RESEARCH PROGRAM ON Livestock

CGIAR

More meat, milk and eggs by and for the poor

CGIAR Research Program on Livestock Agri-Food Systems

2020 Plan of Work and Budget (POWB)

Lead CGIAR Centre: International Livestock Research Institute (ILRI)

Flagship Lead Institutions:

- **Flagship 1–Livestock Genetics:** ILRI
- **Flagship 2–Livestock Health:** Swedish University for Agricultural Sciences (SLU)
- **Flagship 3–Livestock Feeds & Forages:** International Center for Tropical Agriculture (CIAT)
- **Flagship 4–Livestock & the Environment:** ILRI
- **Flagship 5–Livestock Livelihoods and Agri-Food Systems:** ILRI

Other participating CGIAR Centres: International Center for Agricultural Research in the Dry Areas (ICARDA)

Other partners: German Development Agency (GIZ)

31 January 2020

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

ICARDA Science for resilient livelihoods in dry areas

CIAT International Center for Tropical Agriculture Since 1967 Science to cultivate change

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

SLU

CGIAR is a global partnership that unites organizations engaged in research for a food-secure future. The CGIAR Research Program on Livestock provides research-based solutions to help smallholder farmers, pastoralists and agro-pastoralists transition to sustainable, resilient livelihoods and to productive enterprises that will help feed future generations. It aims to increase the productivity of livestock agri-food systems in sustainable ways, making meat, milk and eggs more available and affordable across the developing world. The Program brings together five core partners: the International Livestock Research Institute (ILRI) with a mandate on livestock; the International Center for Tropical Agriculture (CIAT), which works on forages; the International Center for Research in the Dry Areas (ICARDA), which works on small ruminants and dryland systems; the Swedish University of Agricultural Sciences (SLU) with expertise particularly in animal health and genetics and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) which connects research into development and innovation and scaling processes.

The Program thanks all donors and organizations who globally supported its work through their contributions to the **CGIAR system**

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1. Adjustments/ Changes to Your Theories of Change (ToC), if relevant

There are no major changes to the overall Theory of Change for the CRP Livestock. However, Flagships have been working to develop individual Theories of Change to guide work carried out for each of their main product lines/areas of research. Minor changes at Flagship level include:

- **FP1 Livestock Genetics** developed detailed theories of change for each of the main livestock breeding programs: dairy cattle in Tanzania and Ethiopia; small ruminants in Tanzania and Ethiopia; chicken in Ethiopia, Tanzania and Nigeria. This has been important in defining flagship activities for 2020.
- In **FP2 Livestock Health**, an emphasis emerged on understanding current use of antimicrobials to design effective interventions, rather than establishing monitoring systems.
- **FP3 Feeds and Forages** reduced the number of product lines from 15 to seven, allowing for greater focus.
- In **FP4 Livestock and the Environment**, new focus is given to the soil health benefits of forage intensification and rangeland management and the global positioning of the research, including documenting engagement with key agendas: Global Landscape Forum, Intergovernmental Panel on Climate Change, Global Research Alliance for Greenhouse Gases.

Under **FP5 Livestock, Livelihoods and Agri-Food Systems**, priority country projects in Ethiopia, Tanzania, Uganda and Vietnam have drafted Theories of Change for their target value chains. Work is ongoing with support from the Netherlands Royal Tropical Institute (KIT) to develop a methodology for measuring progress against these over the remaining two years of the CRP.

2. Plans and Expected Progress Towards Outcomes

FP1 Livestock Genetics: This year the flagship will achieve seven new milestones against four of its outcomes, in addition to one milestone extended from 2019.

Towards outcome 1.1 “data on livestock diversity and systems”, genomic regions associated with tolerance to *Theileria parva* infection in cattle will be identified (milestone 1.1.8). *Theileria parva* is the causative organism of East Coast fever (ECF), a serious constraint on increased livestock productivity in Africa, therefore a genomic tool to select against this would be a valuable public good and would strengthen the flagship's ongoing dairy cattle breeding programs in East Africa. Genomic characterization of small ruminant populations in Ethiopia, Sudan and Tanzania will also be completed (1.1.6), a key step in developing genomic tools for selection for economically important traits in sheep and goats.

Towards outcome 1.2 “genetic improvement strategies”, breeding strategies will be established for pastoral production systems in Ethiopia and Sudan (1.2.5), building on the highly successful community-based breeding program model already developed for small ruminants in mixed crop-livestock systems. Performance and pedigree data collection, breeding value estimation for identified traits, and selection and communal use of best sires will be an integral part of this. Additionally, work on designing a national genetic improvement strategy for pigs in Uganda will be completed (1.2.7), which will form the basis for future flagship work on pig genetic improvement.

Towards outcome 1.3 “multiplication and delivery systems for improved genetics”, which includes work using advanced reproductive technologies, the flagship will recover its first indigenous chicken ecotype from cryopreserved primordial germ-cells (1.3.5), providing proof of concept of its novel bio-banking

technology designed to facilitate conservation of indigenous chicken breeds. It will also have its first transgenic trypanosomiasis-resistant calf born (1.3.6), a critical step for a technology that could allow cattle to thrive in Africa where trypanosomiasis represents a major constraint.

Towards outcome 1.4 "livestock keepers sustainably using improved livestock genetics", community-based breeding programs will be upscaled in four regions of Ethiopia (Amhara, Oromia, South and Tigray), focusing on three to four sheep and goat populations in each region and involving more than 10,000 households (1.4.2). Finally, the flagship will focus on securing resources to support development of "guidelines on policy and institutional arrangements for animal genetic resource use" [outcome 1.5].

