Resources Development Board
RDB	Rwanda Development Board
SASVM	School of Animal Sciences and Veterinary Medicine
UF	University of Florida
UNDP	United Nations Development Programme
UR	University of Rwanda
USAID	United States Agency for International Development

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Introduction

The U.S. Agency for International Development (USAID) awarded funds to the University of Florida (UF) Institute of Food and Agricultural Sciences (IFAS) to manage the Feed the Future Innovation Lab for Livestock Systems. This five-year initiative (October 2015 to September 2020) supports USAID's agricultural research and capacity building activities under Feed the Future, the U.S. Government's global hunger and food security initiative. The International Livestock Research Institute (ILRI) partners with UF/IFAS in implementing the Livestock Systems Innovation Lab.

The Livestock Systems Innovation Lab has been working in Rwanda since the start of project activities. The initial meetings with the research and extension arm of the Ministry of Agriculture and Animal Resources (MINAGRI), the Rwanda Agriculture and Livestock Resources Development Board (RAB), and the main agricultural education and research institution, University of Rwanda (UR) College of Agriculture, Animal Sciences and Veterinary Medicine (CAVM), identified both institutions as critical partners in strengthening the research potential of the livestock sector in Rwanda. This led to joint prioritization of research for their development needs, issuing of a Request for Grant Applications by the Livestock Systems Innovation Lab, and subsequently, UR/CAVM and RAB became subawardees and subrecipients of funds for livestock research projects in Rwanda.

This report is the result of a rapid gap analysis of the Human and Institutional Capacity Development (HICD) needs of these two institutions as providers of research, extension, education, and workforce development services in livestock systems. The rapid analysis included qualitative interviews and focus group discussions with internal and external stakeholders to the two institutions. The interview and focus group questions investigated the strengths and weaknesses of UR/CAVM and RAB at the individual, organizational, and enabling environment levels. The questions were intended to determine the training and institutional needs as well as other collaborative arrangements for improving research, extension, and teaching capacities in livestock systems.

The report provides an overview of the Livestock Systems Innovation Lab's capacity development approach, the results of the rapid gap analysis, suggested areas of intervention, and recommendations for next steps between the Livestock Systems Innovation Lab, UR/CAVM and RAB. The Livestock Systems Innovation Lab has been renewed for a second phase (October 2020 to September 2025). At the onset of this second phase, the findings from this report will be reviewed in coordination with the above listed partners and other stakeholders to develop an intervention plan that will help UR/CAVM and RAB strengthen their research, extension and teaching capacities to support the livestock systems in Rwanda.

Capacity Development Approach

The USAID framework and other frameworks for HICD emphasize the connection between building the capacity of the individual and organization, and systemic change at the institutional and enabling environment levels. Human capacity development can only function for the growth of the individual, organization, and institution when newly acquired skills are supported by adequate infrastructure, resources, policies, and the capacity to change and adapt (Jones, Rojas, and Gill, 2015). As such, in-depth analyses of human and organizational capacity, institutional gap assessments, and collaboration with key stakeholders must be conducted to fully address HICD needs. These efforts must align with organizational needs and abilities and use an iterative and collaborative process (USAID, 2010).

For the purposes of this project, the following definitions will clarify Livestock Systems Innovation Lab's HICD objectives and activities in terms of capacity development. Figure 1 shows the relationship between individuals, organizations, and the enabling environment (FAO, 2016). The individual (human) level: the knowledge, experiences, and skills that enable an individual to perform. Access to resources and experiences that develop individual capacity are shaped by the organizational and environmental factors in which the individual operates, which in turn are influenced by the degree of capacity and agency of the individual (FAO, 2016; UNDP, 2009).

The organizational level: the internal structure, policies, and procedures that determine an organization's effectiveness (FAO, 2016; UNDP, 2009). This includes support systems (fiscal, human resource, technical), incentive systems, as well as organizational goals and plans that influence an individual's ability to perform (FAO, 2016; USAID, 2012).

The enabling environment level: the broad social system within which individuals and organizations function, including the rules, laws, policies, power relations, and social norms that govern civic engagement (FAO, 2016; UNDP, 2009). The enabling environment involves how human capacity functions within the organization and the environmental system that surrounds it (FAO, 2016; USAID, 2012). These connections extend to external institutions such as government, civil society, the private sector, and the larger cultural system (FAO, 2016; USAID, 2012).

Figure 1: Three levels of capacity development (USAID, 2012)

The Livestock Systems Innovation Lab's HICD plan is built on the rationale that: "*Strong, knowledgeable livestock systems scientists and researchers, along with effective and competent institutions, are essential for the development of agricultural innovation systems and specifically, livestock innovation systems".* An enabling environment (innovation policies and investments, agricultural policies and educational policies) that encourages and permits innovation is just as important.

Figure 2 shows a conceptual model of the Livestock Systems Innovation Lab's HICD Theory of Change and the interactions between human capacity, institutional capacity, and the enabling environment.

After a close examination of capacity development literature and documentation, the HICD team focused the core HICD efforts on Agriculture Education and Training (AET) institutions that are partnering with the Feed the Future Innovation Lab for Livestock Systems to conduct research based on the rationale that:

- AET institutions have both faculty and students who are conducting research in animal-source food (ASF) systems.
- The focus of AET institutions on faculty and students will lead to longer-term sustainability of HICD efforts and other research investments, as students move from the AET organizations into research, government, extension, and various roles in ASF value chains.
- Many AET institutions have partnerships with government research institutions. Inclusion of these institutions in key stakeholder interviews/focus groups will allow the HICD team to evaluate the working relationship between both AET and government-based research institutions and explore avenues to strengthen research collaboration through HICD activities.
- Many AET institutions are positioned to be focal points for current and/or future human capacity development such as professional development training and skills upgrade, across livestock research and development institutions, including public, private, and extension systems.

