

Proposal for a Livestock Agri-Food Systems CGIAR Research Program

ADDENDUM WITH RESPONSES TO THE ISPC COMMENTARY

21 July 2016

In mid-June, the ISPC provided its commentaries on all CRP and platform proposals, including the Livestock CRP proposal. This document contains responses to:

- Five major bullet points (and any other comments in bold) that **MUST** be addressed (Table 1)
- Several other comments and suggestions (Table 2). These include:
 - One overall point about the CRP's smallholder focus
 - Several suggestions for each of the flagships
 - Information on CRP director
 - Management budget information
- Comments on intellectual assets and open access sections of the proposal (Table 3)

The tables contain 1) extracts from the ISPC commentary, 2) the proposed response and 3) an indication of any changes that will be made in the formal proposal narrative or annexes.

Table 1. Responses and narrative changes: main bullet points ‘must haves’.

ISPC Comments	Response	Modifications to narrative
<p>1. For all Flagships, <u>additional explanation on scientific opportunities identified through the priority setting process and their relevance to CRP and Flagship-level Theory of Change is needed. Such a narrative should include evidence on the most important constraints to achieving stated objectives (identified from past work), and how research can address these constraints and deliver outcomes/impacts.</u></p> <p>The addendum should make clear how specific research opportunities identified reflect the Theory of Change, and how research will deliver impact in the specified timeframes (additional, but related issues are discussed in the Flagship-level comments).</p> <p>Examples of innovative work on livestock value chains, property rights in livestock systems, or integrated crop livestock systems that have led to major gains in rural prosperity should be cited. Such an analysis would pave the way for a discussion on research prioritization, indicating activities to</p>	<p>The goal of the CRP is to create a well-nourished, equitable and environmentally healthy world through livestock research for development. This requires an adequate supply of animal source foods to rural and urban consumers, generating sufficient income to producers, (the vast majority of whom are currently smallholders), while securing the natural resource base. Functioning markets with a vibrant inclusive private sector providing input services and value added, reliable supply of livestock commodities based on sustainable and stable productivity operating in an enabling public policy environment are all pre-requisites for this to happen. This framework drives the broad prioritisation of research at both the CRP and flagship levels. The exact balance and prioritization of activities and entry points across these three areas (markets, productivity, enabling environment) will depend on the specific constraints in the context of the livestock species, value chain, country etc. and is expected to change over time.</p> <p>The three elements described above have, to varying degrees, been the subject of decades of livestock research by partners in the CRP as well as other research organizations, national systems and universities worldwide. The development impacts of such research are at times questioned, thus the CRP needed to re-evaluate and prioritise such ‘traditional’ research areas if contributions to the SLOs are to be achieved and the potential of the livestock sector to contribute to inclusive development is to be realised. Such an analysis, drawing from the development and implementation of the Livestock and Fish CRP, various reviews and assessments of the CRP, a number of research for development projects and the ex-ante impact assessment study conducted as part of the present CRP among others, concluded:</p> <ul style="list-style-type: none"> - All three elements – markets, productivity and enabling environment are needed to address development challenges, but the balance, prioritisation and sequencing of solutions in these areas will vary according to the context of the livestock species, value chain, country etc. and is expected to change over time. Work described in the Livelihoods flagship (LLAFS) aims to ensure that the CRP research is appropriate and adjusted. - For markets and value chains, much has been learnt from CRP Livestock and Fish, and the ‘packaging’ of business-ready technical solutions with market and policy dimensions and critical attention to gender remains a key, with the added dimension in LLAFS of ‘integration with a purpose’ – the purpose being improved livelihoods, better nutrition, sound environmental incentives, etc. - For those situations where a value chain construct is not appropriate, but a focus on mitigating vulnerability and enhancing resilience is paramount, improving livelihoods requires greater emphasis on institutional constructs, inclusiveness and enabling policies, combined with new approaches to bundle and deliver solutions. The LLAFS (resilience) and Environment (adaptation) flagship clusters are set up to address this new dimension. - Research on productivity drivers remains important because of the fundamental need to increase and stabilise over time the productivity of animal source agri-food systems. Underpinning gender- 	<p>Several changes have been made to the overall narrative.</p> <p>Section 1.0.1: Several text modifications based on this response, especially, pages 12-13</p>

<p>be emphasized, as those to be dropped or reduced. (p3)</p>	<p>responsive technical research on livestock genetics, health and nutrition needs to deliver both short and longer term solutions to present and future biophysical and climatic challenges, and to address delivery pathways (ISPC, 2014). Critical, and initiated in the Livestock and Fish CRP is the ‘bundling’ of such technical solutions within interventions for inclusive and sustainable public and increasingly private sector-led scaling out.</p> <ul style="list-style-type: none"> - The livestock sector cannot be addressed without taking cognizance of environmental dimensions, spanning both mitigation and adaption to climate change as well as other environmental impacts and incentives. <p>These conditions form the underlying assumptions for the CRP’s theory of change – that transformational change both in smallholder-based livestock commodity systems to vibrant agri-food farms and enterprises providing better livelihoods, as well as in households where livestock can improve resilience and promote equity, requires balanced attention to the three entry points. The CRP is structured to address these critical elements, and to integrate solutions.</p> <p>In many cases low productivity is a key constraint in smallholder livestock systems in the priority countries, limiting supply of animal source foods, resulting in low incomes and high environmental impacts per unit of product. Analysis shows that this ‘yield gap’ is a consequence of low genetic potential, poor nutrition (due to low availability and quality of feeds) and poor animal health (Staal et al, 2009). Research has shown that these constraints can be overcome but to date there has been limited impact of this research at scale in the livestock sector, especially in Africa. This is a consequence of a combination of a) lack of appropriate, gender-responsive technologies, b) lack of integration of appropriate technologies (single technologies are unlikely to be transformative at scale - transforming livestock commodity value chains, predicated on technology combinations has had major impacts on efficiency in developed country settings (e.g. Capper et al., 2009; Capper, 2011) but also, c) critically, a lack of attention to creating private sector opportunities and the importance of an enabling environment including input and output markets and supportive, inclusive policies as a prerequisite for technology uptake, investment in delivery mechanisms and appropriate incentives for environmental sustainability. There is evidence that different combinations of these three elements with public and private investment and innovation can lead to small-scale intensification of livestock enterprises, increasing supply and improving their incomes. Examples include Operation Flood in India, smallholder dairy in Kenya, small-scale poultry in Bangladesh, and small-scale pig production in SE Asia and initiatives of the public and private sector in Latin America to increase forage production (Candler and Kumar, 1998; Costales <i>et al.</i>, 2007; Kaitibie <i>et al.</i>, 2010; Fakhrul Islam and Jabbar, 2005).</p> <p>To stimulate further system transformations and increased productivity and resilience at scale, understanding market potential, developing appropriate technologies and providing evidence to both create an enabling policy environment, to mobilize public and private investment and ensure environmental and other incentives are balanced are therefore all critical and must be addressed as an integrated effort.</p>	
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	<p>When identifying priorities, it has therefore been important to ensure a balance of research on technologies for the three main drivers of productivity (genetics, health, nutrition), systems analysis to promote adoption and for prioritisation, and environmental dimensions, with a balance of discovery versus downstream work.</p> <p>Thus the three technology flagships focus primarily on developing technologies that are appropriate, gender sensitive and adapted to the context of the focus systems and value chains but also ensure that effective delivery mechanisms are established to generate the transformation change that benefits people and their communities. LLAFS provides the integrating mechanisms that address equity, livelihoods, and resilience along with the market and value chain challenges including delivery of animal source foods to poor consumers and enabling policies. The Environment flagship assesses the environmental consequences and opportunities of new developments, proposes solutions for mitigating environmental harm and determines priorities for technological and social adaptation to climate change and other environmental challenges.</p> <p>While current priorities on addressing the yield gap have emerged from and been repeatedly endorsed or refined through multiple consultative processes, the need for a more objective, evidence-based and analytical approach is well recognized. Globally, work is being undertaken to develop and apply an appropriate framework to guide prioritization for livestock research in line with the conceptually powerful crop yield gap analysis approach. This work focuses on the contribution of the three productivity drivers and is confirming (i) their inherent interdependency, meaning that addressing one alone can be expected to provide only limited incremental improvements in productivity, and (ii) that animal genetics, followed by health, provides the most significant potential gains for SS Africa and South Asia, that they need good livestock nutrition for the benefits to be borne out and that environmental pressures must be factored in (Staal et al., 2009).</p> <p>For the ‘fragile growth’ scenario, whilst the same productivity drivers and thus, combinations of technological solutions to address the yield gap and stabilise productivity are important, as is market integration, but other issues must also be prioritised such as increasing adaptive capacity, both of the people and of the environment of which they are the primary stewards. Thus the priorities for research are more skewed towards ensuring a relevant enabling policy environment related to access to resources, governance, risk mitigation etc.</p> <p>The specific prioritization within flagships also takes into account the need to deliver some short term solutions that can be achieved within the 6-year time frame of the CRP while recognising the need for investment in new technologies that may take a much longer timeframe to delivery but which will be critical to maintaining productivity increases over the next 10-20 years.</p> <p>For example, research on feeds and forages will combine a focus on scaling out methods and tools from the Livestock and Fish CRP that improve the ability of national researchers and development practitioners to better match existing resources and options to address feed constraints in specific contexts now (FEAST and TechFit), while at the same time continuing the longer-term pipeline filled with ever-improving or better</p>	
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	<p>targeted lines of forages and full purpose crops. The prioritisation is also influenced by over 40 years of experience of what has worked, what has failed and intense engagement and consensus with partners. Further details of the priorities in the three technology flagships are presented in response to the second major comment below</p> <p>The ex-ante impact assessment reinforced the broad prioritization and demonstrated that the proposed agenda represents an appropriately balanced portfolio of shorter-term, lower risk downstream and longer-term higher risk upstream research.</p> <p>References</p> <p>Candler, W. and Kumar, N. 1998. India - the dairy revolution. Washington, D.C.: World Bank.</p> <p>Capper, J. L. 2011. The environmental impact of beef production in the United States: 1977 compared with 2007. <i>Journal of Animal Science</i> 89(12):4249-4261.</p> <p>Capper, J. L., R. A. Cady, and D. E. Bauman. 2009. The environmental impact of dairy production: 1944 compared with 2007. <i>Journal of Animal Science</i> 87(6):2160-2167.</p> <p>Costales, A., Delgado, C.L., Catelo, M.A., Lapar, M.L., Tiongco, M., Ehui, S.K. and Bautista, A.Z. 2007. Scale and access issues affecting smallholder hog producers in an expanding peri-urban market: southern Luzon, Philippines. IFPRI Research Report 151. Washington, DC: IFPRI.</p> <p>Fakhrul Islam, S.M. and Jabbar, M.A. 2005. Smallholder poultry model for poverty alleviation in Bangladesh: a review of evidence on impact. <i>Livestock Research for Rural Development</i> 17: Article #112.</p> <p>Kaitibie, S., Omore, A.O., Rich, K., Kristjanson, P. 2010. Kenyan dairy policy change: Influence pathways and economic impacts. <i>World Development</i> 38(10):1494-1505</p> <p>Staal, S.J., Poole, J., Baltenweck, I., Mwacharo, J., Notenbaert, A., Randolph, T., Thorpe, W., Nzuma, J. and Herrero, M. 2009. Targeting strategic investment in livestock development as a vehicle for rural livelihoods. Nairobi: ILRI. http://hdl.handle.net/10568/35206.</p>	
ISPC Comments	Response	Modifications to narrative
<p>2. Present further clarification on the scientific rationale underpinning the research focus on improved livestock breeds, vaccines, and improved feeds and forages;</p>	<p>Responses are included below for each of the areas mentioned, improved livestock breeds, vaccines and improved feeds and forages in relation to this comment and those related comments integrated in the flagship commentaries. The responses cover the scientific rationale, how success will be achieved in six years and the mitigation of any risks.</p>	