FP2 Livestock Health: In 2020, the flagship aims to achieve 11 milestones toward its outcomes and to consolidate and conclude the work by 2021. In Kenya, Uganda, Tanzania, Ethiopia, Senegal, Mali and Burkina Faso, tools will be harmonized for data collection to assess the gendered impact of *peste des petits ruminants* (PPR). Also, data for developing risk models and maps will be generated to inform design of PPR control programs in high risk areas with significant cross-border movements (milestone 2.1.8) and for other diseases (2.1.2). Through strengthened collaboration between ILRI, ICARDA and the Tunisian veterinary school, important data gaps on changes in tick distribution in North and East Africa will be addressed and maps produced to improve targeting control of tick-borne diseases (2.1.9).

In 2018/19, a novel herd health package for smallholder pig farms in Uganda identified severe short-comings in health management and over-estimation of occurrence of African swine fever (ASF). Ugandan veterinarians will be trained in this modality and a revised package will be rolled out with health and production gains evaluated (2.2.5). Fully integrated herd health intervention packages will also be rolled out with research partners in Ethiopia. Capacity development using recently tested community conversations, will allow full integration of these tools into local extension systems (2.2.6). Responding to recent and immense interest to address antimicrobial resistance (AMR), this flagship will contribute to improved antimicrobial use by designing and piloting trainings on the responsible use of antibiotics for veterinarians in Uganda and Vietnam (2.3.2), and also interact closely with the newly established AMR CGIAR hub.

A novel challenge method for contagious bovine pleuropneumonia will be tested using a nebuliser to create a much improved and standardized challenge model for vaccine research (2.4.3). For the production of recombinant viral vectors expressing ASF virus antigens, screening of immune responses in European and Kenyan pigs was carried out in 2019. Selected genes from this effort will now be inserted in selected virus vectors for subsequent testing in pigs (2.4.10). Also, 30 live ASF viruses with gene deletions will be produced and tested for attenuation in pigs and at least two viruses will be tested for protection (challenge) in pigs (2.4.11). In East Coast fever research, an *in vitro* sporozoite neutralization assay will be converted into a quantitative, rapid standardized assay, to enable prioritizing vaccine potential of antibody responses to novel sporozoite antigens and different antigen delivery systems (2.4.12).

Finally, the flagship will provide guidance to define and implement viable animal health service delivery models in Ethiopia, Mali, Kenya and Uganda and put in place systems to monitor their impact. This will be done together with public-private partnerships to facilitate integration of the models in their programs and ensure gender concerns are fully integrated (2.5.3).

FP3 Feeds and Forages: In 2020, the flagship will focus on achieving 12 new milestones, plus two milestones extended from 2019. For the outcome on improving ability to assess feed availability and optimize feed utilization [outcome 3.1], on-farm, regional and national feed assessments, particularly the gendered Feed Assessment Tool (G-FEAST), will be applied in East Africa and Southeast Asia (milestone 3.1.13). Two new online tools to enhance access to knowledge on forages will be launched: an improved multi-lingual and mobile-friendly version of the Selection of Forages for the Tropics (SoFT) tool and the Animal Feed Analysis Web Application (AFAWA) tool (3.1.14).

Outcome 3.2 targets provision and uptake of improved forage and rangeland resources. With private forage seed actors, CIAT will scale out new *Urochloa* forage hybrids on an additional 100,000 hectares in the global tropics (Latin America, East Africa and Southeast Asia) and provide technical expertise in commercialization (3.3.10). Breeding of new *Urochloa* and *Megathyrsus* hybrids will be advanced while Napier grass agronomic evaluations and *Lablab purpureus/Sesbania sesban* genotyping will be published to complement options for specific production niches in East Africa. ICARDA, through their multi-trait breeding program, will identify 10-15 dual purpose barley genotypes with higher green forage at cutting and transfer them to NARS for release (Morocco), test 8-10 barley genotypes for sheep grazing (Ethiopia), and share barley populations for further evaluation (India) (3.3.11). Results of dual-purpose sorghum and rice work will be shared with NARS (India) and lentil cultivars evaluated for food-feed traits (Ethiopia) (3.4.5).

On the outcome promoting full purpose crops [3.5], total mixed ration options for intensifying small ruminant fattening and a business model for road side grasses will be tested in India (3.5.7). A feed certification system for Uganda will be piloted and a new least-cost diet designed and tested with private sector partners and regulatory organs in Ethiopia (3.5.6). New extension materials for best agronomic practices for cactus/shrub establishment and maintenance will promote better management of rangelands (India, Tunisia), 5-10 elite accession of Mediterranean forages will be tested for sheep grazing (Tunisia), trainings on hay and silage making conducted in Morocco, and a field day held on sulla feeding in Lebanon (3.6.4).

The final outcome [3.8] enables scaling of feeds and forages with partners through development and testing of feed and forage business plans (Kenya, Ethiopia, Uganda, Tunisia and Colombia) (3.8.16). New extension materials will be produced (East Africa) and recommendations provided on improving existing extension systems for feed and forage production, conservation and seed management (Latin America, East Africa and Tunisia) (3.8.15). Technical baselines for the Colombian Policy on Sustainable Bovine Livestock will be finalized and submitted to policy makers (3.8.17) and flagship results shared through multi-actor platforms in Latin America and East Africa (3.8.18).