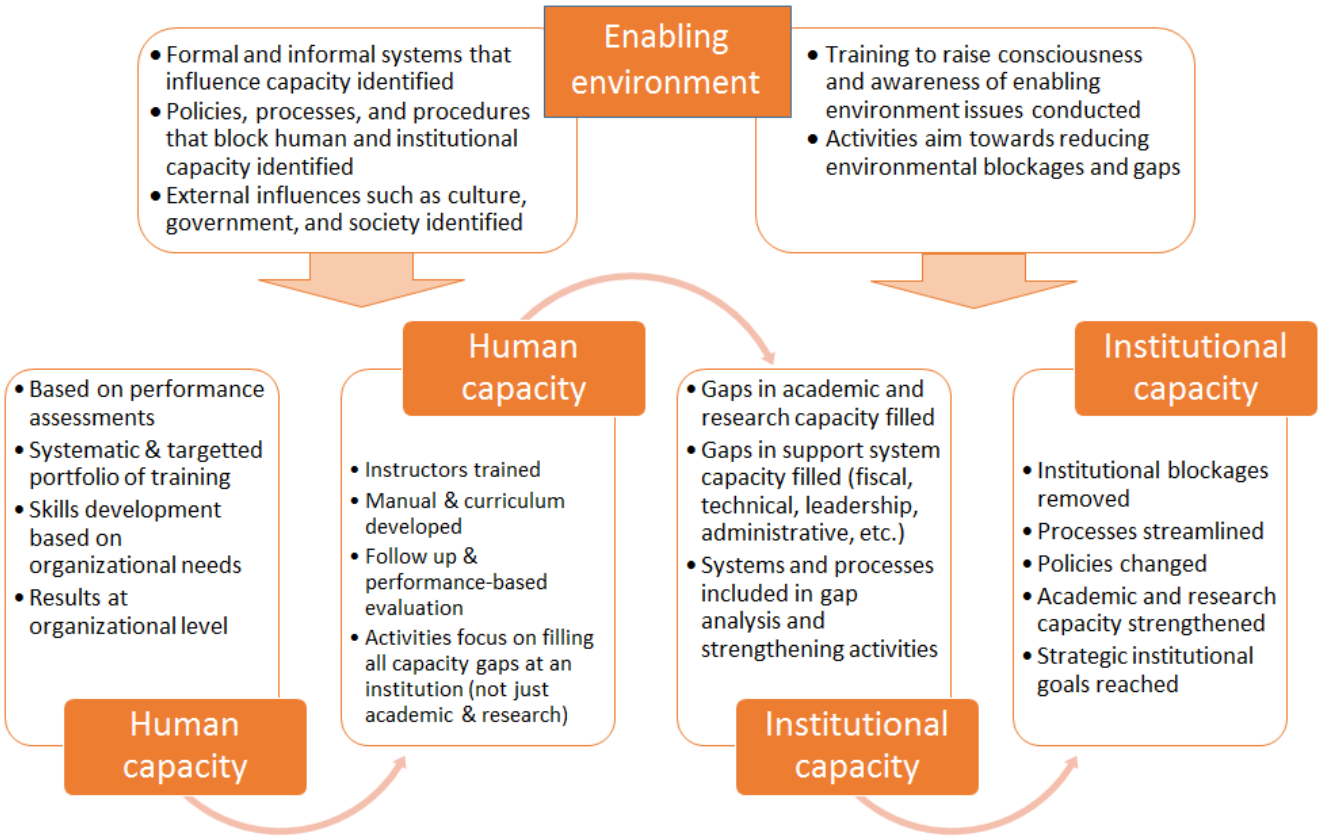

Figure 2: Conceptual Model of the Theory of Change for Livestock Systems Innovation Lab's HICD

With these issues and priorities in mind, the Livestock Systems Innovation Lab's HICD team proposes a phased process that will focus on capacity development efforts with partner AET organizations through:

1. Identifying and filling the human and organizational capacity related gaps among research and academic institutions in the livestock sector.
2. Attuning to institutional arrangements and the enabling environment in which livestock system operates, and collaborating with governmental, non-governmental, and private organizations to provide recommendations to strengthen institutional arrangements and establish a positive enabling environment.

Data Collection and Analysis

Data collection took place over one week. From April 25 to 29, 2019, the HICD team held meetings in Kigali with key stakeholders including the Rwanda Agriculture and Livestock Resources Development Board (RAB), Gorilla Feed Ltd., TechnoServe-Rwanda, Rwanda National Dairy Platform, and Rwanda Development Board (RDB). Site visits were made to UR/CAVM campuses in Busogo (Northern Province) and Nyagatare (Eastern Province). Data collection included more than 20 in-depth interviews and focus group discussions with RAB personnel as well as UR/CAVM faculty and undergraduate and graduate students specializing in livestock-related fields, such as Animal Production, Veterinary Medicine, and Agribusiness and Rural Development. The preliminary results of the analysis were shared during a one-day workshop in Kigali on April 29, 2019. Seventeen representatives from interviewed

organizations and campuses (including undergraduate and graduate students) provided their feedback on shared results and identified key areas for Livestock Systems Innovation Lab's HICD interventions in the livestock sector in Rwanda. The workshop participants' suggestions are incorporated in this report along with suggestions and feedback received from other stakeholders during the HICD gap analysis.

Rapid Gap Analysis Results

Institutional Strengths

While the focus of this report is on the capacity development gaps at UR/CAVM and RAB, it is important to state that the interview and focus group participants had many positive comments about the university and RAB, some of which are listed below:

UR/CAVM

- The University has the only comprehensive agricultural school in Rwanda that combines animal sciences and veterinary medicine degrees with other agricultural disciplines.
- UR/CAVM students praise the quality of education, particularly in the animal production program. The students feel that they are competitive when they leave the institution and get a solid theoretical background in their field, despite the challenges posed by a lack of practical skills training, access to functioning labs and other student resources on campus (libraries, internet, career advice, etc.). Students also report that in their opinion, the curriculum is comparable to other AET institutions in the region (e.g., Makerere University in Uganda), and when possible, the University provides additional opportunities (such as career fair days). For example, UR/CAVM is one of the few universities that provides financial aid and has targeted recruitment programs for students from remote and rural areas.
- Students also feel their faculty have better qualifications and training than the faculty at other Rwandan universities. They feel that the faculty have a strong record of publications and have high standards for research and teaching. The university with a singular, multi-campus environment offers a wide range of academic studies that provides opportunities for students to pursue a variety of interdisciplinary programs which buffers the lack of infrastructure (e.g., working farms, well-equipped classrooms and labs), which are desirable for a university as a place of study.
- Many UR/CAVM faculty participate in RAB research projects, which provide opportunities for UR/CAVM students to participate in field-based research and extension activities utilizing resources and infrastructure available at 13 RAB field stations across the country.
- UR has positive working relationships with both international and national institutions to implement research. UR/CAVM works with IMBARAGA Farmers Organization, Agribusiness Associates, Inc. Rwanda Best Ltd., and other entities within Rwanda. The University has international partnerships with education and research organizations, such as American, Swedish, and South Korean universities, that collaborate to implement curriculum reforms, upgrade degrees, introduce innovative teaching and develop new areas for teaching and research (e.g., in food safety, One Health).
- The university strives to build positive relations with local communities. The university has academic and research agendas that focus on addressing the needs of local stakeholders. MSc and PhD students conduct research in the communities, although they lack opportunities to return the results to communities.
- University has a staff development plan that encourages lecturers with BSc and MSc degrees to pursue higher-level degrees within the university or abroad. UR/CAVM has policies that ensure job preservation for those who are on study leave while also paying a portion of their salary during the period. Those who upgrade

their degrees are automatically promoted upon return. It was noted, however, that study leave arrangements put a lot of strain on other lecturers to fill in the shortage. The University experiences difficulties in finding qualified lecturers to fill these temporary vacancies.

- Most UR senior lecturers with PhD degrees obtained their credentials outside of Rwanda, which makes them attractive not only to university but also to the government to capitalize on their new skills, knowledge and potential international networks. However, this also leads to brain drain as many PhDs are channeled by government to fill administrative positions within the government. On the positive side, this can lead to strong partnership development with government officials that can be leveraged to bring more funding opportunities for university and internship placement for students.
- UR/CAVM also practices hiring international researchers as lecturers who train students as well as provide mentorship to young faculty.
- Finally, UR/CAVM has a strategic plan that prioritizes the institution's resources toward becoming a center of high standards and influencer in education, research, and technology transfer in agriculture, animal husbandry, veterinary medicine, agricultural products development and processing. It also strives to play a role in Rwanda's rural economic transformation by providing training and refresher courses to the farming community as well as participating in research and extension activities in collaboration with other partners.

Appendix 1 provides a brief description of UR/CAVM and its current institutional capacity in terms of teaching and research.

RAB

- RAB is both the research and extension arm of MINAGRI. This allows for a transfer of agricultural innovations and knowledge to farmers through extension programs. RAB works across government prioritized value chain commodities, such as crops (maize, rice, wheat, fruit, coffee, beans, potatoes, cassava and vegetables), and ASF (dairy, meat and eggs), to address food insecurity, especially in rural areas, as well as increase export capacity to neighboring countries.
- RAB is organized into different research and extension stations. Each station covers 3-4 districts in which RAB personnel work closely with local government. A recently introduced structure involves one staff member in each station to cover all key RAB areas (e.g., from crops to livestock), which facilitates better coordination between different initiatives at the local level.
- RAB often collaborates with UR/CAVM researchers in the livestock sector and invites UR/CAVM, particularly the Food Sciences faculty to participate in projects focused on food safety issues across different value chains. RAB has research lab infrastructure that is not available at UR/CAVM and allows UR/CAVM faculty and students to conduct microbiological or other lab tests, including biosafety analysis. RAB is part of Rwanda's One Health Steering Committee, established in 2011, to represent animal health in addressing One Health-related issues in the country.[1]

[1] UR/CAVM is part of the One Health Central and Eastern Africa Network (OHCEA). One Health is integrated in the curricula for the schools of public health and veterinary medicine. Interviews, not related to the HICD Gap Analysis, indicated that there seem to be a lack of collaboration between RAB, UR/CAVM and other institutions participating in One Health on zoonotic disease surveillance, outbreak investigations and response. Furthermore, UR/CAVM needs to develop the capacity of laboratories (human and infrastructure) to conduct adequate laboratory work and training. On the bright side, UR/CAVM leverages existing networks with OHCEA, regional universities and the private sector to encourage graduating students to enter One Health workforce.