<p>how the broader technical advances will lead to research success within six years; and, how risks will be mitigated or managed.</p>		
<p>2. Present further clarification on the scientific rationale underpinning the research focus on <u>improved livestock breeds</u>, vaccines, and improved feeds and forages; how the broader technical advances will lead to research success within six years; and, how risks will be mitigated or managed.</p> <p>Livestock genetics flagship comment: A stronger justification for the relevance of the proposed research should be included in the addendum, including evidence that the genetic potential of livestock species is a limiting factor in these systems.</p>	<p>Improved livestock breeds</p> <p>Scientific rationale The basis for the flagship’s research is that the present genetics of indigenous livestock species is a main limiting factor for improvement of productivity. The portfolio of genetic interventions thus includes a range of approaches: within indigenous breed improvement (small ruminants, chickens), crossbreeding (dairy cattle) and breed replacements (chicken). The work will also improve commodity traits (e.g. milk, meat, eggs) while conserving the genetic adaptation of indigenous livestock to their environmental challenges (e.g. disease resistance or heat tolerance). Last but not least, the flagship has an important discovery component, indigenous livestock genome characterization, which will further inform the genetic potential of indigenous breeds and guide new breeding improvement initiatives (noting that the impact of the latter will be beyond the six year timeframe of the CRP).</p> <p>The importance of better husbandry to improve productivity is recognised and genetic interventions will be delivered in combination with improved husbandry practices to address feeding constraints (dairy cattle, small ruminants), predation and diseases outbreaks (chickens). However, as illustrated by the lessons and successes from the livestock commercial sectors, and evidence obtained from the Livestock and Fish CRP, if better animal husbandry is indeed leading to better improvement in the short and medium term, delivery of new genetics will also immediately lead to productivity improvements (see box and additional text in the narrative). In the medium and long term, selective breeding will allow continuous genetic gain improvement with management interventions tailored to optimise genotype – environment interactions.</p> <p>Research success within six years Flagship success within the six year time frame relies on the successful delivery and implementation of established technical solutions. These include efficient artificial insemination services (dairy), large-scale utilisation of mobile technologies for on-farm live recording of performances (dairy, chickens), utilisation of advance genotyping technics (dairy) demonstration of the impact of community based breeding approaches (small ruminants). These provide a new conducive environment. The successes of all these technical advances have been demonstrated, at smaller scale so far, during the Livestock and Fish CRP. For the Livestock CRP, they will be out-scaled. Novel partnerships, engagement of stakeholders at all levels and a realistic monitoring of progress will be important elements to such scaling which is acknowledged to be a challenge.</p> <p>The flagship also plans to develop and test new technologies (e.g. genome editing, phenotyping platform, large scale annotation and screening of genome data, genomic selection introgression over multiple</p>	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.1.1.1: Changes on page 58 with a new Box 2.1b on genetics and productivity.</p> <p>Section 2.1.1.2: Changes on page 60</p> <p>Section 2.1.1.4: Changes on page 65</p> <p>Section 2.1.1.5: Changes on page 66</p>

	<p>generations etc.). Such interventions are likely to have major impact beyond the six year timeframe, but to generate new technological advances and provide the baselines needed for further improvement of productivity within the six year period.</p> <p>Risk mitigation/management</p> <p>The technological side includes little risk, because all of these have been successfully tested at small scale. Rather the main risks will be inefficient public and/or private partnerships for delivery. This is being mitigated by involving these partners in the design and early implementation phase of the project (e.g. commercial and/or national hatcheries) by strong capacity development components (all species/projects) and a significant focus on gender dimensions to ensure inclusivity. The flagship will monitor and, where possible, factor in the wider policy environment which may also impact on the success of going to scale.</p> <p>Management interventions to mitigate environmental risks are also included, for example compulsory vaccination against Newcastle disease in poultry and minimum feed input (all species). Another category of risk is a non-conducive policy environment. For this, the flagship includes a cluster of policy and institutional support activities, which will influence policy guidelines and strategies (such as nationally in Ethiopia and Tanzania, and more widely with multinational organisations such as the FAO's Animal Production and Health Division and AU – IBAR). Finally, combining livestock breed solutions with gender, technology, market, institutional and policy dimensions as part of the overall CRP approach for focus systems and value chains ensures that genetics contributes as part of integrated solutions for livelihoods, resilience and better nutrition.</p>	
ISPC Comments	Response	Modifications to narrative
<p>2. Present further clarification on the scientific rationale underpinning the research focus on improved livestock breeds, <u>vaccines</u>, and improved feeds and forages; how the broader technical advances will lead to research success within six years; and, how risks will be mitigated or managed.</p>	<p>Improved livestock vaccines</p> <p>Scientific rationale</p> <p>Whilst research to develop vaccines can be costly, technologically challenging and long term, the game-changing pay-offs are well recognised for both human medicine and livestock production. Through the application of genomics and high-throughout 'omics' technologies, which rely on whole genome sequence data, many scientific advances in vaccinology have emerged over the past few years giving rise to renewed optimism in vaccinology (Nakaya and Pulendran, 2015). A basic new principle is that vaccine development has finally entered the era of a 'systems approach', with big data and multidisciplinary science and technology supporting these endeavours. Novel paradigms set by new tools in three key areas of vaccinology, namely, 1) monitoring of immune responses to infection and immunization, 2) candidate vaccine antigen identification and 3) re-design of vaccine antigens to increase their efficacy are accelerating the rate of vaccine development. These principles are used in an iterative manner to implement new and refine existing technologies within ILRI's vaccine platform (ILVAC), aiming to accelerate vaccine discovery and product development.</p>	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.2.1.1: Changes on page 86-87</p> <p>Section 2.2.1.5: Changes on page 96-97</p>