FP4 Livestock and the Environment: In 2020, the flagship will achieve five new milestones, in addition to one milestone extended from 2019. As a contribution to helping national research and development partners incorporate the impacts of environmental change when setting research priorities [outcome 4.1], "adaptation suitability mapping" for forages will be rolled out in collaboration with FP3. The impact of the CLEANED (Comprehensive Livestock and Aquaculture Environmental Assessment for Improved Nutrition, a Secured Environment and Sustainable Development along Value Chains) ex-ante impact assessment tool–developed by Livestock CRP partners over five years ago, which allows users to understand how a given technological intervention may affect key environmental outcomes–will also be assessed in several countries in East Africa (4.1.4), contributing to outcome 4.2.

Towards the outcome on improved environmental management options [4.2], a compiled set of rangeland management tools used in Ethiopia, Tanzania, Tunisia, Jordan and Kenya will be disseminated through workshops and trainings (4.2.4). With CCAFS, experiments on reducing greenhouse gas (GHG) emissions intensities through feeding practices will continue to verify initial experimental findings in more than one system. Under the gender and youth related outcome, while there are no specific milestones, the Participatory Rangeland Management guidelines will be revised to include tools for greater gender responsiveness and inclusion. A youth inclusion approach will also be applied to the dairy value chain work in Tanzania to identify specific opportunities for including youth, building upon a first pilot of this approach under CCAFS in Kenya.

For outcome 4.5 on land governance frameworks, 2020 will see the uptake of rangeland governance and management tools in two countries (4.5.6). Contributing to programs and policies for climate resilience and mitigation, the feasibility of Index-based Livestock Insurance will be assessed in four new West African countries (4.6.3). Many researchers will present at the joint International Rangelands and Grasslands Congress in Kenya in October 2020, providing an opportunity to highlight the flagship work in a key global forum. A synthesis of practices to consider when developing measurement, reporting and verification of GHGs in Latin America will also be produced (4.6.4).

The flagship will implement the CLEANED ex-ante impact assessments in each of the four priority countries. Other activities include assessing the potential for improved grassland exclosure management in Ethiopia, exploring the potential for low emissions interventions in the dairy value chain in Tanzania, and considering the potential for improved pig manure management in Uganda.

FP5 Livestock Livelihoods and Agri-Food Systems: In 2020, progress will be made through six new milestones plus one milestone extended from 2019. To enable analysis-based decision making by research partners and policymakers [outcome 5.1], the team will support selected Comprehensive Africa Agriculture Development Programme (CAADP) countries selected by AU-IBAR (African Union InterAfrican Bureau for Animal Resources) to better articulate how livestock can be included in their plans (milestone 5.1.6). Preparation of livestock master plans (LMPs) will also be initiated in Gambia and Odisha (India). In the process, linkages to align CAADP and LMP prioritization criteria will be established (5.1.7).

Regarding improved livestock system modelling tools used by international researchers and agencies [outcome 5.2], improvements will be achieved in the LMP modeling approach by integrating a spatial multimarket model (5.2.2) and expanding the use of value chain models within the LMP modelling work (5.2.3) to provide more robust guidance on interventions. At the same time, the LMP modelling tool will be “genderized”, allowing future LMPs to identify gender differentiated effects of livestock intervention options, contributing to the outcome on gender equity in policy.

Work on strengthening nutrition-sensitive design of livestock interventions [outcome 5.5] is mainly focused in Kenya and Rwanda. In Kenya, collaboration with county governments and NGOs will support the use of tailored options for better nutritional impact through dairy development (5.5.4).

Finally, this flagship plays a key role in the priority country activities in Ethiopia, Tanzania, Uganda and Vietnam, integrating technical solutions from across the other flagships by establishing appropriate institutional value chain arrangements to enhance competitiveness and inclusiveness (5.7.3). System dynamic tools and the Rural Household Multi-Indicator Survey (RHoMIS) tool will be used to guide interventions.

3. Financial Plan for the coming year, including use of W1/2

The Livestock CRP total budget is $55.6m. W3/bilateral project funding contributes $34.2m (62% of the total), a 53% increase compared to 2019. The non-CGIAR core partner SLU has aligned deliverables from its bilateral project in Vietnam, "Curbing the emergence of antimicrobial resistance in a changing global livestock sector", to FP5, representing an in-kind contribution of approximately $100,000 (the total project budget is $300,000 over 3 years). W1/W2 funds account for $21.3m (38% of the total). Note that the W1/2 allocation in this POWB represents the anticipated 2020 allocation plus unallocated or unspent funding from the CRP Strategic Investment Fund from previous years.

W1/2 funding is important to all flagships. Each flagship is contributing approximately $100,000 per country to the priority country value chain projects in Ethiopia, Tanzania, Uganda and Vietnam. In FP1, W1/2 funding is being used to support several post-graduate students and 50% of a gender scientist to facilitate gender integration within the flagship. A number of major projects are also resourced by a combination of W1/2 funding and bilateral funding. In FP2, the modest increase in W1/2 funding foreseen for 2020 (6%) has mainly been allocated to the herd health (cluster 2) and delivery (cluster 4) activities, since these areas have a considerable number of outputs that are close to "impact".

In FP3, W1/2 funding is being used for activities including: training material development; breeding of tropical forage hybrids - *Urochloa humidicola, Urochloa brizantha, Megathyrsus maximus*; forage seed system analysis and development in Latin America, East Africa and Southeast Asia; development of dual purpose barley in Northern Africa and dual purpose sorghum and rice in India; genotyping of tropical forage species in East Africa; and technical baselines for the Colombian Policy on Sustainable Bovine Livestock. In FP4, W1/2 funding remains important for the work on ex-ante impact assessment of the environmental impact of production technologies, assessing the climate change impacts on heat stress and forages, and gender inclusion and transformation. It is also being used to fund a new line of work on soil health benefits of forage intensification and rangeland management.