- RAB has been successful in establishing a diverse funding portfolio that provided RAB researchers a freedom to focus in areas that are not prioritized by the Government of Rwanda; however, this funding is ad hoc.

Appendix 2 provides a brief description of RAB and its current institutional capacity in terms of research in the livestock related areas.

Challenges Unique to Institutions

UR/CAVM

Human

Laboratory Skills

Issues with laboratories were some of the most reported concerns of faculty and students. There is a lack of laboratory technicians compounded by a lack of basic equipment maintenance skills among those present, including how to maintain, calibrate, and repair the various kinds of laboratory equipment. Technicians lack skills on how to properly use equipment, which tests to run and why, and how to interpret test results. Moreover, there is a lack of continued standardized laboratory training within the university that also offers refresher trainings. Laboratory staff rarely have an opportunity to upgrade their lab skills. When opportunities for training occur, it is usually lecturers who are given the chance to participate.

The labs are primarily used for demonstration purposes. Students, especially undergraduates, rarely get to use the equipment in most of the laboratories and the willingness of laboratory technicians to assist students or to give them access to the laboratories varies but is generally low. Graduate students who must conduct research struggle to find working laboratory equipment and supplies. They also find it difficult to access the better equipped RAB laboratory facilities that are not readily available to students unless their project is part of UR's collaborative research agenda with RAB. Additionally, the spread of UR/CAVM campuses across the country makes it difficult for students to access the better equipped RAB laboratories, which are located in Kigali.[2]

There is little capacity in the veterinary labs in terms of diagnostics, particularly for zoonotic diseases. The majority of the laboratories focus on basic chemistry and biology tests. This is also a challenge with the lack of diagnostic kits, consumables, and equipment for routine laboratory activities. For example, one student stated, "There is a lab on campus for microbiological tests and to study bacteriology and parasitology, but the lab is poorly equipped and often lacks standard supplies to run microbiological tests."

Technical and Practical Skills Gaps

Some key technical skill gaps are creating bottlenecks and blockages for the development of faculty and students. Laboratory skills are discussed above, but it is important to note that issues with laboratory skills, consumables, laboratory access, and infrastructure are directly related to some of the other key gap areas. The lack of knowledge on which laboratory tests to run, how to read the output, and the availability of the equipment to run the needed tests may tie in, for example, to the level of statistics needed to interpret test results and create and use statistical models.

The statistical software packages used at the universities include SPSS, SAS, and STATA, but the level of proficiency widely varies as does the version of the respective software packages that are available. It was difficult to determine if there were any faculty who could teach Biostatistics with R software, which is free of charge. The faculty and graduate

[2] For example, the one closest to Kigali, the Busogo campus, is about 107 kms one way.

students desire to conduct advanced research, including at the molecular level, but have limited statistical skills. Faculty also pointed to the lack of specialized software and computers with the capacity to run large datasets. In addition, the teaching of statistics is theoretical rather than practical, with students receiving very limited opportunities to use statistical software. Both faculty and students perceive this as a key constraint to the capacity of the university to conduct research. One-time, short-term trainings are helpful but considered insufficient to meet the need for building long-lasting capacity in this area. Particularly, students articulated a need to have a faculty member who specializes in the use of statistics in livestock-related disciplines.

Writing grants and scholarly writing is another key challenge. Faculty are expected to publish scientific papers, which is an important requirement for promotion. Faculty also want to compete internationally for grant funding but lack the knowledge of how to access these funds and to write to meet donors' expectations. Many students also expressed interest in improving their writing skills. There is an academic writing course, but it is offered only at the Nyagatare campus and primarily to graduate students.

The most commonly identified issue across junior faculty (lecturers with BSc and MSc degrees) and students is the lack of opportunities to gain practical skills. This is due to the high teaching load of faculty (who pick up additional hours after other faculty go on study leave), a lack of necessary, working equipment and infrastructure, and a lack of capacity of the faculty and technicians to train students.

External stakeholders pointed out that students lack simple practical skills to use office equipment (e.g., PC computer) when they are assigned for internships in their organizations. Few students seek internship with the private sector although there is an extensive desire from students to obtain such an internship to acquire practical skills. According to private sector representatives and students, there is a lack of trust between both sides, with one claiming students only possess theoretical knowledge, whereas students need internships to apply theory in practice and to acquire practical skills. The exams required of students are mostly based on theoretical knowledge. While many students pass these exams, stakeholders external to the Universities report that, at the field level, the graduating students are unprepared for practical work but are solid on theory.

To summarize, the students and faculty identified the following technical and practical skills gap areas:

- Data analysis including biostatistics, R statistical software including sequencing and modeling
- Grant writing at a higher level to become competitive for international and collaborative grants
- Writing for scholarly journals
- Food safety*
- Molecular genetics*
- One Health*
- Biotechnology*
- General software and office equipment training (for students)
- Communication and community outreach

*Topics marked with an asterisk primarily involve laboratory skills training for which there are few, if any, functioning equipment or laboratories. Additionally, technical topics as well as practical skills training would require working internet connectivity for purposes of accessing course materials, practicing methods, accessing case studies and videos and other materials to enrich content. Unfortunately, both campuses visited do not have good internet connectivity.

Teaching Capacity

Faculty, students and external stakeholders stated that the theoretical training at UR/CAVM is of high quality. However, the student to teacher ratio is high, making it challenging for lecturers to integrate student-focused approaches in the classrooms (e.g., experiential learning) and students to seek individual help from lecturers. During the visit to Busogo campus, the HICD team observed a class of 60+ students attending a lecture. Undergraduate students receive more lecture-based classes, while interviewed graduate students claimed that their classes are small and faculty tend to employ discussions and other elements of experiential learning (e.g., group discussions).

Faculty stated that UR/CAVM requires student course evaluations and faculty apply the feedback received to improve their teaching methods and techniques. However, interviewed students were not aware of course evaluation opportunities in their programs when asked. In addition, it was difficult to determine if graduate students are given opportunities to co-teach courses in their departments to take pressure off the lecturers, which is one way to help students interested in academic careers to practice teaching. While interviewed lecturers stated that group/class discussions, field work and lab work approaches are integrated into their teaching methods, the interviewed students stated that classes are heavy on traditional lecture-based teaching.

The practical side of teaching, (e.g., laboratory work) is reportedly poor due to factors mentioned above, including the lack of laboratory equipment and supplies, laboratory personnel and laboratory teaching skills. Laboratory chemicals are almost always in short supply, and in many cases the equipment is not functional, even for demonstration purposes.

Another widely cited issue that makes teaching difficult for faculty is the level of English proficiency among students. All instruction at UR/CAVM is in English. Students from remote and rural areas are not well prepared to absorb academic material in English.[3] Faculty wished for UR/CAVM to offer accelerated English courses especially for first year students and continued advanced English courses for upper level students. Offering English courses that include academic and scientific writing courses can potentially incentivize lecturers to involve students in their research so students can contribute to literature reviews and other publications. Faculty also cited the poor academic preparedness of students from rural schools who lag behind students from Kigali or larger cities (e.g., rural students lack adequate chemistry from high school).