	<p>Efficient vaccines that are applied with good coverage have a tremendous positive impact on animal health. The success story of the global eradication of rinderpest is the most prominent example of this that has worldwide ramifications (Mariner, et al, 2012). In addition, there is growing capacity and knowledge in how to react to disease outbreaks, e.g., vaccination against the recent bluetongue virus, which causes severe production losses in sheep and cattle, in European Mediterranean countries (Savini <i>et al.</i>, 2008), and, in dealing with unknown outbreaks such as the sheep Schmallenburg viral disease (Doceul <i>et al.</i>, 2103).</p> <p>Research success in six years and mitigation of risks</p> <p>The CRP includes a number of approaches that mitigate the risk that this long term, upstream research does not also deliver results in the six year time frame of the CRP. Included here are:</p> <ul style="list-style-type: none"> - The potential for technological breakthroughs in vaccinology that may have applications beyond the focus diseases of the CRP. - Application of new technologies such as “omics” provides more powerful tools than in past and combined with participation in large international consortia increases the efficiency in the vaccine research and likelihood of success. - Inclusion of processes to ensure ‘stop-go’ decisions so that investment in this research does not continue without due cognizance of the likelihood of success. These will be informed by both the technical progress and feasibility as well as the realities of disease prioritisation in focus systems and value chains (cluster 1 of this flagship and broader prioritisation in the LLAFS flagship). <p>The CRP also includes activities that will deliver results based on vaccines in the short term based mainly on the (considerable) past work of ILRI and partners, as well as the new partnership with SLU that brings a strength in herd health management. Deliverables in the short term – within the six year time frame include:</p> <ul style="list-style-type: none"> - Contributing to more enabling policy environments that support livestock healthcare strategies better suited to smallholder-based livestock systems through engagement or events to provide evidence to policy makers regarding AMR and APR (national governments, OIE), PPR control (AU-IBAR, OIE and FAO), FMD control (Global Foot and Mouth Research Alliance: GFRA), African swine fever control (Global African Swine Fever Research Alliance: GARA), better coordination of research (STAR-IDAZ), and veterinary policies and veterinary service delivery strategies geared to the developing country context (OIE). - Improvements to existing vaccines (PPR and CCPP; ITM for ECF) - Delivery strategies for existing and improved vaccines (as also stressed by ISPC, 2014), including partnership with the private sector, such as for ITM testing in Tanzania, PPR in Mali or implementation in the context of major research for development programs (such as the Accelerating Value Chains Development project in Kenya). The flagship, and indeed CRP focus on ensuring delivery approaches are inclusive for gender, and increasingly young people will also ensure robust delivery of solutions. - Solutions for herd health management that have been shown to be part of transforming the efficiency of animal agriculture (Capper <i>et al.</i>, 2009; Capper, 2011) and especially in the CRP focus systems and value chains will be increasingly important as part of the approach to mitigate against the emergence of AMR. 	
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	<ul style="list-style-type: none"> - Integration of vaccine solutions with those related to genetics and feeds as well as livelihood, market and policy interventions to address broader livelihood, resilience and nutrition outcomes (in the LLAFS flagship). - Partnership management and monitoring (Annex 3.1) as well as appropriate IP arrangements where the private sector is engaged will be integral for the success of delivery approaches. <p>References</p> <ul style="list-style-type: none"> • Capper, J. L. 2011. The environmental impact of beef production in the United States: 1977 compared with 2007. <i>Journal of Animal Science</i> 89(12):4249-4261. • Capper, J. L., R. A. Cady, and D. E. Bauman. 2009. The environmental impact of dairy production: 1944 compared with 2007. <i>Journal of Animal Science</i> 87(6):2160-2167. • Doceul, V., Lara, E., Sailleau, C., Belbis, G., Richardson, J., Bréard, E., Viarouge, C., Dominguez, M., Hendrikx, P., Calavas, D., Desprat, A., Languille, J., Comtet, L., Pourquier, P., Eléouët, J.F., Delmas, B., Marianneau, P., Vitour, D., and Zientara, S. 2013. Epidemiology, molecular virology and diagnostics of Schmallenberg virus, an emerging orthobunyavirus in Europe. <i>Vet Res.</i> 44(1): 31. • ISPC. 2014. Strategic review of livestock in the CGIAR (including ISPC synthesis and commentary). Rome: CGIAR Independent Science and Partnership Council. • Mariner, J. C., House, J. A., Mebus, C. A., Sollod, A. E., Chibeu, D., Jones, B. A., Roeder, P. L., Admassu, B., van 't Klooster, G. G. 2012. Rinderpest eradication: appropriate technology and social innovations. <i>Science</i> 337: 1309-12. • Nakaya, H. I. and Pulendran, B., 2015. Vaccinology in the era of high-throughput biology. <i>Philos Trans R Soc Lond B Biol Sci.</i> 370, pp1671. • Savini, G., MacLachlan, N.J. Sánchez-Vizcaino, J.M., and Zientara, S. 2008. Vaccines against bluetongue in Europe. <i>Comparative Immunology, Microbiology and Infectious Diseases</i> 31(2-3): 101-120. 	
ISPC Comments	Response	Modifications to narrative
<p>2. Present further clarification on the scientific rationale underpinning the research focus on improved livestock breeds, vaccines, and improved feeds and forages; how the broader technical advances will lead to research success within six years; and, how risks will be mitigated or managed.</p>	<p>Improved feeds and forages</p> <p>Scientific rationale As described above, and in the opening flagship narrative, there is considerable scientific evidence that feeds are a crucial component of improving livestock productivity and addressing efficiency and thus, underpin the development ambitions of the program.</p> <p>The scientific evidence supporting the choice of research topics to address major feed constraints is summarised here and in the narrative revisions.</p> <ul style="list-style-type: none"> • The context for feed and forage interventions is very variable at all levels of scale. This flagship builds on evidence that simple approaches to connect feed solutions to individual contexts can better prioritise and tailor solutions. • Technical constraints to be addressed include: 	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.3.1.1: Changes on page 117</p> <p>Section 2.3.1.4: Changes on pages 123-124</p> <p>Section 2.3.1.6: Changes on page 126-130</p>

<p>Livestock feeds and forages comment: But, in the context of substantive past efforts by CIAT, ILRI, and other CGIAR Centres, evidence on the most important constraints to achieving stated objectives (e.g. technical, cost/ profitability, market orientation) and pinpointing changes that will deliver success over the coming years should be included in the addendum.</p>	<ul style="list-style-type: none"> ○ Land scarcity. Whilst forages can be planted on vast acreages in some parts of the world, for mixed crop-livestock systems in particular for the intensifying trajectory, where human population density is high (and increasing) and land holdings are small, land (and other resources) are often constrained meaning that food and feed must come from the same resource investment. This leads to prioritising work to improve the quantity, quality and use of full purpose crops (Smith et al 1997; Lenné et al 2003). ○ For both forages and full purpose crops, climatic and biotic challenges present on going and unpredictable threats. Crop breeders continue to address new pests and diseases as well as climate change threats through traditional and new approaches and these will equally benefit full purpose crops. For forage and rangeland species, the application of molecular and conventional genetics and genomics has the potential to mitigate such risks (Maass et al 2015; Wanjala et al 2013). ○ Variable feed supply (time and space) is well recognised to limit livestock productivity. This constraint can be addressed through smart approaches to combine available feed solutions as well as processing and conservation strategies. Cluster 3 in particular addresses these issues (Shikuku et al 2016). <ul style="list-style-type: none"> ● Institutional constraints include: <ul style="list-style-type: none"> ○ Seed supply and delivery. A number of recent reports have emphasised this dimension as a key bottleneck (ISPC, 2014; World Bank, 2012) to providing livestock feeding solutions. Evidence from studies by ILRI and others has shown that approaches based on innovation systems, as well as developing business enterprises (World Bank, 2012) are promising solutions (Ayele et al 2012; Stur et al 2013). ○ The World Bank report on opportunities for ruminant livestock feeding also identified the need to reduce transactions costs that preclude smallholders accessing feed options (seeds, other interventions or even information) (World Bank, 2012). Again, development of appropriate scale and scope of business enterprises which may also present additional opportunities especially for women and young people are reported to be key solutions (Lukuyu et al 2015) ○ The enabling environment provided by appropriate public sector policies is important in the feeds arena, such as for providing a conducive investment environment and ensuring appropriate feed standards and regulations are in place. These dimension are addressed through the value chain and policy research described in LLAFS (Kebebe et al 2015). <p>Research success within six years Successful results are anticipated during the six years of the CRP for a number of reasons.</p> <ul style="list-style-type: none"> ● Whilst the CRP builds on and continues to use research based on decades of investment, several new dimensions have been incorporated to address the constraints and opportunities described above and reflected in particular in clusters 1 and 4. 	
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	<ul style="list-style-type: none"> • Solutions including full purpose crops will include working closely with AFS CRPs and building on lessons from earlier work where feed parameters are included in national cereal release criteria (Aruna et al 2015). • Recent work on developing feeds from cassava peels is ready to go to scale and opportunities with the business sector are being explored (Okike et al 2015). • A three year pipeline is already in place for interspecific Brachiaria hybrids meaning new accessions will be ready for scaling in the framework of the six years. <p>The flagship acknowledges that some of the research undertaken may not yield results at scale within six years, but rather forms part of the longer pipeline, as described in the response to bullet 1 above.</p> <p>Risk mitigation/management</p> <p>There are plenty of examples of investments in feed solutions that work in a project context but fail to go to scale and have lasting impact (Sumberg 2002; Hall et al 2007). In many cases, such limited success is attributed to the lack of appropriate and responsive solutions – which in the proposed research is mitigated by activities described in cluster 1 and ensuring that information from this work as well as cluster 1 of LLAFS is used to adjust approaches. It is also mitigated by having feeds work bundled with other technological solutions and developed in the context of wider livelihood, food security and poverty reduction ambitions as described in the LLAFS flagship. A second constraint to scalable, sustainable feed solutions relates to delivery and business solutions which are addressed as above.</p> <p>References</p> <ul style="list-style-type: none"> • Aruna, C., Swarnalatha, M., Kumar, P. P., Devender, V., Suguna, M., Blümmel, M., and Patil, J.V. 2015. Genetic options for improving fodder yield and quality in forage sorghum. <i>Tropical Grasslands-Forrajes Tropicales</i> 3(1): 49-58. • Ayele, S., Duncan, A.J., Larbi, A. and Truong Tan Khanh. 2012. Enhancing innovation in livestock value chains through networks: Lessons from fodder innovation case studies in developing countries. <i>Science and Public Policy</i> 39(3):333-346. • Bramwel, W., Wanjala, B.W., Obonyo, M., Wachira, F.N., Muchugi, A., Mulaa, M., Harvey, J., Skilton, R.A., Proud, J. and Hanson, J. 2013. Genetic diversity in Napier grass (<i>Pennisetum purpureum</i>) cultivars: Implications for breeding and conservation. <i>AoB PLANTS</i> 5 : plt022 • Lenné, J. M., Fernandez-Rivera, S., and Blümmel, M. 2003. Approaches to improve the utilization of food–feed crops—synthesis. <i>Field Crops Research</i> 84(1): 213-222. • Hall, R. Sulaiman, and P. Bezkorowajnyj. 2007. Reframing technical change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity. Addis Ababa: CGIAR Systemwide Livestock Programme. 1-52, 2007. • Kebebe, E., Duncan, A.J., Klerkx, L., Boer, I.J.M. de and Oosting, S.J. 2015. Understanding socio-economic and policy constraints to dairy development in Ethiopia: A coupled functional-structural innovation systems analysis. <i>Agricultural Systems</i> 141:69–78 	
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ISPC Comments	Response	Modifications to narrative
<p>3. Provide additional information on the functional integration with other AFS CRPs to clarify how the Livestock CRP will influence trait discovery in crop breeding CRPs and assess potential trade-offs between the uses for crop and livestock production.</p> <p>The proposal should better describe (in the requested addendum) the strength of integration with crop AFS CRPs.</p>	<p>On influencing trait discovery in crop breeding CRPs, work (Aruna et al 2015; Lenné et al 2003) on ‘full-purpose’ crops described in the proposal was developed in close consultation with AFS crop commodity CRPs. This full purpose crop concept, represents, in effect, a new paradigm in crop improvement. The concept draws from experiences from earlier research including on most key cereal and legumes with CGIAR, NARES and the private sector during the 1st phase of the CRPs.</p> <p>The Livestock Feed and Forages Flagship will provide the nodal platform to identify the most suitable laboratory feed and fodder quality traits and to phenotype for such traits. In the Livestock and Fish CRP, such parameters were generally used for comprehensive proof-of-concept studies although for some crops (for example sorghum and pearl millets in India) the information has already resulted in new variety release criteria (new cultivars are now only released if superior in both grain yield and in stover quantity and fodder quality).</p> <p>In the livestock CRP, existing and new information about crop residue fodder traits will be used to inform improvement programs for key cereals and legumes to provide cultivars that are superior in multiple traits relating to grain as food and feed and to crop residues as fodder.</p>	<p>Updates have been made to the narratives of the feeds and forages, environment and LLAFS flagships</p> <p>Feeds and forages:</p> <ul style="list-style-type: none"> - Section 2.3.1.3: Changes on page 119 - Section 2.3.1.4: Changes on page 124 <p>Environment:</p> <ul style="list-style-type: none"> - Section 2.4.1.4: Changes on page 148 - Section 2.4.1.5: Changes on page 150