In FP5, W1/2 funding is allocated firstly, to protect bilateral investments for which co-financing costs are required in order to ensure timely deliverables, and secondly, towards activities important to the cluster and flagship outcomes. These include, for example, finalising the social and behavioural change communication strategy for nutrition in Kenya, deepening the scaling up and gender assessments in Uganda and expanding the modelling for the local poultry value chain project. A call for 'mini ideas' matching the flagship theory of change and building on existing projects was done in October 2019 to give all flagship scientists the opportunity to get their research supported. Funds were allocated to modelling work, to adapt the Women's Empowerment in Livestock Index (WELI) to the service and marketing node of the livestock value chain, and to identify barriers and constraints for women farmers to participate in livestock production in Nicaragua.

TABLES

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestones	Indicate of the following	Means of verification	CGIAR Cross-Cutting Markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For M/H select the main risk from the list
						for gender	for youth	for CapDev	for CC		
F1	• {primary} Increased conservation and use of genetic resources • Closed yield gaps through improved agronomic and animal husbandry practices	F1 Outcome: Outcome 1.1: Data on livestock diversity and systems, including from a gendered lens, used to develop or refine genetic improvement and / or conservation strategies by policymakers, national research and development partners, and the private sector, in 5 CRP priority countries and other locations.	2020 - 1.1.6 Baseline genome characterization information of existing small ruminant populations including genome sequencing available for Ethiopia, Sudan, Tanzania	Identical to proposal	Scientific paper and other documents	0	0	1	1	Medium	1. Research/ science
			2020 - 1.1.8 Identification of genomic regions strongly associated with tolerance to *Theileria parva* infection in cattle	Reworded / rephrased from proposal	Reports and publications	0	0	0	0	Medium	1. Research/ science

F1	• {primary} Increased conservation and use of genetic resources • Closed yield gaps through improved agronomic and animal husbandry practices •Increased livelihood opportunities	F1 Outcome: Outcome 1.2 Genetic improvement strategies for improved livestock genetics implemented by national research and development partners, and the private sector in 6 CRP priority countries and other locations.	2020 - 1.2.5 Breeding strategies for pastoral production systems established in Ethiopia and Sudan	Identical to proposal	Scientific publication and report	1	1	1	1	Medium	1. Research/ science
			2020 - 1.2.7 National genetic improvement strategy for pigs in Uganda endorsed by stakeholders	New/ changed	Report of stakeholder consultation /meeting	0	0	0	0	Medium	3. Partnership
F1	• {primary} Technologies that reduce women`s labor and energy expenditure adopted •Adoption of CGIAR materials with enhanced genetic gains •Increased livelihood opportunities	F1 Outcome: Outcome 1.3 Business models for multiplication and delivery of improved livestock genetics, to resource poor women and men livestock keepers, implemented by national research and development partners, and the private sector in five CRP priority countries and other locations.	2020 - 1.3.5 First indigenous ecotype recovered from cryopreserved primordial germ-cells (PGC)	Reworded / rephrased from proposal	Scientific publication report	0	0	0	0	Medium	1. Research/ science
			2020 - 1.3.6 First transgenic trypanoresistant calf born at ILRI facility	Reworded / rephrased from proposal	Press releases and reports	0	0	0	0	High	1. Research/ science

F1	• {primary} Adoption of CGIAR materials with enhanced genetic gains • Increased livelihood opportunities • Technologies that reduce women`s labor and energy expenditure adopted	F1 Outcome: Outcome 1.4 Women and men resource poor livestock keepers sustainably utilizing improved livestock genetics, both productive and adapted, in 3 priority countries and other locations.	2020 - 1.4.2 Community-based breeding program upscaled in four regions of Ethiopia (Amhara, Oromia, South and Tigray) with more than 10,000 households participating	New/ changed	Reports of breeding program	1	1	0	0	Low	
F2	• {primary} Reduced livestock and fish disease risks associated with intensification and climate change	F2 Outcome: Outcome 2.1 Assessment tools for significance of animal diseases and risk maps for emergence of animal diseases are used by 100 local and national and 50 international research partners and donors to prioritise research and development interventions to reduce livestock disease risks for livestock keepers.	2020 - 2.1.2 The findings from the use of assessment tools for significance of animal diseases and risk maps for emergence of animal diseases are used by 75 national and 25 international research partners and major donors, in both priority countries and other locations, to prioritise research and development interventions	Identical to proposal	Records of interactions with partners	1	0	1	0	Medium	1. Research/ science

			2020 - 2.1.8 Harmonised data collection for gender sensitive modelling for *peste des petits ruminants* (PPR) control in high risk transboundary areas implemented in Kenya, Uganda, Tanzania, Ethiopia, Senegal, Mali and Burkina Faso	New/ changed	Activity reports from the field and preliminary reports on data collected	1	0	1	0	Medium	6. External environment (political, economic, legal, market)
			2020 - 2.1.9 Tick distribution in North and East Africa mapped	New/ changed	Maps produced	0	0	0	1	Medium	1. Research/ science
F2	• {primary} Closed yield gaps through improved agronomic and animal husbandry practices	F2 Outcome: Outcome 2.2 Context specific herd health management packages adopted by farmers, extension and animal health workers in priority countries and other locations.	2020 - 2.2.5 Herd health services in pigs used and evaluated in Uganda	Identical to proposal	Scientific publication and CG-space reports	1	0	1	0	Medium	1. Research/ science
			2020 - 2.2.6 Integrated herd health interventions in small ruminants in Ethiopia implemented	New/ changed	Implementation guidelines and activity reports availed	1	1	2	1	Medium	3. Partnership