In summary, some of the areas where faculty and students indicated similar gaps in teaching include:

- Upgrading curricula and smaller classes
- Experiential learning with focus on practical learning
- Updated technology skills
- Linking outputs to community needs

Student Advising

Students emphasized that they have positive relationships with their faculty, but they expressed concerns about student advising by faculty. According to the interviewed students, there are too few supervisory faculty members, particularly at the graduate level. The faculty that serve as advisors are stretched across teaching, conducting research,

[3] English became an official language of Rwanda in 2003 and since 2009 replaced French as the official language of instruction at universities (Trines, 2019).

student advising and splitting their time between campuses.[4] Because of this, students have little time to spend with their advisors. Interviewed students reported that they receive little guidance during the thesis preparation process, which creates issues during their thesis defense. In addition, it can be challenging for students to find advisors in the areas that are not traditional to UR/CAVM research/teaching portfolio. Due to the lack of advisors, expertise, and related infrastructure, interviewed students claimed that they were unable to advance their research into new areas. Both graduate and undergraduate students often default to basing their final projects on theory or replicating the work that has already been conducted by others.

Organizational

Laboratory Management

In addition to laboratory skills, laboratory management is a significant issue. Understaffing by laboratory technicians and lack of laboratory skills to maintain and fix equipment are acute. Poor laboratory practices often lead to malfunctioning equipment. Laboratory staff are in dire need of training on how to run, maintain, and repair laboratory equipment as well as the general administrative duties associated with managing a lab. It is also important to note that funding for repairing, maintaining, and purchasing equipment is a challenge. This is an issue that requires further exploration to determine where blockages occur. Most cited is the funding issue. According to interviewed lecturers and administrators, UR/CAVM is more autonomous in utilizing their financial resources even when funding comes from the government.

Qualifications of Teaching Staff

Appendix 1 provides a summary of UR/CAVM teaching staff numbers and the proportion of staff with PhD, MSc and BSc degrees in 2016. Based on IFPRI studies, UR/CAVM experiences not only the shortage of highly qualified teaching staff (i.e., lecturers with PhD degrees) but also struggles to retain the remaining PhDs (Tailor et al., 2018; Flaherty et al., 2018). Like other countries, UR/CAVM lecturers with PhD degrees tend to do more research than lecturers with MSc degrees (50% teaching, 40% research, 5% outreach and 5% administration vs. 70% teaching, 25% research and 5% outreach, respectively); however, a distribution of responsibilities across teaching, research, outreach and administration creates competing commitments for lecturers who struggle to focus qualitatively on teaching, research, and student advising, while also commuting between campuses to fulfill their teaching expectations.

In 2000, the Rwandan government set a goal to transform the country from a low-income agrarian economy to a medium-income, export-oriented and knowledge-based economy. Many resources were put in place to train more specialists with MSc and PhD degrees outside of Rwanda.[5] The demand from both public and private sectors for these specialists is high, especially from the Government of Rwanda. The lecturers from the UR/CAVM are often invited to work for Government to fill in the critical areas of the expanding economy. This in turn creates a shortage of highly qualified teaching staff at the university level, which inadvertently also leads to reduced academic and research output. Under current trends, as more technical personnel are trained outside of Rwanda, unless these highly trained individuals in the university system are incentivized to remain in academia and universities are provided with adequate financial resources to upgrade labs, classrooms and to conduct both formative and advanced research, the university will continue experiencing a shortage of well-trained and qualified individuals with advanced degrees.

[4] Interviewed faculty shared concerns about sharing teaching responsibilities across different campuses. According to one faculty, it takes about a day to travel from Busogo campus to Nyagatare campus. Faculty expressed interest in funding opportunities that would facilitate developing distant learning and remote communication infrastructure that can aid them in teaching, collaboration and communication with their peers and students.

[5] Many students are also sent outside of Rwanda. Several graduate students interviewed for this study spent a year of training in Israel.

High Lecturer Turnover

As stated in the previous section, there are few PhD holders at the university. They often have to juggle demanding requirements to teach, undertake research, conduct community outreach, and administration. In addition, they have to cover coursework for faculty who are on study leave. PhD holders eagerly take offers to fill newly created positions within the government system. Although the HICD questions did not probe whether leaving academia was motivated by higher salaries offered by government agencies or the private sector, a study by Kifle et al. (2019) argues that academic job demands on lecturers do not match salary levels earned, which are considerably lower than what they could potentially earn outside of academia.

Junior lecturers are employed as lecturers after graduation with a BSc or as soon as they begin their advanced degrees. This is typically a one to two-year period, after which time the junior faculty typically leaves the University to begin their advanced degree or to take a position at another institution. Junior faculty see the position as a stepping-stone to something else. This creates a constant turnover of faculty who are teaching basic classes. It also means that younger faculty are not able to participate in training and other professional development opportunities – in part due to their heavy teaching load.

Recommendations

To summarize this and the preceding section, some of the areas where interviewed lecturers and administrators proposed actions include:

- Initiate various programs for faculty development.
- Train students to serve as teaching assistants to senior lecturers and for junior lecturers to assume more administrative duties to take the burden off the PhD-holder lecturers who can focus more on building collaborative research opportunities for the university and students.
- Create lecture-focused positions vs. research-focused positions that would enable those with research interests to pursue research opportunities that would contribute to developing and expanding the university's research enterprise.
- Offer salaries that are comparable to what is offered by government agencies or the private sector.

"Shelf" Research

Many faculty and students at the university expressed concerns that the research system is conducting "shelf research" or "academic exercises," meaning that the research is repetitive and not innovative. They stressed that while there is a national research plan, there is inadequate funding to reach the goals of the plan. Moreover, the livestock research is limited in scope, and the result is a repetition of the same "old" ways of conducting research. They claimed that the national research plan is particularly narrowly focused on increasing the production of value chain commodities, such as milk, meat and eggs, leaving other related disciplines (animal health, epidemiology, forage quality, molecular genetics, etc.) behind.

External stakeholders stated that much of the research conducted is not of practical use for them, particularly at the community level. While MINAGRI encourages collaboration between UR/CAVM and RAB (there is an MOU in place to facilitate collaboration in research and extension), stakeholders stated that very little integration of university research takes places at the RAB level. Interviewees felt that research should be focused on community needs and organized as a community-based research system. As part of their job duties, UR/CAVM lecturers host or participate in community or stakeholder meetings to determine their priorities and needs but very little translates into research or extension projects due to lack of funding as well a heavy academic load. Many professional organizations, such as the Rwanda National Dairy Platform, called for research outcomes to be widely circulated outside of the closed university

setting to disseminate results as well as connect with industry. For example, more research is needed in integrating local knowledge and capacities in dairy processing. A small dairy unit in Busogo campus requires an upgrade, which can be used to train more students in practical skills as well as target National Dairy Platform clients (farmers) with trainings on modern milk processing and food safety techniques.

Curriculum Gaps

Interviewed students claimed that the change from undergraduate to graduate coursework is particularly challenging. At the undergraduate level, they felt they were "spoon-fed," and provided with lecture materials to memorize and repeat memorized materials in tests. At the graduate level, the "way of thinking and learning" changes due to increased emphasis on the part of lecturers on critical thinking skills, and therefore graduate students, interviewed as part of the HICD gap analysis, felt unprepared for the change. Both undergraduate and graduate students felt that their coursework was lacking perspective on innovation, interdisciplinarity, the social component of animal and veterinary sciences, and practical application. This was partially crosschecked with interviewed lecturers who desired capacity building in social science research methods and teaching courses or collaborating for research across disciplines.

In summary, graduate students and lecturers would like to see courses or coursework integration on:

- Interdisciplinary research and social science methods
- One Health
- Community development and facilitation
- Publishing in peer-reviewed journals

Institutional Relationships

Overall, it was perceived that relationships between the university and non-university institutions are weak. This is particularly relevant in terms of research and extension linkages and community outreach. In principle, RAB could be bridging this gap and making use of the existing MOU between with RAB to facilitate collaboration. Professional organizations expressed the same desire and suggested MINAGRI to mandate the university to work with industry and disseminate research outcomes to industry, which eventually would lead to switching from "shelf" research to industry-responsive research and outcomes.