<p>This could be considered in the part of the addendum that considers interactions with other CRPs.</p>	<p>There are therefore mechanisms in place to assure that: 1) robust parameters to assess variations in food-feed-fodder traits will be generated; and 2) information will be used in multi-dimensional crop improvement. The genetic gains platform will further strengthen the opportunities for new science to identify feed quality traits.</p> <p>On potential trade-offs between uses for crop and livestock production, use of a systems approach by the CRP (in the feeds and forages, environment and LLAFS flagships) allows for analysis of trade-offs between multiple objectives, including social and economic as well as productivity related. There will be many such trade-offs relating to crop versus livestock production. In relation to the food – feed crops generated by the full purpose crop platform, trade-offs will be evaluated from several perspectives to understand how the improved varieties can optimally respond to demand for both food and feed, thus resolving competition for land and other inputs.</p> <p>It will not be possible to resolve all trade-offs with this approach, however, especially those between retaining biomass to improve soil quality versus using it for animal feed (Valbuena <i>et al.</i>, 2012), or the synergies from incorporating animal manure to improve soil quality. These analyses will require integration with the other AFS CRPs, as livestock are present in most smallholder systems, and this provides a further focus for interaction with the AFS CRPs so that the integrated, and at times essential role of animals in smallholder systems is not overlooked.</p> <p>References</p> <ul style="list-style-type: none"> - Aruna, C., Swarnalatha, M., Kumar, P. P., Devender, V., Suguna, M., Blümmel, M., and Patil, J.V. 2015. Genetic options for improving fodder yield and quality in forage sorghum. <i>Tropical Grasslands-Forrajes Tropicales</i> 3(1): 49-58. - Lenné, J. M., Fernandez-Rivera, S., and Blümmel, M. 2003. Approaches to improve the utilization of food–feed crops—synthesis. <i>Field Crops Research</i> 84(1): 213-222. - Valbuena, D., Erenstein, O., Homann, S., Abdoulaye, T., Claessens, L., Duncan, A.J., Gérard, B., Rufino, M.C., Teufel, N., Rooyen, A. van and Wijk, M.T. van. 2012. Conservation agriculture in mixed crop-livestock systems: Scoping crop residue trade-offs in sub-Saharan Africa and South Asia. <i>Field Crops Research</i> 132:175-184 	<ul style="list-style-type: none"> - Section 2.4.1.6: Changes on page 151-152 <p>LLAFS:</p> <ul style="list-style-type: none"> - Section 2.5.1.3: Changes on page 171 - Section 2.5.1.6: Changes on page 178
ISPC Comments	Response	Modifications to narrative
<p>4. Even though the targets are overly optimistic for many CRPs, Livestock is an outlier in that some of the targets proposed (number of people likely to be lifted out of poverty, rate of yield increase) do not appear credible. <u>These targets should be revisited or</u></p>	<p>The CRP recognises that its original target for SLO 1.2 was very high as it was interpreted as <u>all</u> income increases on-farm to be people “assisted to exit poverty”. The methodology annex (3.10.3) now explains, with references, the conversion of increase in income, by species, to estimated numbers of people actually exiting poverty. Targets at the sub-IDO level which contribute to SLO 1.2 remain unchanged.</p> <p>The yield change targets presented at SLO level in PIM Table A are an aggregation of targets across the 3 technology flagships and multiple species. Note that the table in the methodology annex (3.10.3) defines the breakdown. The average increases proposed are larger than for crop commodity CRPs because, in the short term at least, there are greater potential gains in livestock productivity through combining genetics, feeding</p>	<p>Clarifications, explanations and changes have been made to section 1.0.2 and table 1.2 in the overall narrative: pages 15-16.</p> <p>Annex 3.10.3 explaining the methods used to calculate targets has been updated.</p>

<p><u>additional justification, grounded in empirical evidence, provided for the numbers quoted.</u></p> <p>In the light of such data, the proposed poverty related target appears unrealistic, and this issue should be addressed in the addendum.</p>	<p>and health solutions than for crop genetics (which went through a cycle of high returns in the early days of the Green Revolution). Feed and forage breeding research are at an early stage, similar to the Green Revolution for crops, in which significant increases in yield potential and closing the yield gap can be achieved before the diminishing returns currently facing staple crop breeding are reached. Both livestock genetics and health technologies offer stepwise increases in productivity beyond the small incremental gains generally found in the staple crop and NRM-type research. Changes have been made to the genetic target ranges and standardisation of feeds and forages.</p> <p>Additional justification with evidence has been included in the flagship responses to bullet 2 above and reference to these included in the methodology annex and the overall narrative.</p> <p>The response to overall bullet 1 also provides more detailed information on how the CRP will focus on yield gap analysis, as the integration of genetics, health and feed & forages, as a key strategic component of the CRP.</p> <p>The aggregation across flagships and species for PIM Table A has been reduced to provide a more realistic picture at this aggregated level.</p>	<p>PIM tables have been updated: Table A – changes have been made to the poverty and yield change targets</p> <p>Tables B to D – added text on yield gain ranges (for genetics) to sub-IDO indicator targets</p>
<p>Livestock genetics: Further details of the expected timeline to impact would help to allay these concerns of the ISPC, and the issues raised should be addressed in the addendum on the genetic gain targets.</p>	<p>See responses above.</p>	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.1.1.2: adjustments made to target ranges of values at species level (Pages 60-61).</p>
<p>Livestock health: It is not evident, however, how or to what extent outcomes/impacts can be expected in a six-year timeframe, and these comments should be addressed in the addendum.</p>	<p>The Flagship's timeline to impact and its targets look ambitious but are realistic considering the following: (i) the CRP uses established technologies, (ii) several of the breeding improvement projects (ACGG, ADDG, CBBP) embedded within this livestock CRP have already started and will be ongoing at the start of the CRP, so deliverables for these projects are expected from the first year onward, (iii) previous studies have shown that major genetic gains may be achieved through 'new' genetics (e.g. small ruminant in Ethiopia, crossbred cattle in Senegal, poultry in Ethiopia), (iv) new public – private partnerships (e.g. delivery of better poultry genetics and improved genetics through AI) are part of project up-scaling activities.</p> <p>However, there are also local circumstances beyond the CRP's control which may influence negatively these targets at local or at national level (e.g. unpredicted forthcoming political instability, extreme climatic challenges). Additionally, achievement of these targets depends on the CRP's continued ability to mobilize large-scale development-focused projects to deliver technologies widely. Accordingly, the flagship narrative now provides target ranges for both income and genetic gains at species levels.</p>	<p>See response to bullet 2 above.</p>
ISPC Comments	Response	Modifications to narrative
<p>5. Include additional detail on the CRP's relationship with the private sector, and how this</p>	<p>Partnership with private sector is clearly critical for the Livestock CRP to achieve its objectives. The rationale and modalities for such partnerships are outlined in the partnership strategy (annex 3.1) and several examples are cited there. The private sector contributes to the comparative advantage of the CRP in two</p>	<p>Several changes have been made to the overall narrative.</p>

<p>contributes to maximizing Livestock's comparative advantage.</p> <p>While there is a discussion of roles and responsibilities relative to a small (but significant) number of partners, there is much less with respect to the private sector.</p> <p>The ISPC requests Livestock to include additional detail on the CRP's relationship with the private sector, and how this contributes to maximizing its comparative advantage in an addendum to the proposal.</p>	<p>main ways. The first is strengthening the ability of the CRP to undertake discovery research through the additional capacity private sector can bring to bear on specific technical issues such as proprietary IP that can accelerate vaccine development. The second is harnessing the central role of the private sector in scaling out research outputs, not only in the form of commercial products but also as business development services for professionalizing small-scale producers and value chain actors or upgrading livestock value chains, as well as promoting business-based inclusive and sustainable livestock development models nationally and globally. Potential private sector collaborators that can contribute effectively in these roles range from multinational companies (e.g. animal pharmaceutical companies) to companies operating in national and local commercial sectors, to SMSE and individual business operators working in both formal and informal sectors. These roles are consistent with and assumed a central feature of how the CRP is addressing the three partnership challenges described in the partnership strategy, as well as allowing the CRP to learn from successful private sector strategies and models. Conversely, the CRP strengthens the comparative advantage of private sector partners by increasing their access to information and options that better target their product and market development.</p> <p>The CRP's relationship with the private sector is guided by the principles outlined in the partnership strategy, but recognizing the different objectives and motivations of the private versus public sector means more care is required to ensure each party's objectives are mutually compatible, rather than necessarily having a common objective as expected with other types of partners. When establishing a partnership with the private sector, particular attention is therefore given to explicitly identifying the motivation for the private sector involvement, which typically will refer to one of the following perceived benefits:</p> <ul style="list-style-type: none"> • Product development – being the leader and getting edge in marketing a new product, to capture profit on new product • Market development – understanding how to adapt products or services to expand their market share to new population segments, e.g. the recent interest in the 'bottom of the pyramid' markets, or an SMSE establishing its initial market • Enhancing intangibles of goodwill, brand recognition and reputation, possibly related to business-motivated CSR or to promoting sector development (e.g. meat producers group) <p>The specific opportunity and motivation informs the appropriate type of partnership arrangement as service provider, research collaborator, development implementer or member of a local or international platform. It also suggests that the CRP will need a process for explicitly assessing risks of such arrangements, including potential reputational risk of perceptions of providing unfair advantage to individual partners.</p> <p>These elements of the partnership strategy explain the rationale for existing collaboration with the private sector and guide evaluation of new potential partners. Examples of the various configurations of private sector partnership are provided in the profiles of key strategic partnerships in Annex 3.1, with additional detail on selected examples provided as an additional annex Table 3.1c.</p>	<p>Section 1.0.8: Changes on pages 32 and 33</p> <p>Changes have been made in Annex 3.1</p> <p>Changes in the 'selecting partners' section, page 3</p> <p>An additional Table 3.1c (page 26 of the annex) has been added to provide examples of private sector partners describing their role, the level at which they collaborate with the CRP (local, national, global), and their motivation, illustrating the narrative added highlighting considerations specific to the private sector partnership.</p>
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Table 2. Responses to other comments and suggestions