F2	• {primary} Reduced biological and chemical hazards in the food system •Closed yield gaps through improved agronomic and animal husbandry practices	F2 Outcome: Outcome 2.3 Livestock keepers have necessary knowledge of anti-microbial resistance (AMR) and anti-parasitic resistance (APR) to change their practices accordingly, piloted in two priority countries (Uganda and Vietnam).	2020 - 2.3.2 Interventions towards more responsible use of antibiotics being implemented in 2 countries	Reworded / rephrased from proposal	Report from training of animal health personnel	1	0	2	0	Low	
F2 F2	• {primary} Closed yield gaps through improved agronomic and animal husbandry practices	F2 Outcome: Outcome 2.4 National and international research partners, government agencies and the private sector use 2 novel diagnostic assays and vaccines for control of ASF, CBPP, CCPP, ECF and PPR in at least 6 countries.	2020 - 2.4.3 A novel challenge method for contagious bovine pleuropneumonia (CBPP) tested at ILRI Nairobi	Reworded / rephrased from proposal	Presentation for data generated on a novel challenge model for CBPP	0	0	0	0	Medium	1. Research/ science
			2020 - 2.4.10 Production of recombinant viral vectors expressing 8 African swine fever virus (ASFV) antigens for testing in pigs	Reworded / rephrased from proposal	Data available on a set of 30 African swine fever virus (ASFV) gene modified strains as candidate vaccines	0	0	0	0	Low	

			2020 - 2.4.11 Several African swine fever virus (ASFV) vaccine candidates produced, with 30 tested for attenuation in pigs and at least 2 tested in protection experiments	Reworded / rephrased from proposal	Data available on assessment of attenuation of at least five novel gene modified strains of ASFV	0	0	0	0	Medium	1. Research/ science
			2020 - 2.4.12 Improved *in-vitro* assays systems to measure correlates for East Coast fever (ECF)	Reworded / rephrased from proposal	A blog on quantitative assay to measure antibody responses to the p67C antigen and optimization of the ECF sporozoite neutralization assay	0	0	0	0	Medium	1. Research/ science
F2	• {primary} Closed yield gaps through improved agronomic and animal husbandry practices	F2 Outcome: Outcome 2.5 Improved access to livestock-related health services and products for female and male livestock keepers in the 4	2020 - 2.5.3 Government, development and private sector actors use tested sustainable delivery models to provide products	Identical to proposal	Report guidelines on delivery models	1	1	1	0	Medium	3. Partnership

	• Technologies that reduce women`s labor and energy expenditure adopted	priority countries (Ethiopia, Tanzania, Uganda and Vietnam)	and services to livestock keepers in 4 priority countries								
F3	• {primary} Closed yield gaps through improved agronomic and animal husbandry practices • Technologies that reduce women`s labor and energy expenditure adopted	F3 Outcome: Outcome 3.1 - Local, national and international research and development partners, the private sector, decision-makers and livestock producers are able to diagnose feed constraints and opportunities and to effectively prioritize and target feed and forage interventions, resulting in: a 10% improvement in utilization of feeds and forages, a 20% increase in animal production using improved feed and forage technologies, a 10% accuracy increase for biomass and quality	2020 – 3.1.13 Feed Assessment Tool (FEAST) and Gendered Feed Assessment Tool (G-FEAST) are applied by non-CGIAR researchers in at least 1 priority country (Vietnam) and 2 other countries (Burkina Faso and Rwanda)	New/ changed	Reports on the application of FEAST and G-FEAST in the different countries	2	N/A	1	N/A	Medium	6. External environment (political, economic, legal, market)
			2020 – 3.1.14 2 Updated Selection of Forages for the Tropics (SoFT) and Animal Feed Analysis Web Application (AFAWA) tools being used by at least 100,000 users globally	New/ changed	Reports on user statistics for the tools mentioned	N/A	N/A	1	1	Low	

		estimation and at least 250,000 annual visitors to global databases, repositories, interactive tools and maps and the Tropical Grasslands/ *Forrajes Tropicales* journal website.									
F3	• {primary} Closed yield gaps through improved agronomic and animal husbandry practices • Technologies that reduce women`s labor and energy expenditure adopted	F3 Outcome: Outcome 3.3 – National and international research and development partners and the private sector are using CRP developed forage and rangeland resources (with enhanced traits), in 30 countries and reaching producers who plant over 2 million ha, to increase the rate of genetic gain and exploit the genetic diversity of forages and rangeland species to enhance stress-tolerance, biomass productivity and nutritive value.	2020 – 3.3.10 Already available forage hybrids scaled with private sector partner in at least 15 countries on 100,000 additional hectares (calculated based on seed sales). Total area of hybrids scaled will have reached 1,100,000 hectares	New/ changed	Private sector seed sales data that show sales and # of hectares sown per country	N/A	N/A	N/A	1	Medium	6. External environment (political, economic, legal, market)
			2020 – 3.3.11 10 Barley genotypes with higher biomass, higher grain yield, better tolerance to biotic and abiotic stresses validated by NARS partners in field stations in	New/ changed	Reports	N/A	N/A	1	N/ A	Medium	3. Partnership