Enabling Environment

Laboratory Infrastructure

As discussed above, laboratory infrastructure at the UR/CAVM level is lacking, including equipment, supplies and consumables. These issues limit the university's ability to conduct quality research and causes significant issues with international funders and partners due to delays in the ability of researchers to meet deadlines. In many instances, this also results in graduate students finishing their programs without practical laboratory skills, which further exacerbates the situation if these graduates return to work for the university. The university administrators, faculty, and students appealed to the Ministry of Education to allocate more funds to equip labs with modern equipment and appropriate facilities that would bring university research and practical training of students on par with international standards.

Technological Infrastructure

In addition to issues with laboratory infrastructure, students from different campuses stated a lack of technological services such as access to a digital library, e-journals, and analytical software. They also reported that the internet connectivity is intermittent and library computers have no connection to the internet.

Poor internet connectivity and lack of technological infrastructure was also acute for the lecturers' ability to explore or participate in distant learning opportunities. Investments in this area are needed to equip UR/CAVM with various technologies that would facilitate student-lecturer and student-student communication. This will also help lecturers to save time from not having to commute between campuses and utilize their time to better serve students or explore opportunities to connect classrooms to the global learning environment.

Gender Constraints

The main challenge female students face is their normative duties to take care of children and maintain the household. Many students (both male and female) marry early. These students have to arrange their time in a way to allow them to participate in classes and extracurricular activities. Female students are often unable to participate in opportunities to engage with faculty outside of scheduled class time, which makes them feel less connected with faculty to engage in discussions and receive mentoring attention.

Many highly qualified female lecturers occupy top administrative positions within the university system. The female students would like to see more opportunities for them to share their experiences, speak about work-life balances and how they overcome family challenges to pursue careers in research, and how they can serve as role models for young female students.

RAB

Human and Organizational

Grant Writing and Management

Challenges in writing and winning grants are common across UR/CAVM and RAB. The issue with grant writing reaches beyond the lack of adequate skills to write competitive grants. Respondents also point out that to win grants it is necessary to have previously established relationships with international partners in order for the grant writing team to be fast and efficient enough to respond to complex grant solicitations. Forming these relationships is challenging. Another challenge is that due to the heavy administrative load of RAB technical personnel, they are often unable to purposively search for grants to apply for or dedicate adequate time to write grants as this conflicts with their highly demanding responsibilities within RAB and the need to respond to ad hoc calls from MINAGRI to attend an urgent meeting. Instead, RAB relies on other partners to bring potential grants and grant developing skills to their attention. This results in being slow to react to grant solicitations when they are announced and missed opportunities.

The institutional support for grant writing is very limited. There are no administrative personnel responsible for providing feedback on the grant proposals or assisting with more complex aspects of grant writing and developing budgets. Proposals are submitted to the potential donor, often without adequate oversight or review at RAB's administrative level.

Another issue is managing awarded grants. RAB's positionality within MINAGRI makes its management and accounting system rigid and they must follow the government setup. Grant funds require integration into the government budget through the Ministry of Finance requiring RAB to wait until financial resources from donors become available from that Ministry. This type of financing deters donors because they can potentially lose track of finances that merge into the government budget and it causes significant delays in project implementation. RAB has a special project unit that manages large donor projects (e.g., from World Bank). At the time of study, it was difficult to determine if this unit had the capacity to manage donor funds and how smaller-budget projects entered the system without merging financial resources with government funds. This requires further exploration.

Recommendations from the Livestock Systems Innovation Lab's HICD Team

The campuses of UR/CAVM are geographically dispersed across Rwanda, which makes leveraging HICD efforts a challenge. Training efforts will require decisions about a) choosing a central location and inviting participants from each University campus to attend, which will have cost implications in terms of per diems, travel expenses, and hotel costs; b) holding training activities at each individual University campus, which will make finding trainers a challenge due to the greater time commitment; or c) prioritizing one or two main University campuses in which HICD efforts can have the most leverage. Due to the positionality of the two key departments within UR/CAVM that deal directly with the animal production and veterinary medicine within Nyagatare campus, the HICD team proposes to maximize efforts in Nyagatare in order to bring livestock-related critical skills development to the larger academic and student body there. Faculty and students from other UR/CAVM campuses could be invited. This plan would maximize the use of scarce resources and may enable the provision of support for travel from other campuses to Nyagatare.[6] The recommendations below are the priorities that a) have been identified by the participants, b) align with the Livestock Systems Innovation Lab and USAID priorities, and c) will allow the HICD team to leverage its funds to the maximum potential.

Human

Short-Term Training

Technological and practical skills gaps were identified across all of the stakeholders. There are several areas in which short-term training can assist in filling the capacity gaps. Where possible, short-term training should involve a Training of Trainers component. Training should also be focused on UR/CAVM faculty and RAB professional researchers and technical staff at research stations with graduate students as a secondary audience. This will help to build the capacity of existing and long-term researchers who will pass their improved skills to the larger body of students and smallholder farmers (for extension staff of RAB). The HICD team also recommends that, where possible, short-term training should include at least one follow-up training rather than a "one-and-done" training model. The following areas are suggested as priorities for training initiatives as these gap areas are consistent across Livestock Systems Innovation Lab target countries, allowing the Lab to leverage training that has been developed for one country to be adapted for others.

- The "research package" including design, participatory methodology, analysis, and interpretation with greater focus on qualitative research methods,
- Quantitative methods with focus on various statistical packages, including Biostatics with R, and modelling,
- Laboratory skills (modern methods and technologies; interpretation of results, lab management),
- Teaching pedagogy and practices,
- Facilitation skills for community engagement,
- Publications in international journals,
- Grant writing, especially for international funding opportunities.

In addition to these areas of focus, there are multiple technical skill areas that have been requested for training initiatives. The HICD team recommends leveraging the activities and presence of Lab's subawardees in the country for conducting such trainings. This may include trainings in the following areas:

- Livestock production and management systems,

[6] Another alternative is to record trainings and offer them with training materials for interested participants from other UR/CAVM campuses. The HICD team is currently working on digitizing the training content to offer online courses on critical skills on a continuous basis to the Livestock Systems Innovation Lab's stakeholders.

- Animal health and nutrition,
- Veterinary epidemiology,
- Animal genetics,
- Market systems and value chains,
- ASF nutrition and food safety,
- Gender training (mainstreaming gender in learning environment and research).[7]

Community Development Training

There is a need for training in community development to effectively build trust with and engage communities with researchers, academics, and students. Some of the skills that have been outlined as training needs include:

- Theories of community development,
- Working with communities to build trust,
- Participatory methodology,
- Communications skills,
- Power and gender dynamics.

The HICD team is working on community development curricula in response to demand for this training from other Livestock Systems Innovation Lab's target countries. The training can integrate most topics presented above and deliver either a one-week or two-week long training that will cover community development theories and provide hands-on communication and trust-building approaches to UR/CAVM and RAB researchers.

Organizational

Teaching and Pedagogy Training

In the past, UR/CAVM provided short-term training to faculty on teaching practices. However, the participants report that these opportunities are inconsistently applied. The students point out that there are some faculty who are innovative teachers who integrate active learning into their classroom. However, they feel that these teachers are not the norm and that many of the teachers are static in their teaching methods, relying on lecture and PowerPoint to convey mostly theoretical information. The lack of practical experience in the classroom as well as in the field is consistently an issue brought up by all levels of stakeholders. As such, there remains a need for teaching and pedagogical training. This training must be streamlined to become part of continued education for UR/CAVM faculty to ensure upgraded skills and effective methodologies for teaching. As such, the sustainability of teaching and pedagogical training should be considered prior to any initiatives. Along with short-term training, HICD team will explore in collaboration with UR/CAVM why their internal pedagogical trainings are intermittent and how the Livestock Systems Innovation Lab could support a plan to develop a more consistent and reliable program for training instructors.