ISPC Comments	Response	Modifications to narrative
Overall		
<p>This is an important issue for the CRP to clarify: explicate the arguments and assumptions that the research areas proposed are likely to play a critical role in the growth of smallholder-based animal agriculture production. The CRP is designed entirely around the premise of growth in the smallholder livestock sector, and if it is false, the research agenda of Livestock would not be able to deliver what is promised (p2/3)</p> <p>The CRP may want to consider ways in which research priorities might change if it turns out that smallholder systems are not the place where the CRP can make its biggest contribution. (p4)</p>	<p>While focusing on ‘inclusive, sustainable growth’ as a key trajectory for the smallholder sector, this does not refer to growing numbers of smallholders, or to keeping smallholders as smallholders. It rather takes a smallholder-centred approach to livestock development with an emphasis on productivity growth as part of recognising that transition of today’s smallholders in the context of responding to livestock product demand is a significant opportunity to ensure a positive transition for livelihoods, the environment and health.</p> <p>This approach is supported by findings and recommendations of the ISPC Foresight Study on Urbanization and Farm Size which explicitly “recommends a research program facilitating the entire pathway from subsistence/transition farming to either intensification or diversification and continuing to large farms” (Haan, 2013).</p> <p>The rationale for this follows below. Evidence suggests that in some cases some producers may commercialize and scale into small enterprises and associated businesses, or may generationally exit agriculture through investing livestock-generated assets into education or remunerative enterprises (Kristjanson <i>et al.</i>, 2004). In Asia, this will be associated with falling rural populations and increasing farm and herd sizes; in Africa, continued increases in rural populations and smaller farm sizes and increasing herd sizes will be the driver (Masters <i>et al.</i>, 2013). The results are unlikely to be growth in smallholder numbers in all settings but they will drive labour-saving innovation and intensification. Furthermore, associated with smallholder productivity growth is the expansion of employment and opportunities for SMSE as value chains develop, and particularly for youth and women.</p> <p>It is worth noting that a focus on smallholders does not preclude engagement with larger producers and enterprises who may leverage or stimulate innovation and services for smallholders. A key opportunity for the CRP is to interact with the private sector, identifying lessons it can provide for incorporating smallholders into markets, and conversely offering the private sector inclusive and gender responsive business strategies. Evidence of this is seen in the recently concluded East Africa Dairy Development project (www.heifer.org/eadd) and the Dairy Genetics East Africa project where large scale producers/investors were engaged in the development of business models benefiting smallholders.</p> <p>The evidence for taking a smallholder-centred approach to achieve the CRP’s objective, and thus, the SLOs, is substantial and presumably informed the smallholder focus in the SRF goal statement. The continued role of smallholders and pastoralists in providing the bulk of livestock products particularly in SSA and much of Asia</p>	<p>Several changes have been made to the overall narrative to emphasize the role of smallholder-based systems transitioning to professional and high-growth in high growth scenarios and for strengthening livestock-based resilience (section 1.0.1. pages 2-5).</p> <p>A sentence added in the opening paragraph of section 1.0.1 (page 2) to highlight win-win-win benefits of targeting smallholder-based livestock livelihood and commodity systems to address all three SLOs.</p>

	<p>now and for the coming decades is indisputable, as concluded in a recent ISPC study: “smallholder livestock farming will most likely remain for some time to come the main supplier of meat and milk in South Asia and sub-Saharan Africa” (Haan, 2013: 2). Some examples of the evidence:</p> <ul style="list-style-type: none"> - The more than 70 million smallholder dairy farmers in India produce more milk than all North American farmers put together (Hemme <i>et al.</i>, 2015). - In rapidly developing Vietnam, small- to medium-sized pig producers supply some 95% of the pork consumed, and projections have shown that, even under the most optimistic investment scenarios, industrial production systems will not provide the majority share for decades (Lapar <i>et al.</i>, 2012). - The continued dominance of smallholders is due in large part to the fact that smallholders continue to be competitive compared to large producers in low-wage settings, particularly in ruminant production, and there is little evidence of economies of scale in production in many systems (Hemme <i>et al.</i>, 2014; Sharma <i>et al.</i>, 2003), largely because of utilization of low cost farm resources and family labour. <p>The rationale is thus very simple: in order to increase availability of animal source foods requires an increase in the productivity and performance of those who are the core providers of that supply particularly since large scale production remains so constrained (with the exception of some monogastric systems). Supply response cannot be impacted without a smallholder-centred approach.</p> <p>In addition, as evidenced in the text of the LLAFS flagship, livestock systems provide important, multiple and sometimes unique livelihood and asset opportunities for the rural poor, including the landless, for women and potentially for young people such as those that improved poultry might offer. To best contribute to the SLO related to poverty reduction, necessitates working with the smallholders who depend so heavily on livestock.</p> <p>A smallholder-centred approach is thus required for both a) increasing supply of ASFs (and increase food security), and b) reducing poverty in livestock depending communities. It simultaneously presents opportunities to address environmental and human health issues as part of a positive sector transition.</p> <p>The CRP recognises that the environment in which all those involved in the livestock sector operate will change as the various scenarios to respond to demand unfold and business opportunities are exploited by the private sector at all levels of scale. Understanding and monitoring the influence of such changes will form part of the foresight studies, initially in cluster 1 of the LAFS flagship.</p> <p>References:</p> <p>Haan, C. de. 2013. Urbanization and farm size changes in Africa and Asia: Implications for livestock research. Rome: CGIAR Independent Science and Partnership Council.</p>	
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Livestock genetics		
<p>Given that the likelihood of success can vary widely between species, an explanation of the links between genetics/genomics approaches and livestock trait performance, and documentation of past successes of productivity increases would strengthen the proposal. (p7)</p>	<p>Links between genetics/genomics approaches and livestock trait performances have been extensively documented for the commercial improved livestock breeds (e.g. see Hill (2014) for dairy cattle, Dekkers <i>et al.</i> (2011) for pigs, Martins <i>et al.</i> (2012) for broiler chickens). Today, successful genomic selection programs are ongoing in dairy cattle, pigs and poultry.</p> <p>In dairy cattle and chickens the initial genetic intervention strategies involves the identification of more productive genotypes (crossbred or breeds) and their distribution to farmers at large geographic scales. This will lead to an immediate productivity jump (bullet 2 response in Table 1 and box added to narrative). In small ruminants, within breed/population selection will be followed and therefore the impact of genetic gains on productivity is anticipated to be slower but continuous across generations.</p> <p>References: Dekkers, J.C.M., Mathur, P.K. and Knol, E.F. 2011. Genetic improvement of the pig. IN The genetics of the pig (ed. MF Rothschild and A Ruvinsky). Wallingford: CABI: 390–425.</p> <p>Martins, J.D.S., Litz, F.H., Castilhano, H., Campos, D.F., Taveira, R.Z., and da Silveira Neto, O.J. 2012. Genetic improvement of broilers. PUBVET 6 (18).</p>	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.1.1.3: Changes on page 60</p> <p>Section 2.1.1.4: Changes on page 64</p> <p>See also response to bullet 2 in Table 1.</p>
Livestock health		
<p>A discussion of the critical constraints to better animal health – not just those supportive of activities in each cluster, and the extent to which animal disease is a constraint in various production systems would have strengthened the proposal. (p8)</p>	<p>See also responses to bullet 2 in Table1.</p> <p>Based on experience from the Livestock and Fish CRP, a number of animal health constraints and matching scientific opportunities were identified:</p> <ul style="list-style-type: none"> - The disease and health landscape varies over time and between locations, therefore a cluster dealing with evaluating and assessing emerging threats and constraints (cluster 1) is included and will also relate to the broader prioritisation studies in cluster 1 of the LLAFS flagship. - There are far more health constraints than single, but severe, diseases that affect productivity, thus the inclusion of cluster 2 on herd health addressing the broader range of constraints and that interacting with feed and breed solutions from other technology flagships. - There are several major infectious diseases hampering the productivity increase in the focus systems and value chains but these have been of limited commercial interest for the biotech industry, therefore the focus of vaccine and diagnostic development includes such diseases. 	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.2.1.1: Changes on page 86</p>