			Morocco and Ethiopia.								
F3	• {primary} Closed yield gaps through improved agronomic and animal husbandry practices • Technologies that reduce women`s labor and energy expenditure adopted	F3 Outcome: Outcome 3.4 – New forage and crop cultivars, superior to local (based on food, feed and fodder traits weighted according to target domains), made available by development partners, government agencies and the private sector and applied by farmers in 7 priority counties and other locations.	2020 – 3.4.5 Identified dual-purpose crops (food and feed), superior to local feeds, are made available by development partners, government agencies and the private sector and applied by 150,000 farmers in at least one country and at least one new additional dual purpose cultivar will be released and 3 new promising cultivars tested in 3 new countries	New/ changed	Report	N/A	N/A	N/A	N/A	Medium	6. External environment (political, economic, legal, market)
F3	• Closed yield gaps through improved agronomic and animal husbandry practices • Technologies	F3 Outcome: Outcome 3.5 - National and international development partners, government agencies and extension services, the private	2020 - 3.5.6 Training and feed certification system piloted and monitored in Uganda and one least-cost diet designed and tested including	New/ changed	Reports	N/A	N/A	1	N/A	Medium	6. External environment (political, economic, legal, market)

	that reduce women`s labor and energy expenditure adopted • {primary} More efficient use of inputs	sector and community-based organisations in 3 priority countries are using CRP-related research outputs for better utilization of existing and novel feed and forage resources. This will be through (a) scalable processing technologies, (b) management strategies to conserve and rehabilitate rangelands and (c) diet formulation that increases productivity while reducing overall feed and forage costs and environment impacts.	aflatoxin binder inhibition effects with private sector and regulatory organs in Ethiopia								
			2020 - 3.5.7 Commercial least-cost diet for intensified small ruminant fattening in India developed and branded and one pilot treatment unit/plant established in India	New/ changed	Reports	N/A	N/A	N/A	N/A	Medium	6. External environment (political, economic, legal, market)
F3	• {primary} More efficient use of inputs • Technologies that reduce women`s labor and energy	F3 Outcome: Outcome 3.6 - Livestock producers in 3 priority countries: apply management strategies to conserve and rehabilitate rangelands and	2020 - 3.6.4 Agronomic practices for selected forage accessions developed and made available for Lebanon and Morocco	New/ changed	Reports	N/A	N/A	N/A	N/A	Medium	6. External environment (political, economic, legal, market)

	expenditure adopted	pastures while ensuring ongoing ability to produce, preserve and store feed biomass and use diets that increase productivity while reducing overall feed and forage costs and environmental impacts (with the environment and livelihoods flagships).									
F3	• {primary} More efficient use of inputs •Closed yield gaps through improved agronomic and animal husbandry practices • Technologies that reduce women`s labor and energy expenditure adopted	F3 Outcome: Outcome 3.8 - Increased delivery and uptake of feed and forage resources through proof-of-concept scaling, business model development and value-chain approaches by development partners, the private sector (feed and forage traders, feed processors) and (1 million by 2022) farmers across diverse environments in priority countries	2020 - 3.8.15 ICARDA, ILRI and CIAT in collaboration with national and international development partners and other value chain actors pilot test and evaluate at least four extension approaches using new media (e.g. apps, SMS, e-learning) in at least 1 priority country and 2 other countries	New/ changed	Reports	1	1	1	1	Medium	6. External environment (political, economic, legal, market)
					Reports	1	1	1	1	Medium	

		and other locations in Latin America, North and East Africa and South and Southeast Asia.	2020 - 3.8.16 At least 2 inclusive business models for forage seed production and conservation identified in Uganda, Kenya and Colombia, and 1 existing seed business model evaluated and 1 seed processing business model developed for Tunisia	New/ changed						6. External environment (political, economic, legal, market)
			2020 - 3.8.17 Technical basis for the Colombian Policy on Sustainable Bovine Livestock submitted to the policy makers in Colombia	New/ changed	Report	1	1	N/A	1	High	6. External environment (political, economic, legal, market)
			2020 - 3.8.18 At least 3 regional multi-stakeholder feeds and forages platforms established in Kenya and at least 10 regional livestock	New/ changed	Reports	N/A	N/A	1	1	Medium	6. External environment (political, economic, legal, market)

			roundtables functioning on their own in Colombia								
F4	• More productive and equitable management of natural resources •Land, water and forest degradation (Including deforestation) minimized and reversed • {primary} Increased resilience of agro-ecosystems and communities, especially those including smallholders	F4 Outcome: 4.1 Environmental concerns are considered in decision making across at least 10 priority countries and other locations, by national and international development partners, government agencies and extension systems, including technology developers seeking to improve cattle, small ruminant and pig production.	2020 - 4.1.4 Technology developers take environmental issues into account in research priority setting in 5 countries	Identical to proposal	Documenting use of tools by technology flagships in the form of case studies	0	0	1	2	Low	
F4	• {primary} Agricultural systems diversified and intensified in ways that	F4 Outcome: 4.2 Targeted solutions are used by research and development partners, across at least 10 priority	2020 - 4.2.4 Quantification of environmental impacts guides development/ selection of	Identical to proposal	Use of tools by partners/ stakeholders is documented in blogs and case studies,	1	0	2	1	Low	

	protect soils and water • Reduced net greenhouse gas emissions from agriculture, forests and other forms of land-use (Mitigation and adaptation achieved) •Land, water and forest degradation (Including deforestation) minimized and reversed	countries and other locations, to increase the productivity of cattle, small ruminants and pigs in the face of ongoing environmental changes.	productivity enhancing options in five countries		quantification of impacts is written up and shared						
F4	• Land, water and forest degradation (Including deforestation) minimized and reversed •Increased resilience of agro-ecosystems and communities, especially	F4 Outcome: 4.5 National government agencies across at least 5 priority countries design and implement key policies to improve the environmental management of livestock systems	2020 - 4.5.6 Tools, frameworks and processes for improved rangeland governance and management available in two countries	New/ changed	Document availability and use of tools	1	0	2	0	Low	

	those including smallholders • {primary} More productive and equitable management of natural resources										
	• {primary} Reduced net greenhouse gas emissions from agriculture, forests and other forms of land-use (More sustainably managed agro-ecosystems) •Increased resilience of agro-ecosystems and communities, especially those including smallholders	F4 Outcome: 4.6 Evidence generated by the flagship influences key global livestock agendas (IPCC, Global agenda for Sustainable Livestock)	2020 - 4.6.3 Feasibility of Index Based Livestock Insurance (IBLI) assessed in four countries	New/ changed	Feasibility study reports	0	0	1	1	Low	
			2020 - 4.6.4 Synthesis of practices to consider when developing measurement, reporting and verification (MRV) for livestock greenhouse gas emissions in Latin America	New/ changed	Synthesis report available	0	0	0	2	Low	