Community-based and Private Sector-demand Driven Research

The lack of alignment of research priorities with the community and at times with private sector needs is another issue that was brought up by multiple stakeholders. The research being conducted at UR/CAMV and RAB is based on funding from MINAGRI, which prioritizes certain nationally important programs that may not necessarily align well with local community needs. However, UR/CAVM has more flexibility in choosing research programs to participate in or bring external funds that align with researchers' interests in certain areas, whereas RAB funding is driven by

[7] The topics in this list are broad and will require narrowing down to a particular theme within the area presented.

national priorities. As such, despite the best efforts of UR/CAVM faculty and RAB researchers to collaborate with communities and the private sector, there is a significant disconnect between end user needs and their research agenda. In addition, both UR/CAVM faculty and students conduct "shelf research," meaning that their results are rarely shared back with the communities, extensionists, private sector, and others. As a result, students feel the full brunt of distrust from communities and the private sector who regard students as lacking practical or applied skills that may be of use to end users. Moreover, some of the disconnect with communities is driven by inadequate inter-institutional coordination between RAB and UR/CAVM and the lack of integrating UR/CAVM in extension programs within RAB.

Despite these challenges, there is demand and need for community-based and private sector responsive research. The recommendation of the HICD team is to work with both UR/CAVM and RAB to develop an outreach strategy. This strategy can bridge the needs of the communities and private sector with the national research master plan. Another approach is to create opportunities for UR/CAVM's participation in RAB's extension programs. Given that UR's campuses are strategically located across the country, the UR lecturers can partner with RAB stations in those areas to participate in extension programs and share their research findings with community members. This would require a series of stakeholder platforms with local communities, private sector and RAB and University researchers, as well as a process of finding and/or developing synergies between the local needs and what can be funded through national research mechanisms. Such efforts could also include a strong grant development component in order to bolster the capacity of researchers to secure external funding. This should be focused on community-based and private sector responsive research initiatives, resulting in more flexibility in involving students.

Integration of Multi-campus Environment Through Digital Platform Strategy

The geographic spread of UR/CAVM campuses across the country represents a real challenge to faculty and students to explore multidisciplinary collaboration for teaching and research. This also represents a challenge to university administrators to channel scarce resources to make UR/CAVM campuses adequately equipped and resourced (e.g., absence of labs, and some campus labs lack standard lab materials and supplies). Time spent for travel between campuses is an opportunity loss for faculty. Some academic programs have not been established in some campuses, putting both faculty and students at a disadvantage. Despite these challenges, UR/CAVM faculty is keen to take advantage of campus disbursement across the country, which allows them to serve larger areas and communities. UR/CAVM is keen to consider a digital campus approach to integrate campuses through a digital platform (like e-learning or distance learning) to allow faculty to teach courses from locations where they are. Faculty are also interested in the potential for students to attend "global' classrooms. The HICD team can help UR/CAVM develop such a strategy and explore funding opportunities from international donors to develop such infrastructure. UF/IFAS has extensive experience bringing faculty, students and researchers from various research and education centers together through digitized platforms and will be willing to share experience how to set such infrastructure as well as embrace new teaching, learning and collaboration models.

Enabling Environment

National Policy

RAB and UR/CAVM are interested in strengthening the cross-institutional collaboration to jointly set research priorities or apply for funding. One initiative of this kind was facilitated by the Livestock Systems Innovation Lab under the Alliance grant funding mechanism, which facilitated close collaboration between RAB researchers, UR/CAVM faculty and researchers from one of the CGIAR centers, ILRI. The Alliance project has recently started to measure the outcomes of this collaboration and lessons learned, and there are considerable potential benefits in promoting such collaborations through national policy support. First, it allows the leveraging of resources (human,

social, physical) in more efficient ways. Second, it allows cross-fertilization of ideas and experiences. Third, it brings both research and academic communities together resulting in more opportunities for student involvement, especially at RAB or ILRI. Finally, it opens opportunities to strengthen cooperation with key international research networks (as in the case of CGIAR). Bringing MINAGRI on-board to support such initiatives through an adequate policy framework with adequate funding will be critical, since this has been already stipulated in the National Agricultural Policy for Rwanda (MINAGRI, 2017). The HICD and Enabling Policy teams can facilitate such conversations during the Livestock Systems Innovation Lab's Innovation Platform meetings.

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Appendices

Appendix 1: About UR/CAVM

The University of Rwanda (UR) was established by the Government of Rwanda by merging seven public Higher Learning Institutions into a consolidated entity governed by the Board of Governors and an Academic Senate that has also staff and student representation. The Vice Chancellor, who is the University's chief executive officer, leads 14 campus institutions with three deputy vice chancellors and six college principles.

UR consists of the following academic colleges:

- College of Arts and Social Sciences
- Colleges of Agriculture, Animal Sciences and Veterinary Medicine (CAVM)
- College of Business and Economics
- College of Education
- College of Medicine and Health Sciences
- College of Science and Technology

UR is Rwanda's largest higher education institution with a single college – CAVM – that brings together all agriculture and livestock sector-related fields under one umbrella. CAVM was established in 2014. It has four schools:

- School of Agricultural Engineering
- School of Agriculture and Food Sciences
- School of Animal Sciences and Veterinary Medicine (SASVM)
- School of Forestry and Biodiversity and Biological Sciences

SASVM is the only public school in Rwanda that trains animal scientists and veterinarians. The School is divided into the Veterinary Medicine Department and Animal Production Department. The Bachelor of Science (BSc) degree is offered in Veterinary Medicine, Animal Production, and Biodiversity: Zoology and Conservation. The Master of Science (MSc) degree is offered in Animal Production. Currently, there are no livestock-related PhD programs within SASVM. Most PhD seeking students go abroad (e.g., China, Sweden, Uganda, USA, etc.) for post-graduate studies.

The SASVM departments are geographically disbursed between different campuses:

- Nyagatare campus (Eastern Province) offers Agricultural Engineering, Veterinary Medicine, Animal Production and Business and Economics BSs and MSs degrees.
- Busogo campus (Northern Province) offers BSs and MSs degrees in Agricultural Economics, Agribusiness and Rural Development, as well as in Food Sciences. This campus is also the headquarters of CAVM.
- Huye campus (Southern Province) houses Aquatic Sciences and Fisheries Department.

According to Tailor, Aimable and Beintema's study (2018), in 2016 CAVM had about 4215 students of whom 3197 were undergraduate students and 1018 graduate students. Figure 3 shows that male students greatly outnumber female students with more female students pursuing BSc than MSc degrees. In 2016, CAVM employed about 160 teaching staff of whom 23% were holders of PhD, 66% of MSc degree and 11% of BSc degree. Furthermore, the distribution of teaching staff in 2016 greatly varied with assistant lecturers being the dominant group (46%) followed by lecturers (22%), teaching assistants (10%), senior lecturers (8%), deans and program heads (7%), associate professors (4%) and professors (3%). When it comes to the makeup of teaching staff by discipline, the livestock-related disciplines are outnumbered by crop-related disciplines. According to Flaherty, Bientema and Gatete (2018), 57% of Rwanda's overall researchers are focused on crops, whereas only 18% are involved in livestock research. Figure 4 illustrates that in 2016, there was one PhD trained teaching staff in animal breeding/genetics, followed by 13 MSc and 3 PhD trained staff in animal husbandry, 11 MSc and 3 PhDs in veterinary medicine, 1 PhD in Zoology/entomology, and 20 MSc and 9 PhDs in food sciences and nutrition (Tailor et al. 2018).