	<ul style="list-style-type: none"> - A major constraint in achieving impact from livestock research is the uptake of efficient technologies, practices and products (here produced in clusters 2 and 3), therefore in line with ISPC (2014) recommendation, cluster 4 is included, specialised in developing, testing and optimizing delivery models for health related services and products working through the integration processes of the LLAFS flagship and including public and private sector partnerships. 	
The proposal is less clear on what specific (rapid) diagnostic tools and inventions in herd health it aims to deliver, including the country-disease combinations it will target. (p8)	<p>The diagnostic specifications have been further developed in the “science quality” section of the flagship narrative and in the description of the Flagship’s cluster 2. For the diagnostics there is a strengthened country-disease combination and for the herd health, strengthened production system – intervention linkages. Rapid diagnostic tools will be developed in response to three dimensions of demand:</p> <ul style="list-style-type: none"> - The need for broad, non-specific diagnostic approaches that can help to identify a range of (new) pathogens. - The development and application of diagnostic tests for priority diseases (CBPP/CCPP in particular). - Provision of existing (but new and not yet rolled out to national veterinary services) diagnostics such as for MERS-CoV, FMD and RVF. - Beyond developing new diagnostics, opportunities for deploying diagnostics for broader herd health dimensions and possible service provision opportunities for small scale private sector may also be explored. 	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.2.1.4: Changes on pages 93-100</p>
In defining the role for the CGIAR relative to other public and private providers of services and technologies, is this primarily an advisory role (related to organization of animal health systems or focusing on animal health policies) or an area of upstream scientific research (developing vaccines, developing rapid diagnostics etc.)? (p8)	<p>The Animal Health Flagship roles relate to other public and private animal health providers both downstream and upstream.</p> <p>Relative to other providers of animal health (as a whole), the flagship provides evidence and options for effective delivery of products and services in animal health systems. Some of this information may also contribute towards developing better animal health policies (although not a focus of the flagship, such information may be used by partners).</p> <p>Regarding upstream research the flagship has partnerships on vaccine development with for example Hester Biosciences Inc. on PPR.</p> <p>There is not a significant advisory role <i>per se</i>, activities focus rather on collaborative research, capacity development and generation of evidence.</p>	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.2.1.4: Changes on page 97</p>
Livestock feeds and forages		
The science quality section focuses on tools rather than problems to be solved and a discussion of the	Part of the logic of the Feeds and Forages flagship is that the success of feed interventions is highly dependent on local context because of strong variation in the various factors that limit improved feeding over space and time. This is explained this more clearly in the revised proposal through adjustments to the	The flagship narrative has been updated as follows:

strategy through which research might address these problems..... (this paragraph p9)	narrative in the Science Quality section and in the descriptions of Clusters 1 and 4. The prominence of tools has been toned down and explained more clearly the rationale behind the need for such tools. Clusters 2 and 3 already both address major problems with improved feed supply in smallholder systems, namely lack of appropriate genetic resources for forages and ‘full-purpose’ crops (Cluster 2) and poor efficiency in using existing feed sources optimally (Cluster 3). Cluster 4 focuses on the means to improve innovation system function around feed resources including seed supply but also other organizational interventions to allow technical advances to reach farmers at scale – this is explained more clearly in the revised narrative for Cluster 4.	Changes to sections 2.3.1.4 and 2.3.1.6 (clusters 1 and 4), also as described above in Table 1 for bullet 2: pages 123-124 and 126-130.
The main dimension of comparative advantage to consider is whether research is the relevant way to deal with feed and forage issues..... (this paragraph p9)	Research is certainly a strong element of any strategy to improve feed supply among smallholder farmers. The CGIAR system and partners have strong comparative advantage in developing practical improved feeding strategies and connecting these to the smallholder context. There is strong comparative advantage in forage breeding as evidenced, for example, by success with Brachiaria breeding over recent years. However, the flagship acknowledges that technical research in isolation, will not bring about transformation and must be continually evaluated for its application to solve constraints in the focus systems and value chains. Thus such research needs to be connected to an intimate understanding of the system constraints within which smallholder farmers do business. Furthermore research on feeds needs to include development of prototype organizational innovations that can be taken to scale. The revised narrative for Clusters 1 and 4 makes the case that taking this broader view of research CGIAR centres and their partners do indeed show strong comparative advantage. A second source of comparative advantage is the unique opportunity to link feed improvement to the immense crop breeding capacity of CGIAR as already demonstrated by the evolving collaborations on several crops to enhance their feed value while protecting their high food yields.	
Livestock and the environment		
The proposal would be stronger if the Theory of Change better articulates how the proposed activities across clusters will amount to a greater whole. (p10)	<p>The Environment flagship will produce outputs and outcomes that are different in scale and characteristics, and that indeed will have different outcome pathways; but this is necessary to achieve the overall desired impacts.</p> <p>The challenge of introducing and implementing environmental management of livestock production systems requires interventions undertaken with multiple stakeholders and levels. Cluster 1 focuses on integrating productivity enhancing technologies with environmental issues, both the environmental footprint and the challenges that future environmental change will pose for these productivity goals. This produces greater consideration of environmental issues in livestock production, which is part of providing on-the-ground solutions to be implemented in the target locations and countries. This cluster also generates the foresight and ex-ante impact assessment information that decision makers need in Cluster 3. This cluster will target local and national solutions to the challenges of regional and global environmental change.</p> <p>Cluster 2 narrows in to develop and implement specific technological solutions to optimize natural resource use, minimizing negative environmental footprints and enhancing positive environmental services. This is also part of providing solutions for environmental management at local and national levels.</p>	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.4.1.3: Changes on page 144</p> <p>Section 2.4.1.6: Changes on page 151</p>

	Cluster 3 recognizes that environmental management requires institutional and policy change to set in place the regulations and incentives for behaviour change. Cluster 3 both brings together and enables the outputs of Clusters 1 and 2. It also brings together the evidence and experience of the flagship to inform regional and global advocacy agendas.	
A discussion of how the results from various Flagships will be brought together to assess trade-offs and implications for achieving CRP objectives and assess trade-offs would also strengthen the proposal. (p10)	As discussed in the response to Bullet 3 in Table 1, the Environment flagship uses a systems approach (along with LLAFS) to address trade-offs among multiple objectives. Such trade-off analysis will be important for selecting specific environmental management solutions, but also for designing policies and regulations aimed at stimulating better environmental management of livestock production.	Narrative adjustments as described in bullet 3 in Table 1.
Then, the question of how specific activities (e.g., improvement in emission measures) will contribute to the larger CRP/CGIAR objectives, beyond potentially contributing to IPCC processes through the introduction of new emissions factors, remains. (p10)	<p>The TOC diagram on page 146 indicates how the research outcomes contribute to sub-IDOs, of which there are seven to which this flagship contributes.</p> <p>For example, Land and Water Degradation will be addressed through all three clusters: under Cluster 1 the potential impact of productivity enhancing technologies on land and water resources will be assessed and the information fed back to the technology flagships. Under Cluster 2, partners and beneficiaries will implement specific solutions to reduce the impact of livestock production on land and water degradation, and where possible use livestock production to improve land and water management. Under Cluster 3, the focus is on specific policies and institutional arrangements to increase/ enable more widespread implementation of practices to reverse land and water degradation, specifically improving/ strengthening land tenure arrangements and schemes for payments for ecosystem services.</p> <p>A similar multi-cluster approach applies to the other six sub-IDOs.</p>	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.4.1.6: Narrative modified to strengthen these points: page 151</p>
While the importance of adapting to climate change is mentioned frequently as one of the important justifications for the Environment flagship, detail on strategies and potential approaches is lacking. The focus appears to remain on mitigation, or adaptation at a national level (Uganda and pig value chain) (p10)	The role of this flagship is to work with the other flagships to develop and implement interventions that help livestock production systems adapt to climate change. Adaptation to climate change is not the remit exclusively of this flagship. It provides information about the likely impacts of climate change that each of the other flagships will use. So the technology flagships will be responsible for using the information from the Environment flagship to modify/ adapt their interventions to account for the impacts of climate change on livestock production systems and environments. Much of the household and community adaptation of livelihood strategies will be implemented through the LLAFS flagship. This adaptation will happen at multiple levels, from local to national.	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.4.1.6: Changes on page 151</p>
Hence, the narrative on how things have changed or have been dropped on the basis of past learning could be strengthened (p11)	Previous work under the Challenge Programme for Water and Food (Peden <i>et al.</i> , 2009) documented that livestock production has a significant impact on water quality and quantity (use). This justifies the work on water. In terms of land degradation and soil quality, the need to quantify many of the environmental	The flagship narrative has been updated as follows:

	<p>impacts of production technologies is noted, with fodder/ forage being an excellent example. Improved manure management and rangeland management are two more.</p> <p>References</p> <p>Peden, D., Alemayehu, M., Amede, T., Awulachew, S.B., Faki, H., Hailelassie, A., Herrero, M., Mapezda, E., Mpairwe, D., Musa, M.T., Tadesse, G. and Breugel, P. van. 2009. Nile basin livestock water productivity. Colombo, Sri Lanka: CGIAR Challenge Program on Water and Food</p>	Section 2.4.1.5: Changes on page 150
External research partners seem appropriate, but information on roles of partners in the flagship (and vice versa) is not sufficiently detailed. (p11)	External research partners will have specific roles. For example, research partner CSIRO will be a key modelling collaborator for the analyses under Cluster 1. International research consortia will provide both indications of the international priorities and data gaps, as well as avenues for the flagship research to be disseminated to other partners. As individual activities and projects within the flagship are developed the roles of each partner will be clearly articulated.	<p>The flagship narrative has been updated as follows:</p> <p>These clarifications added to Section 2.4.1.7 on page 156</p>
Livestock livelihoods and agri-food systems		
Grand challenges: One instance where the aspirational impact target is questionable is nutrition – existing evidence suggests that increasing the productivity and efficiency of livestock systems (a primary focus of the CRP) is not sufficient to combat malnutrition in the poor producer households and thus greater clarification of the scientific rationale for this target will strengthen the proposal. (p3)	The flagship agrees that the evidence is scarce regarding the contribution of productivity and even income to improved nutrition, although there are some studies that support this link (e.g. in Kerala and Zambia). This is an important knowledge gap that the CRP needs to address. The driving rationale is the puzzling juxtaposition of high-nutritive-value ASFs at the same time that there are high rates of malnutrition within our target communities – hence the need to learn more about the reasons for that discrepancy and identify means to bridge the gaps. We recognize that is an area of exploratory research but is required in order to address the nutrition SLO, potentially beyond the six year time frame. We will work closely with A4NH and national partners on formative research and other methods to influence dietary behaviour.	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.5.1.1: Changes on page 168</p>
Inter CRP synergies: There are other potential overlaps with PIM in the areas of value chains and livelihoods (LLAFS flagship) as well as on policymaking (agricultural and environmental) to deal with incentives for livestock production and environmental externalities. In these cases, however, the collaboration with PIM is not obvious in the proposal. (p3)	Agree there are areas of potential collaboration with PIM. These are listed in Annex 3.6 and, as the CRPs are operationalised, collaboration arrangements will be further refined.	<p>The flagship narrative has been updated as follows:</p> <p>Section 2.5.1.6: Changes on page 178</p> <p>Updates to the CRP links with PIM have been made to the table in Annex 3.6, pages 58-59</p>
The same issue arises in the context of the flagship on livelihoods and	Agree - the integration function is one major focus of this flagship.	