F5	• {primary} Conducive agricultural policy environment	F5 Outcome: 5.1 National and international research partners and policymakers use analyses of livestock-sector dynamics, investment and ex-ante impact assessments to guide priority setting, investment and policy development for the livestock sector in 5 priority countries and within the Livestock CRP	2020 - 5.1.6 National and international research partners use analyses of livestock sector dynamics, investment and ex-ante impact assessments to guide priority setting for the livestock sector in 2 priority countries	Identical to proposal	Reports from research partners	0	0	1	0	Low	
			2020 - 5.1.7 National partners and their donors participate in new Livestock Master Plan development in 2 priority countries, based on bilateral support	Identical to proposal	Livestock Master Plan documents for 2 new countries with national partners and donors included in the list of stakeholders involved in their preparation	1	0	1	0	Low	
F5	• {primary} Conducive agricultural policy environment	F5 Outcome: 5.2 International researchers and agencies use improved livestock	2020 - 5.2.2 Improved data protocols, impact indicators and new model structures	Identical to proposal	Publication available	0	0	1	0	Low	

		system modelling tools and apply them to new problems based on their mandate areas	developed and documented								
			2020 - 5.2.3 Livestock system modelling tools and databases improved with national and international partners to fit needs in 3 priority countries	Identical to proposal	Reports of work on tools with partners	0	0	1	0	Low	
F5	• {primary} Increased availability of diverse nutrient-rich foods	F5 Outcome: 5.5 Local and national development actors, government agencies, and the private sector invest in and adopt the most successful approaches for enhancing livestock-mediated nutritional impact, including institutional arrangements and behavioural change, in 3 priority countries.	2020 - 5.5.4 Local and national development actors and government agencies adopt tailored options for nutritional impact through livestock development, including cost-effective institutional arrangements and behavioural approaches, within communities in Kenya	Reworded / rephrased from proposal	Data from the Accelerated Value Chain Development bilateral project in Kenya	0	0	1	0	Medium	3. Partnership
F5	• {primary} Reduced market	F5 Outcome: 5.7 Development partners, private	2020 - 5.7.3 Development partners, private	Identical to proposal	Reports of priority	1	0	1	0	Medium	3. Partnership

	barriers •Increased livelihood opportunities	sector and government agencies across 4 priority countries apply innovative institutional arrangements to enhance competitiveness and inclusiveness	sector and government agencies in 2 priority countries apply innovative institutional arrangements to raise competitiveness and inclusiveness		country projects						

Table 2B: Planned Evaluations/Reviews, Impact Assessments and Learning Exercises

CRP	FP	Status	Planned studies/learning exercises in the coming year	Geographic scope	Who is commissioning this study
Livestock	F3	On Going	Report on forage adoption decision analysis with primary livestock producers in Colombia	National, Colombia	CIAT
Livestock	F3	On Going	Report on assessment of effectiveness of the Feed Assessment tool (FEAST) in Rwanda	National, Rwanda	ILRI
Livestock	F3	On Going	Student report on co-benefits and trade-offs of forages grasses in terms of forage productivity/quality, soil conservation impacts and crop productivity effects in Wolaita, Ethiopia	National, Ethiopia	CIAT
Livestock	F3	On Going	Report on drivers of adoption of irrigated fodder production practices in Ethiopia	National, Ethiopia	ILRI
Livestock	F3	On Going	A review report on forage adoption and use in Kenya and Uganda	Multi-national, Kenya, Uganda	ILRI
Livestock	F3	On Going	Report on 1 cost-benefit analysis on nitrogen-use-efficiency in different forages in Colombia	National, Colombia	CIAT
Livestock	F3	On Going	Report on 2 Cost-benefit analyses for improved forage technologies (*Avena altoandina, Arachis pintoi* CIAT 22260) in Colombia	National, Colombia	CIAT
Livestock	F3	On Going	Improved dissemination strategies leading to high adoption of new drought tolerant barley variety (Kounouz)	National, Tunisia	ICARDA

Table 2C: Planned major new collaborations (CGIAR internal, or with non-CGIAR collaborators)