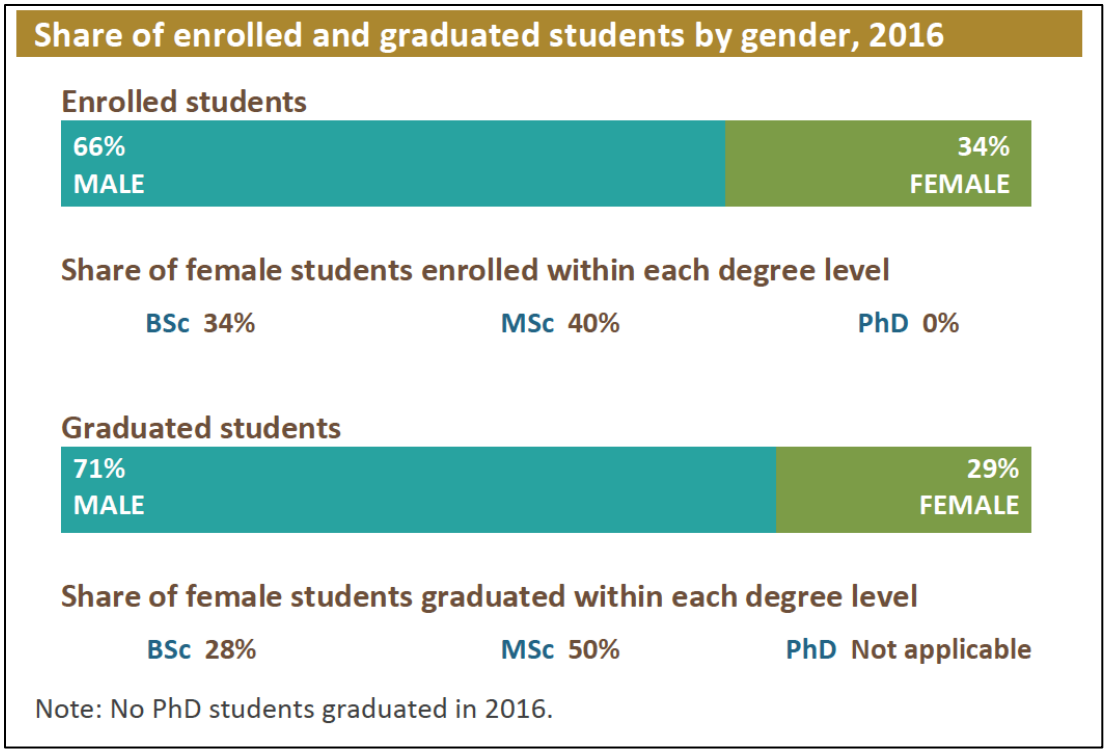

Figure 3: Graduate student composition (Source: Tailor et al. 2018)

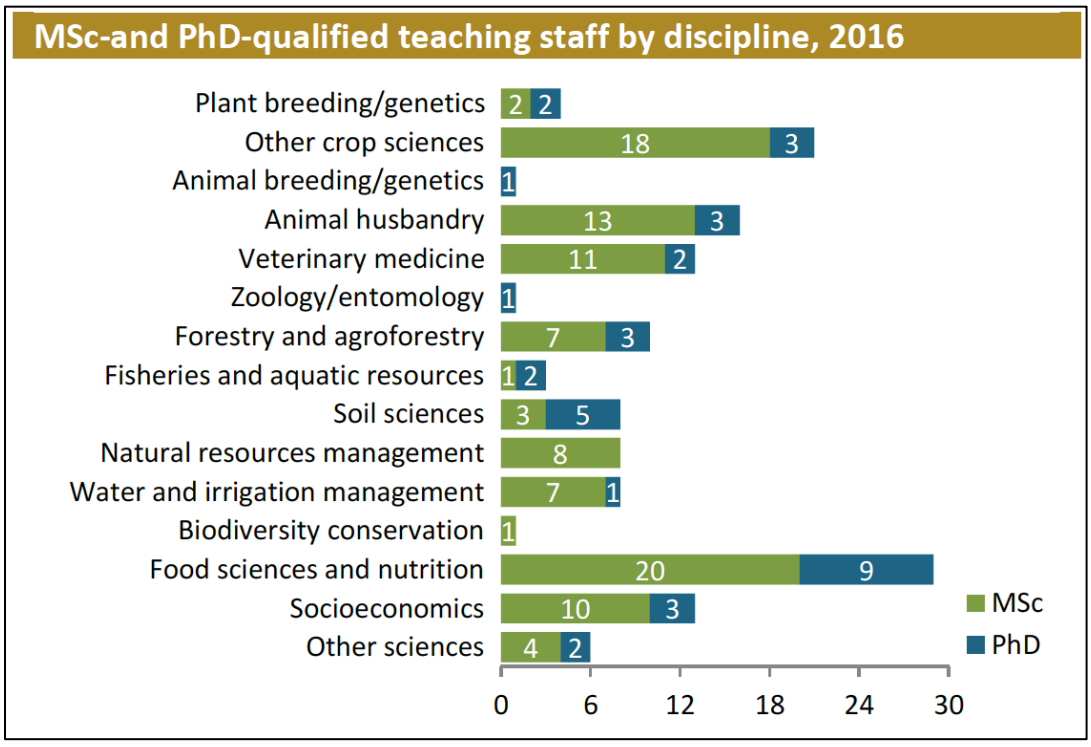

Figure 4: Teaching staff's credentials breakdown by discipline (Source: Tailor et al. 2018)

Figure 5 shows that CAVM's academic environment is dominated by men, whereas some key departmental and college level positions are occupied by women. At the time of the HCID Gap Analysis, the Principal of CAVM was a woman.

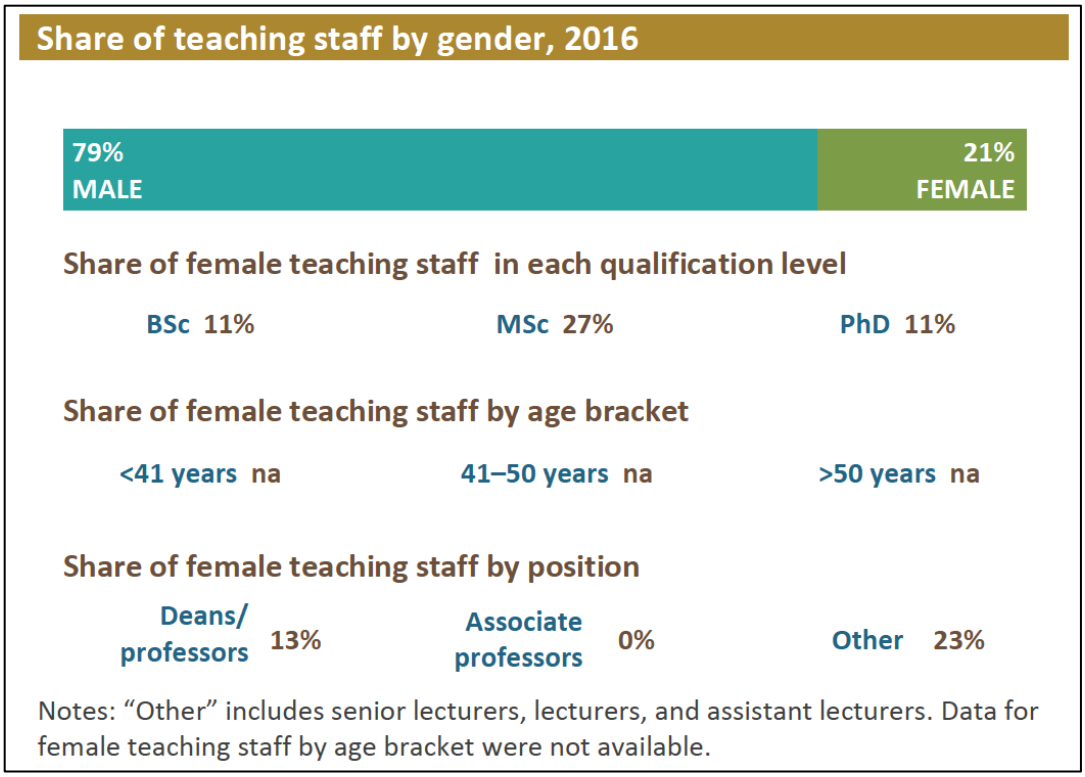

Figure 5: Academic staff composition (Source: Tailor et al. 2018)

Appendix 2: About RAB

Rwanda Agriculture and Animal Resources Development Board (RAB) is an autonomous body established by LAW N14/2017 of 14/04/2017. RAB's general mission is to champion the agriculture sector development into a knowledge-based, technology driven and market-oriented industry that uses modern technology in crop and animal production, fisheries, and forestry as well as stewards sustainable use of soil and water resources in producing and processing food, fiber and fuel wood.