agri-food systems (LLAFS). It is not obvious this work should occur outside of other flagships. At the least, the integration across these flagships will be essential. (p5)		
What would strengthen the strategy is explicit recognition that some of the linkages articulated between livestock, gender (in this context, women), and potential impacts on nutrition or empowerment are worthy of continued scientific enquiry. (p5)	Agree	The flagship narrative has been updated as follows: Section 2.5.1.6: Changes on page 180
[dairy VCs in Burkina Faso??? P11]	Reference in the commentary to dairy VCs in Burkina Faso is inaccurate, the priority VC in Burkina Faso is small ruminants.	
The LLAFS flagship risks appearing as being largely engaged in piloting successful development projects with livestock components, and the narrative could be strengthened by including information on priority value chains and associated research. The open question about what the research in this flagship will deliver (p11)	<p>Much of the outputs delivered through action research/piloting with development projects has been and will continue to be tested business models for improving the performance of livestock systems, with emphasis on collective action of different kinds as well as access to markets and services. These may include:</p> <ul style="list-style-type: none"> - Business models for community based small ruminant breeding management, and improved genetics - Business models for better linking dairy farmers to markets and services, through dairy producer business hubs - Business models for better managing small producer collective action (eg small ruminants or poultry) - Innovation platform (IP) approaches (including training of trainer materials) for catalysing uptake of improved practices among smallholder livestock producers (eg goats), and improving market access <p>Training and certification approaches to upgrade informal livestock product markets, targeting capacity development among small informal traders such as raw milk traders or traditional artisanal processors</p>	The flagship narrative has been updated as follows: Section 2.5.1.6: Changes on page 182
It also noted that (1) there were few signs of scaling technologies or methods beyond the countries in which research is taking place, (2) the nine hubs operate as separate research programs (p11)	Several of the approaches and materials developed above (e.g. innovation platforms, training and certification) have been adopted by national partners in other countries and scaled up for their own purposes. The CRP actively promoted different types of uptake through making products widely accessible, investing in different communications media and channels, and taking results to international fora.	
Hence, discussion of the effort that will be put in place to test interventions and to track how livelihoods are changed by different		The flagship narrative has been updated as follows:

value chain interventions and technologies will strengthen the proposal. (p11)		Section 2.5.1.5: Changes on page 177																																								
The design of the flagship requires very close collaboration with non-CGIAR development institutions leaving open questions of how this will occur, and who (within the CRP) has the resource (time) and experience needed to manage such implementation. (p12)	<p>Several of the teams involved in this flagship have enormous experience in working as knowledge and technical partners with non-CGIAR development agencies. Team CVs illustrate this.</p> <p>The CRP also employs partnership planning tools such as Outcome Mapping to jointly develop and monitor R4D objectives and activities with partners, for more effective joint efforts. Project examples include the large BMGF funded East Africa Dairy Development Project, and the CIDA funded LIVES project. GIZ also brings some of the needed experience and skills to support these partnerships.</p>	See Annex 3.7, page 135 onwards																																								
The budget, however, appears small to fund local implementation activities, and it is assumed that these activities are primarily funded from other sources. If the flagship, however, intends to pay for the full cost of interventions, it is unlikely to be able to do all that it describes and deliver information on what works and what doesn't. (p12)	While the W1/W2 budget is relatively small, this flagship has the largest share of W3 funding in the CRP. Because of the successful delivery of applied knowledge projects for development partners, we are confident of our ability to continue to attract significant W3 funding.																																									
Other responses																																										
CRP Director appointment	In consultation with the other program partners, Tom Randolph was appointed Director of the CRP.	<p>CV provided in Annex 3.7</p> <p>Section 1.0.11 in the overall narrative amended on page 38</p>																																								
Management budgets	<p>The table providing a breakdown of management support costs (MSC) in the harmonized format agreed by the CRP directors and the SMO is provided in the row below.</p> <p>Note: There is a small discrepancy between the total MSC amounts reported for 2019, 2022 and the 6-year total due to the internal audit costs being left out when submitted in March.</p>	The table below has been inserted at the end of section 1.1.4 (pages 47-49)																																								
Table 1.1.4. Explanation of Management support cost budget components:																																										
<table><tr><th rowspan="2">COST COMPONENT</th><th rowspan="2"></th><th colspan="7">AMOUNT BUDGETED</th></tr><tr><th>2017</th><th>2018</th><th>2019</th><th>2020</th><th>2021</th><th>2022</th><th>6-year Total</th></tr><tr><td>A. Basic components as were given in the guidance document</td><td>SubTotal</td><td>1,045,557</td><td>1,097,835</td><td>1,238,977</td><td>1,210,363</td><td>1,270,881</td><td>1,420,675</td><td>7,284,288</td></tr><tr><td>A.1 Management fee charged by the lead centre to handle CRP Finance and Administrative matters (Finance, accounting, reporting, contracts management, legal, HR, IT, communication-if handled by lead centre)</td><td>Amount:</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table>									COST COMPONENT		AMOUNT BUDGETED							2017	2018	2019	2020	2021	2022	6-year Total	A. Basic components as were given in the guidance document	SubTotal	1,045,557	1,097,835	1,238,977	1,210,363	1,270,881	1,420,675	7,284,288	A.1 Management fee charged by the lead centre to handle CRP Finance and Administrative matters (Finance, accounting, reporting, contracts management, legal, HR, IT, communication-if handled by lead centre)	Amount:	-	-	-	-	-	-	-
COST COMPONENT		AMOUNT BUDGETED																																								
		2017	2018	2019	2020	2021	2022	6-year Total																																		
A. Basic components as were given in the guidance document	SubTotal	1,045,557	1,097,835	1,238,977	1,210,363	1,270,881	1,420,675	7,284,288																																		
A.1 Management fee charged by the lead centre to handle CRP Finance and Administrative matters (Finance, accounting, reporting, contracts management, legal, HR, IT, communication-if handled by lead centre)	Amount:	-	-	-	-	-	-	-																																		

<p>A.2 Combines three of the basic components to protect confidentiality of staff salaries – the sum total of these three component should be reported as a single amount:</p> <ul style="list-style-type: none"> • CRP director including related cost – benefits and on-cost if customary (computer, vehicle lease and office space) based on percentage time allocation • Infrastructure and general and administrative charges if CRP leader is not located at the lead centre • Financial and administrative support based on time allocation <p><i>Includes CRP Director, Program Support Coordinator, Administrative Assistant, lead centre Financial Support and PMU office supplies and services</i></p>	Amount:							
		510,577	536,106	562,911	591,057	620,610	651,640	3,472,900
<p>A.3 Flagship leader and regional coordinators only if a significant percentage time (>50%) is dedicated to managerial activities.</p> <p>N/A</p>	Amount:	-	-	-	-	-	-	-
<p>A.4 CRP Management Committee and related costs</p> <p><i>Travel and meeting costs</i></p>	Amount:	51,980	54,579	57,308	60,173	63,182	66,341	353,563
<p>A.5 Independent Steering Committee (or Science Committee) and related costs</p> <p><i>Travel, meetings and honoraria</i></p>	Amount:	301,875	316,969	332,817	349,458	366,931	385,277	2,053,327
<p>A.6 Communication activity related specifically to CRP communication and webpage (not if handled by lead centre)</p> <p>N/A</p>	Amount:	0	0	0	0	0	0	0
<p>A.7 CRP internal audit by the CGIAR Internal Audit Unit, or its future equivalent in the new System governance structure</p>	Amount:	-	-	86,250			86,250	172,500
<p>A.8 CRP internal and external reviews (e.g. CCEEs and other evaluations and reviews), as well as impact assessments</p>	Amount:	181,125	190,181	199,690	209,675	220,159	231,166	1,231,996
<p>B. CRP-level cross-cutting components not mentioned in the guidance document</p>	SubTotal	1,363,063	1,431,216	1,502,778	1,577,916	1,656,811	1,739,652	9,271,436
<p>B.1 CRP special events (e.g. CRP-wide program meetings)</p> <p><i>Annual CRP Program meetings</i></p>	Amount:	115,000	120,750	120,750	115,000	139,783	146,772	758,055
<p>B.2 CRP leadership meetings (e.g. country coordinators, flagship leaders, cross-cutting coordinators)</p> <p><i>Flagship and country coordinator travel and meeting costs</i></p>	Amount:	58,650	61,583	64,662	79,682	83,666	87,849	436,092
<p>B.3 CRP M&E coordination and systems (not including external evaluations and impact assessments)</p> <p><i>M&E staff salaries (Evaluation and M&E Specialists), MEL online system development and maintenance costs, data collection, quality assurance</i></p>	Amount:	306,874	322,218	338,329	355,245	353,974	371,673	2,048,313
<p>B.4 CRP communications, open access, IP assets, CKM (including lead centre staff budgeted as direct costs not allowed under A.6 above)</p>	Amount:	505,609	530,889	557,434	585,306	614,571	645,299	3,439,108
<p>B.5 CRP Capdev coordination</p> <p><i>CapDev Coordinator's salary and travel</i></p>	Amount:	50,376	52,895	55,539	58,316	61,232	64,294	342,651
<p>B.6 CRP Gender and youth coordination</p>	Amount:	104,029	109,230	114,692	120,427	126,448	132,770	707,596