Name of Platform/CRP or non-CGIAR collaborator	**Brief description of collaboration (give and take among CRPs/Platforms/non-CGIAR collaborator) and value added (e.g. scientific or efficiency benefits)**
CIRAD - *Centre de coopération internationale en recherche agronomique pour le développement*	Risk modelling and mapping for *peste des petits ruminants* (PPR) in West Africa as part of the Epidemiology and Control of *Peste des Petits Ruminants* in East and West Africa (ECO-PPR) project
CIRAD - *Centre de coopération internationale en recherche agronomique pour le développement*	Risk modelling and mapping for *peste des petits ruminants* (PPR) in West Africa as part of the Epidemiology and Control of *Peste des Petits Ruminants* in East and West Africa (ECO-PPR) project and in the Development of Smart Innovation through Research in Agriculture (DeSIRA) project in Zimbabwe starting this year to develop diagnostic tests for Department of Veterinary services
ClinGlobal Limited	Transformation of Animal Health Services and Solution in Low to Middle Income Countries (TAHSSL) platform partner; Contract Research Organization (CRO) readiness and data management expertise
FLI - Friedrich-Loeffler-Institut (FLI)	African swine fever (ASF) vaccine development; brings synthetic genomics, CRISPR (clustered regularly interspaced short palindromic repeats)-Cas technology, and WSL (wild boar lung) cell-line
GALVmed - Global Alliance for Livestock Veterinary Medicines	Transformation of Animal Health Services and Solution in Low to Middle Income Countries (TAHSSL) platform partner; product development expertise
ISRA - *Institut Senegalais de Recherche Agricole*	Field work for the Epidemiology and Control of *Peste des Petits Ruminants* in East and West Africa (ECO-PPR) project in Senegal
JCVI - J. Craig Venter Institute	African swine fever (ASF) vaccine development; brings synthetic genomics and CRISPR (clustered regularly interspaced short palindromic repeats)-Cas technology
MCI Santé Animale Ltd	Private sector partner in contagious caprine pleuropneumonia (CCPP) bacterin vaccine development
Makerere University	Capacity development in the Boosting Uganda's Investment in Livestock Development (BUILD) project
RVC - Royal Veterinary College	Epidemiological and network studies in the Epidemiology and Control of *Peste des Petits Ruminants* in East and West Africa (ECO-PPR) project, with joint appointment for scientist

UoN - University of Nairobi	Lab analysis of microbial under the Fleming Fund project
WSU - Washington State University	Partner in the Fleming Fund project on anti-microbial resistance (AMR)
ICRAF	Synergies of Animal Welfare and Agroforestry (SAWA) project work taking place in ICRAF project sites
University of Zimbabwe	Capacity development in the Development of Smart Innovation through Research in Agriculture (DeSIRA) project
FLI - Friedrich-Loeffler-Institut (FLI)	Characterization of *peste des petits ruminants* virus (PPRV) isolates in the Boosting Uganda's Investment in Livestock Development (BUILD) project
INRA - *Institut National de la Recherche Agronomique* (Morocco)	Intensification of the partnership with this Moroccan NARS partner for large scale evaluation and release of dual-purpose barley
AGROSAVIA - *Corporación Colombiana de Investigación Agropecuaria*	Intensification of the work with this Colombian NARS partner in the context of the Colombian Forages Network (germplasm evaluation, economic analysis and forage breeding)
Papalotla - *Semillas Papalotla SA de DV*	Intensification of the work with this private sector forage seed partner to better coordinate the evaluation of new hybrids and to include socio-economic research to the portfolio (i.e. cost-benefit analysis, forage seed system work and adoption strategies)
CCAFS	Strong interaction with the LivestockPlus project on a) research on Biological Nitrification Inhibition and b) gender-work related to livestock and forages
GP	Given the new Gender platform starting on 1 January 2020, being coordinated by ILRI, the collaboration with other CGIAR centres on gender research will be strengthened
Stanford University	Collaboration to strengthen flagship work on gender, especially on shaping the learning agenda
University of Edinburgh	Collaboration on human nutrition, especially on the pathways between livestock keeping and human nutrition, through a joint appointee

Table 3: Planned Budget

Flagship	Planned Budget				Comments on major changes
	W1/W2	W3/Bilateral	Center Own fund	Total	
F1 Livestock Genetics	$3,844,655.42	$6,104,201.95	$0.00	$9,948,857.40	W3/bilateral funding currently secured for 2020 is approximately 46% higher than in the POWB 2019
F2 Livestock Health	$3,896,809.01	$5,498,790.39	$0.00	$9,395,599.40	W3/bilateral funding currently secured for 2020 is approximately 300% higher than in the POWB 2019
F3 Feeds and Forages	$3,380,122.25	$4,380,300.00	$0.00	$7,760,422.30	W3/bilateral funding currently secured for 2020 is approximately 5% lower than in the POWB 2019; the flagship has been allocated more W1/2 funding in 2020 due to good performance
F4 Livestock and the Environment	$2,429,411.55	$2,564,803.00	$0.00	$4,994,214.60	W3/bilateral funding currently secured for 2020 is approximately 23% lower than in the POWB 2019; the flagship has been allocated more W1/2 funding in 2020 due to good performance
F5 Livestock Livelihoods and Agri-Food Systems	$3,423,307.77	$15,716,373.00	$0.00	$19,139,680.80	W3/bilateral funding currently secured for 2020 is approximately 80% higher than in the POWB 2019; W1/2 is higher than in 2019 since this flagship is coordinating the management and cross-flagship activities in the priority countries
Strategic Competitive Research grant	$2,100,000.00	$0.00	$0.00	$2,100,000.00	The Strategic Investment Fund allocation has been increased by 75% this year compared to the POWB 2019; the funds will be used to support a gender postdoc as well as to commission some evaluations/impact assessments of CRP research activities
CRP Management & Support Cost	$2,267,198.00	$0.00	$0.00	$2,267,198.00	The total management budget (for PMU and flagships) is approximately 14% lower than in the POWB 2019
CRP Total	**$21,341,504.00**	**$34,264,468.34**	**$0.00**	**$55,605,972.50**	The total CRP budget for 2020 has increased by approximately 37% compared to the POWB 2019, due to both an increase in W3/bilateral funds and use of unallocated or unspent W1/2 funds from the CRP Strategic Investment Fund from previous years