RAB was formed from merging three agriculture agencies: the Rwanda Animal Resources Development Authority (RARDA), the Rwanda Agricultural Development Authority (RADA) and the Rwanda Agriculture Research Institute (French acronym: ISAR). The merger and current reforms within RAB are designed to remove the historical legacy, which led to disconnect between research and extension as well as research and education. RAB strives to bring research and extension under one umbrella, highlight the importance of collaboration with AET institutions, strengthen linkages with policy-making, and establish effective customer-focused service delivery systems through institutional integrations in the agricultural sector.

RAB is comprised of Animal Resources Research and Technology Transfer Department, which coordinates animal-resources related policies and strategies, and Agriculture Research and Technology Transfer Department, which coordinates agriculture-related policies and strategies (see next page for organizational chart). The first department was integral in the Livestock Systems Innovation Lab HICD gap analysis in providing input and valuable feedback on strengthening HICD efforts in the livestock sector.

RAB also has a single project implementation unit (SPIU), which is responsible for coordinating large donor interventions in Rwanda. The current projects within SPIU are: Climate Resilience Post-harvest and Agribusiness Support Project, Rwanda Dairy Development Project, Land Husbandry, Water Harvesting and Hillside Irrigation Project, The Third Rural Sector Support Project, and the Rural Community Support Project.

RAB has 13 research and extension stations operating across the country: Rubirizi in Kigali; Ngoma and Nyagatare in Eastern Province; Muhanga, Nyamagabe, Rubona and Songa in Southern Province; Musanze and Rwerere in Northern Province; Gakuta, Gishwati, Ntendezi and Tamira in Western Province.

According to Flaherty et al. (2018), RAB has become slightly better positioned in terms of its human capacity. In 2016, it had more technical personnel with PhD degrees than UR/CAVM (101 vs. 37, respectively), while less personnel with MSc degrees than UR/CAVM (99 vs. 106, respectively). This is partly driven by changes to how RAB classifies research personnel. Since 2014, RAB has been classifying MSc degrees as the minimum requirement to quality as a researcher, while those with BSc degrees were reclassified as research technicians (Flaherty et al., 2018). The share of female researchers is slightly over 20%, but during interviews it was impossible to determine how many of RAB's technical and management personnel were females as well as the share of female researchers with PhD and MSc degrees.

As in the case of UR/CAVM, more than 50% of RAB researchers are involved in crop and land management-related research, while about 18% of researchers are involved in livestock-related research (Flaherty et al. 2018). This is also illustrated in RAB's organizational chart in Figure 6. There are more than 107 personnel involved in the Crop Research and Technology Transfer Department vs. 91 in the Animal Resources Research and Technology Transfer Department and associated divisions.

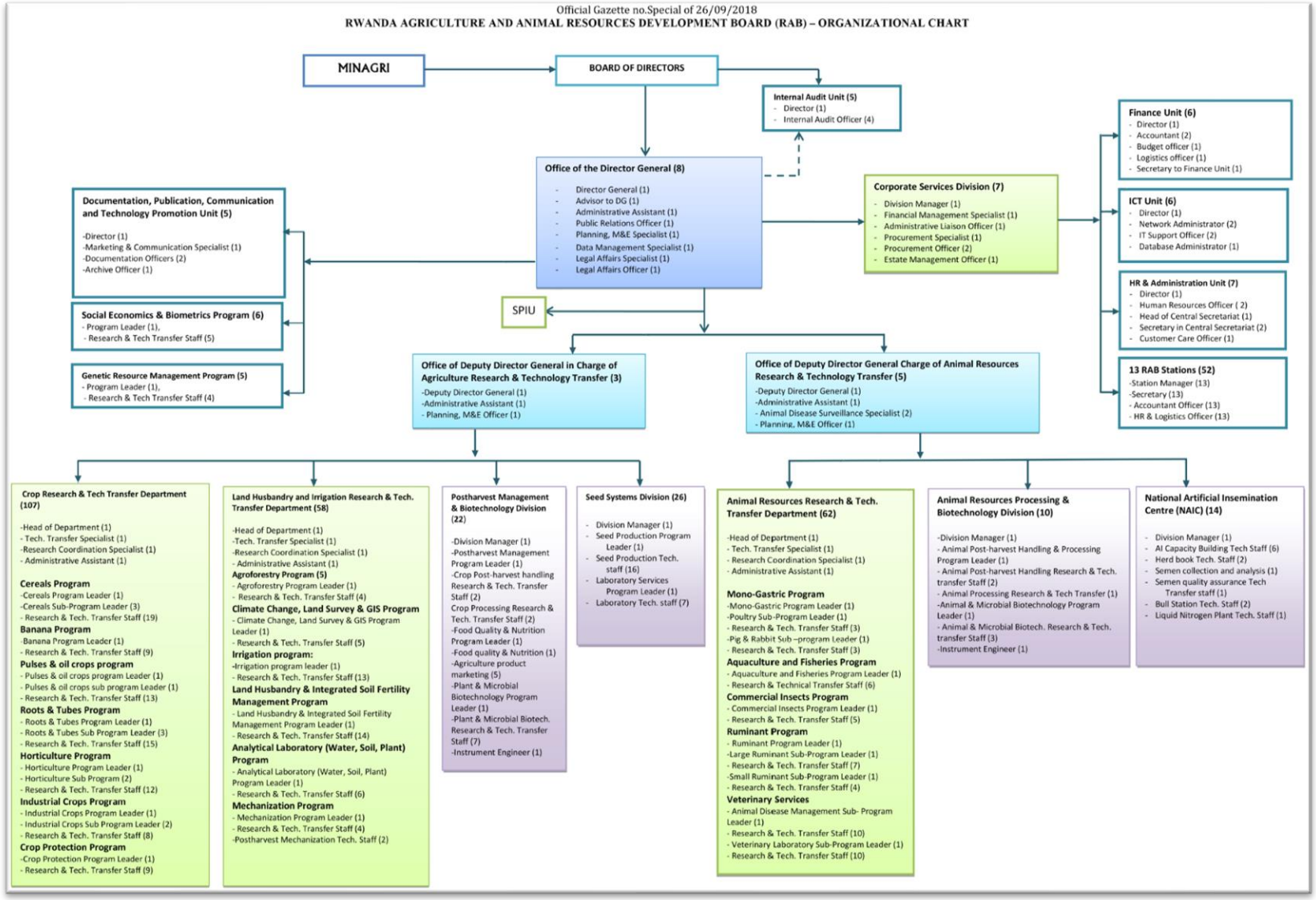

Figure 6: Organizational Chart of RAB

Appendix 3: Photos from the HICD Gap Analysis Workshop, April 2019

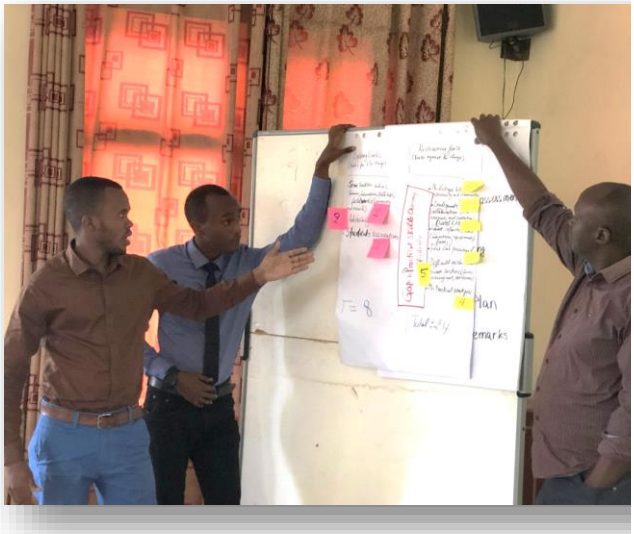

Photo credits: Ludgate, April 2019

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