<i>Gender and youth coordinator's salary and travel</i>								
B.7 CRP Site integration support	Amount:							
<i>Contributions to CGIAR country coordination activities</i>		56,925	59,771	62,760	65,898	69,193	72,652	387,199
B.8 Other: Country Coordination	Amount:							
<i>CRP country coordinator and office costs (15%)</i>		165,600	173,880	188,612	198,043	207,945	218,342	1,152,421
C. Strategic Investment Fund	Amount:	2,533,074	2,659,728	2,792,714	2,932,350	3,078,967	3,232,916	17,229,749
		2017	2018	2019	2020	2021	2022	6-year Total
D. Funding source: MSC budget is assumed to be funded from W1/2. Some CRPs have been successful in mobilizing W3/bilateral funding to support CRP-level cross-cutting initiatives.		0	0	0	0	0	0	0
D.1 Grant: (note name, donor; purpose in this cell)	Amount:	0	0	0	0	0	0	0

M&E and impact assessment budgets	<p>The table providing a summary of M&E and impact assessment costs in the harmonized format agreed by the CRP directors and the SMO is in the row below.</p> <p>By using this approach and using the definition of impact assessment explained in the table, the total investment in impact assessment has been adjusted upward to an average USD 845k per year.</p>	<p>Table 1.1.6 (page 51) in the CRP budget narrative in the main CRP proposal has been changed to reflect the adjusted estimate of investment in impact assessment. This amount has also been updated in the online tool.</p> <p>The tables below have been inserted after Table 1.1.6 in the CRP budget narrative and labelled as Tables 1.1.6a and 1.1.6b.</p>
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Table 1.1.6a. Amount dedicated to M&E and Impact Assessment in the CRP budget

M&E investments		AMOUNT BUDGETED						
		2017	2018	2019	2020	2021	2022	6-year Total
M&E (including impact assessment)	SubTotal	1,399,625	1,469,606	1,102,087	1,598,191	1,215,050	1,275,803	8,060,362
Under the MSC budget	Amount:	369,625	388,106	407,512	427,887	449,281	471,746	2,514,157
Under the Competitive Grants Fund	Amount:	720,000	756,000	352,800	811,440	388,962	408,410	3,437,612
Under flagship budgets	Amount:	310,000	325,500	341,775	358,864	376,807	395,647	2,108,593

Impact assessment	SubTotal	960,000	1,008,000	617,400	1,089,270	680,684	714,718	5,070,071
Under the MSC budget	Amount:	0	0	0	0	0	0	0
Under the Competitive Grants Fund	Amount:	700,000	735,000	330,750	788,288	364,652	382,884	3,301,574
Under flagship budgets	Amount:	260,000	273,000	286,650	300,983	316,032	331,833	1,768,497

Table 1.1.6b. Explanation of the definitions used for the types of costs/activities included under each category

M&E	<p>The CRP defines M&E to include:</p> <ul style="list-style-type: none"> • Establishing and maintaining an online system for planning and reporting that includes activities, budget, deliverables and a performance indicator database • Establishing and monitoring CRP ToC and Flagship ToC, Strategy & Implementation Plans (e.g. milestones), Annual Plan of Work & Budget • Planning and implementing baseline surveys and studies • Establishing and maintaining our ToC evidence base • Change pathway monitoring • CRP-level impact assessments, ex-ante and ex-post (see below) • External evaluations (CCEE, IEE, audits) are budgeted separately.
Under the MSC budget	<ul style="list-style-type: none"> • Staff: part of the ToR of the Program Support Coordinator; M&E specialists, Research Methods Group Leader, Evaluation Specialist, Research Quality Specialist • M&E software system and its maintenance • Baselines (if not specifically designed for an individual flagship) • Indicator data collection • Quality Assurance
Under the Strategic Investment Fund	<ul style="list-style-type: none"> • Initial investment in M&E system development and piloting • Commissioned ex-ante impact assessments
Under flagship budgets	<ul style="list-style-type: none"> • Change pathway monitoring and reflection workshops • Flagship-specific ex-ante and ex-post impact assessments
Impact assessment	<p>The CRP defines IA to include ex-ante impact assessment studies, adoption studies, ex-post impact assessment studies. Ex-ante impact assessment may be at CRP level as part of foresight to inform prioritization; or may be specific to a given innovation and flagship. Adoption and ex-post impact assessment studies will be mainly to evaluate discrete innovations or interventions.</p>
Under the MSC budget	Staff to oversee planning and quality assurance
Under the Strategic Investment Fund	Commissioned CRP-level adoption studies, impact assessments; supplementing flagship impact assessments as needed
Under flagship budgets	Flagship-specific adoption studies, impact assessments

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Table 3. Responses to comments on intellectual asserts and open access

Comment (page in the commentary)	Response	Modification to narrative (indicate page no./section and highlight the proposed modifications)
Intellectual assets management		
The dissemination pathways and IP/legal considerations identified in Table 3.9a provide an excellent basis for this, all that is missing are specific examples or mapping to highlight their relevance to the flagships/clusters of the CRP.	The table in Annex 3.9 is updated with some illustrative examples	See annex table 3.9a, page 153
i) identify and explain the IA management approach underlying the dissemination pathways which are utilized by the CRP	Dissemination is a responsibility across the CRP and the annex explains that this will utilize “activities in communication, research data management and open access, partnership and capacity development” as well as engagement with researchers across the research to development cycle. Each pathway has its own dynamic, documented and managed in different ways. Under IA, the legal dimensions are the particular focus of a wide collaborative effort.	
identify and explain the critical/strategic issues and challenges arising from an IA management perspective which are relevant to the CRP;		
map the aforementioned to specific flagships/clusters supported by actual/anticipated examples at project level where available	The annex 3.9 explains that a CRP-wide legal and IP group will be constituted to manage these activities. It will draw heavily on the wider CGIAR community of practice. Each flagship has a specific section covering IA where specific examples are provided.	
The following approaches to decision making and capacity should be considered: (i) development of as CRP level IP policy framework to guide implementing partners; (ii) formation of an IP Management	As annex 3.9 states, the CGIAR Principles for the Management of Intellectual Assets and the CGIAR Open Access and Data Management Policy provide the necessary wider policy framework.	

Committee to support the CRP and to coordinate IA management across CRP.	<p>The CGIAR guidelines on open access, for example, make it clear that centres lead the implementation in this area and CRPs need to follow. With system and centre level policies already existing, the CRP does not see the need for a further policy; rather it will focus on the support and compliance mechanisms necessary to implement the existing policies and guidelines.</p> <p>IP management will be one of the areas covered by the Program Management Committee, which may establish sub-committees as appropriate.</p>	
The responsibility of the Program Management Committee in relation to IA management issues is not explained or distinguished from that of the Lead Center (e.g. role in determining non-standard dissemination pathways that may involve restrictions, particularly those that require justification/reporting)	The CRP will consider this and other specialized areas when the TOR and scope of the PMC is specified.	
The CRP proposal could be further strengthened by providing insight into IP legal capacity across the CRP (e.g. by attaching CVs or ToRs for the relevant staff at Lead Center and CRP strategic partners, and indicating anticipated FTE commitments). This would also help ensure the CRP has appropriate capacity to manage the critical issues/challenges identified from an IA management perspective.	The CRP estimates legal and IP dedicated to the CRP as approximately 0.5FTE, drawn from the different partners, with time budgeted and support through the lead centre's legal and IP unit. See annex 3.9.	Linda Opati CV added to Annex 3.7
The IA Management sections of the CRP could be strengthened by providing a more detailed budget narrative for specific activities related to IA management.	The proposal provided an overall summary budget for IA, OA, RDM and communications across the flagships and under management. These were based on detailed budgets worked out at each level.	
Open access and open data		
roles and responsibilities have not been clarified, and budget lines for tasks not specified-	The proposal provided an overall summary budget for IA, OA, RDM and communications across the flagships and under management. Roles and responsibilities are also summarised in the overall narrative (1.0.13) and relevant annex (3.8). Both activities (tasks) and associated budget are provided within each flagship narrative (2.x.1.1.1 and 2.x.2.5).	
no details have been provided on what sorts of activities are envisioned.	Different dissemination pathways and activities are described in table 3.9a under Annex 3.9 on IA. The section on 'implementing open access' sets out the main activity areas, platforms, challenges and approaches the CRP will follow. Each	

	flagship also provides in 2.x.1.1.1 more detail about specific approaches and platforms for their specific topic area.	
How will Livestock encourage budgeting for missing elements and/or effectively implement OA/OD in their absence?	Annex 3.8 states: “Over time, bilateral projects will also budget for open access, open data and RDM. Promoting and requiring this will be part of the CRP strategy to achieve the global accessibility its aims for. Until all projects properly budget these areas, the CRP will co-finance critical open access and open data investments as well as strategic platforms at the CRP level that add value and synergies and make dispersed knowledge findable and re-usable.”	
The narrative on technical aspects of OA/OD is poor: Data curation/quality control is not addressed; there is no narrative on technical considerations at all, and little if any mention of metadata, including the CG Core, around which discussions have been held with ILRI staff regarding CGspace in particular, but also CKAN; and no detail whatsoever on interoperability standards or data sharing protocols.	See annex 3.8 for additional information on metadata and standards. Minor revisions made. The CRP understood this to be a short strategic write up of a large area of work. There are very many technical, curation and other management details underlying each platform and system and institutional workflow that was not described. These are described elsewhere on lead centre and partner websites (http://www.ilri.org/open for example).	See annex 3.8 page 143
No itemized budget has been included, despite the guidance. Under these circumstances it is difficult to judge whether OA/OD in accordance with FAIR principles is achievable.	The proposal provided an overall summary budget for IA, OA, RDM and communications across the flagships and under management. The latter version of the guidance (attached) provided suggestions for budgeting – a version of this, in spreadsheet form, was used with flagships to help them to budget adequately for OA / OD and the summary of this is presented in Annex 3.8 as per the guidance.	